FEATURE DOCUMENT

RINGING FEATURES

NO. 2 ELECTRONIC SWITCHING SYSTEM

CONTENTS PAGE

CONTENTS PAGE

Printed in U.S.A.

FIGURES PAGE

FIGURES PAGE

TABLES

FEATURE DEFINITION AND DESCRIPTION

1. DEFINITION/INTRODUCTION

DEFINITION

1.01 This feature document describes the various types of ringing that are required to alert the called customer of an impending call.

INTRODUCTION

1.02 In the No. 2 Electronic Switching System (ESS), the ringing features for calls terminating in the local office are provided by ringing circuits connected to the network. This feature document details the following ringing features:

- Types of Ringing for Multiparty Service—ac-dc or superimposed
- Regular Ringing—"immediate ringing" to called individual, 2-party, coin, and private branch exchange (PBX) lines
- Special Ringing—ringing to multiparty (4-party and 8-party, also individual and 2-party special coded) lines and reverting ringing.

1.03 The ringing features are available in any No. 2 ESS office. The type of multiparty service to be provided and the reverting call option desired must be specified in the initial No. 2 ESS Equipment Questionnaire and the Office Data Administration (ODA) run for the office. The required number of ringing circuits (SD-2H116-01 and SD-2H126-01 or -02) depends on specific office requirements.

1.04 More detailed information pertaining to 2-party and multiparty service and reverting calls is available in Section 232-190-132 (Two-Party and Multiparty Service).

2. USER PERSPECTIVE

CUSTOMER

A. Types of Ringing

2.01 A No. 2 ESS office may be equipped to provide ac-dc ringing only or ac-dc ringing plus superimposed ringing. AC-DC ringing is always used for individual and 2-party ringing. For multiparty ringing, the selection of ac-dc ringing or superimposed ringing is based on the type of multiparty service the operating company desires to provide. AC-DC ringing is chosen if the office is to provide 4-party semiselective service. Superimposed ringing is chosen to provide 4-party full selective service and 8-party semiselective service. Tables A and B include the ringing codes and other information for ac-dc and superimposed ringing. Full selective service allows each of the four parties on a line to be rung individually. Semiselective service provides ringing to two of the parties on a line. In order to distinguish which party is being rung, two distinct ringing codes (Figure 1) are necessary. Code 1 ringing includes cycles of two seconds of ringing followed by four seconds of silence. Code 2 ringing includes cycles of one second of ringing, one second of silence, one second of ringing, and three seconds of silence.

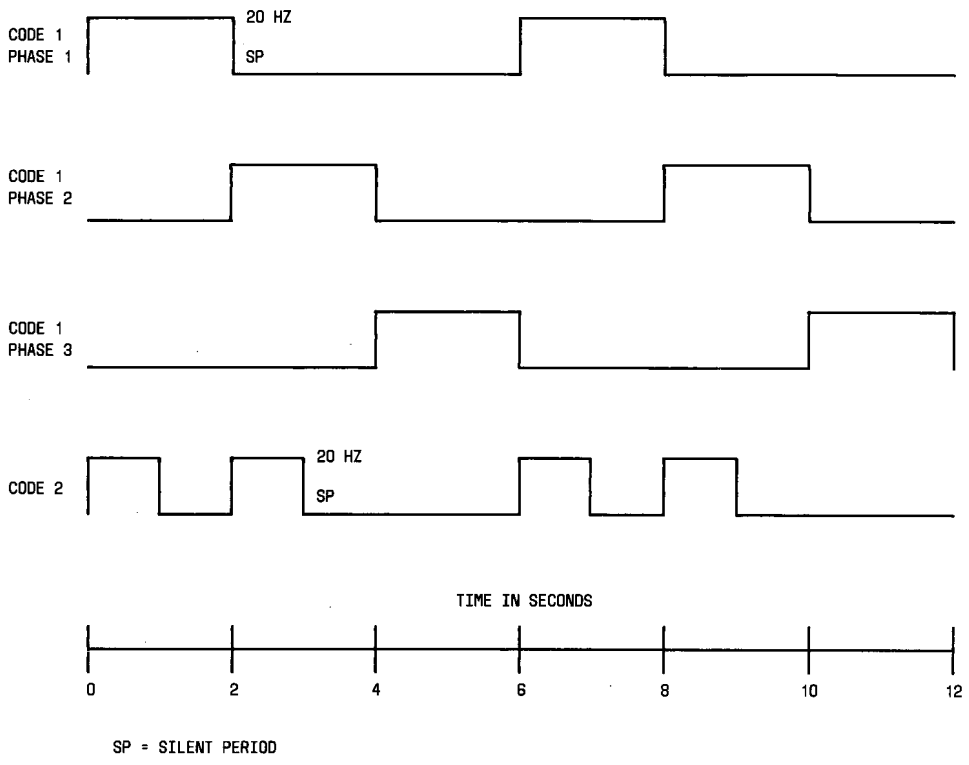

Fig. 1—Code 1 and Code 2 Ringing

TABLE A

RINGING CODES FOR 2-PARTY LINES

AC-DC RINGING		
2-PARTY FULL SELECTIVE		
PARTY	LINE SIDE	RINGING CODE
1	Ring	1
2	Tip	1

TABLE B

RINGING CODES FOR 4-PARTY AND 8-PARTY LINES

AC-DC RINGING		
4-PARTY SEMISELECTIVE		
PARTY	LINE SIDE	RINGING CODE
1	Ring	1
2	Tip	1
3	Ring	2
4	Tip	2

SUPERIMPOSED RINGING				
4-PARTY FULL SELECTIVE				
PARTY	LINE SIDE	POLARITY	IDENT DIGIT	RINGING CODE
1	Ring	—	2	1
2	Tip	—	3	1
3	Ring	+	4	1
4	Tip	+	5	1
8-PARTY SEMISELECTIVE				
1	Ring	—	2	1
2	Tip	—	3	1
3	Ring	+	4	1
4	Tip	+	5	1
5	Ring	—	6	2
6	Tip	—	7	2
7	Ring	+	8	2
8	Tip	+	9	2

B. Regular Ringing

2.02 Calls to individual, 2-party, coin, and PBX lines are provided with "immediate ringing." One of the three staggered phases (phases are commonly referred to as brushes in systems where ringing is not electronically generated) of normal code 1 ac-dc ringing (Figure 1) (each cycle consisting of two seconds of ringing followed by four seconds of silence) is selected from a regular ringing circuit which provides the least possible delay in starting the ringing to the called line. The term "immediate ring" has developed from this concept.

2.03 The audible ringing tone provided with the code 1 ringing is deliberately not synchronized with the regular ringing to discourage "free" signaling between customers via a predetermined number of rings. This implies that the called party may answer before the calling party hears an audible ringing tone.

C. Special Ringing

2.04 Calls to multiparty lines and calls to a party on the same line require special ringing provided by a special ringing circuit.

2.05 With 4-party semiselective service (ac-dc ringing), the two parties on the same side of the line hear each other's ringing code. With 4-party full selective service (superimposed ringing), parties on the same side of the line do not hear each other's ringing code. With 8-party semiselective service (superimposed ringing), the two parties on the same side of the line and of the same polarity hear each other's ring.

2.06 An extension of the coded ringing feature is available in the No. 2 ESS for one- and/or two-party lines for customers who want special ringing signals to indicate for whom an incoming call is intended. The available ringing can be grouped into three options:

(1) Single party with coded ringing—this option rings the line with code 2 ringing instead of the normal code 1 ringing. This can be utilized when two individual telephones are located near each other and the code 2 ringing on one makes it easier to determine which telephone to answer. This is sometimes called "teen-age service." Also this can be used where two lines come to a single telephone equipped with a key or switch to select one of the two lines.

(2) Two party with coded ringing (each party hears both ringing codes)—this option can be used when a business telephone and a residence telephone of the same customer comprise the two parties and calls to either number are to be answered at either locaton. Either the business or the residence telephone rings with code 1 and the other rings with code 2.

(3) Two-party with coded ringing (each party hears only one ringing code)—this option rings one of the parties with code 1 ringing and the other party with code 2 ringing. A party with code 2 ringing could have other main stations collocated with this one.

2.07 When a 2-party or multiparty customer dials the directory number of a subscriber on the same line, a ***reverting*** call is initiated. The No. 2 ESS office has the option of handling a reverting call in one of four different ways:

(1) Route to busy tone—this option is used to deny this type of call. When dialing is completed, a busy tone is returned. The calling party is expected to go on-hook. The calling party must dial the operator for assistance in completing the call.

(2) Route to an operator—this option allows the calls to be routed to an operator when dialing is completed. The operator obtains the called party, supervises the call, and makes any necessary charges.

(3) Complete the call depending on whether superimposed ringing is provided—

(a) AC-DC Ringing—When dialing is completed, a busy tone is returned which signifies the calling party to go on-hook. Normal coded ringing is applied to the party called, and revertive ringing is applied to the other side of the line. The revertive code is applied first. The reverting ringing sequences for ac-dc ringing are shown in Figure 2. The calling party then waits for the called party to go off-hook which stops the ringing. Cessation of the ringing notifies the calling party to remove the receiver and start talking.

(b) Superimposed Ringing—Reverting calls require 4-party and 8-party customers to dial an additional digit that identifies the calling party and is used by the system to determine the appropriate ringing signal to be applied to the calling party. A second dial tone is returned to the calling line after the called directory number has been completed. At this time, the calling party dials the additional digit (2 through 9). A busy tone is then provided and the call progresses in the same manner described for the ac-dc reverting call. The reverting ringing sequence for superimposed ringing are shown in Figure 3.

TELEPHONE COMPANY

2.08 Reverting calls from 2-party message rate customers are routed to an operator. Reverting calls of 2-party flat rate customers are also routed to an operator if at least one 2-party message rate customer is assigned in the office.

2.09 The type of ringing for multiparty service and one of the four reverting call options to be provided by the No. 2 ESS offices are determined by the operating company.

2.10 In line with the Bell System objective to reduce operator assistance traffic whenever possible, option 3(a) or 3(b) is usually selected for handling reverting calls.

3. SYSTEM PERSPECTIVE

FEATURE OPERATION

A. Types of Ringing

3.01 Figure 4 shows a ringing features flow diagram. In all types of ringing, alternating current activates the ringer and direct current controls the removal of ringing when an answer is detected. AC-DC ringing consists of 20 Hz 86 volts ac in series with -48 volts dc. Tables A and B include the ringing codes for ac-dc ringing. AC-DC ringing is used for individual, 2-party, and 4-party semiselective service and requires nongas tube ringers.

3.02 Superimposed ringing is ringing in which either SUP - (20 Hz 86 volts ac in series with -38 volts dc) or SUP + (20 Hz 86 volts ac in series with +38 volts dc) is selected depending on the party to be rung. The additional voltages are supplied by an option added to the ringing and tone plant. Superimposed ringing enhances 4-party service making it fully selective and allows 8-party semiselective service. Table B includes the ringing codes for superimposed ringing. Superimposed ringing requires the use of gas tube ringers.

3.03 The type of multiparty ringing for the No. 2 ESS office is designated in OFFOF0 (Office

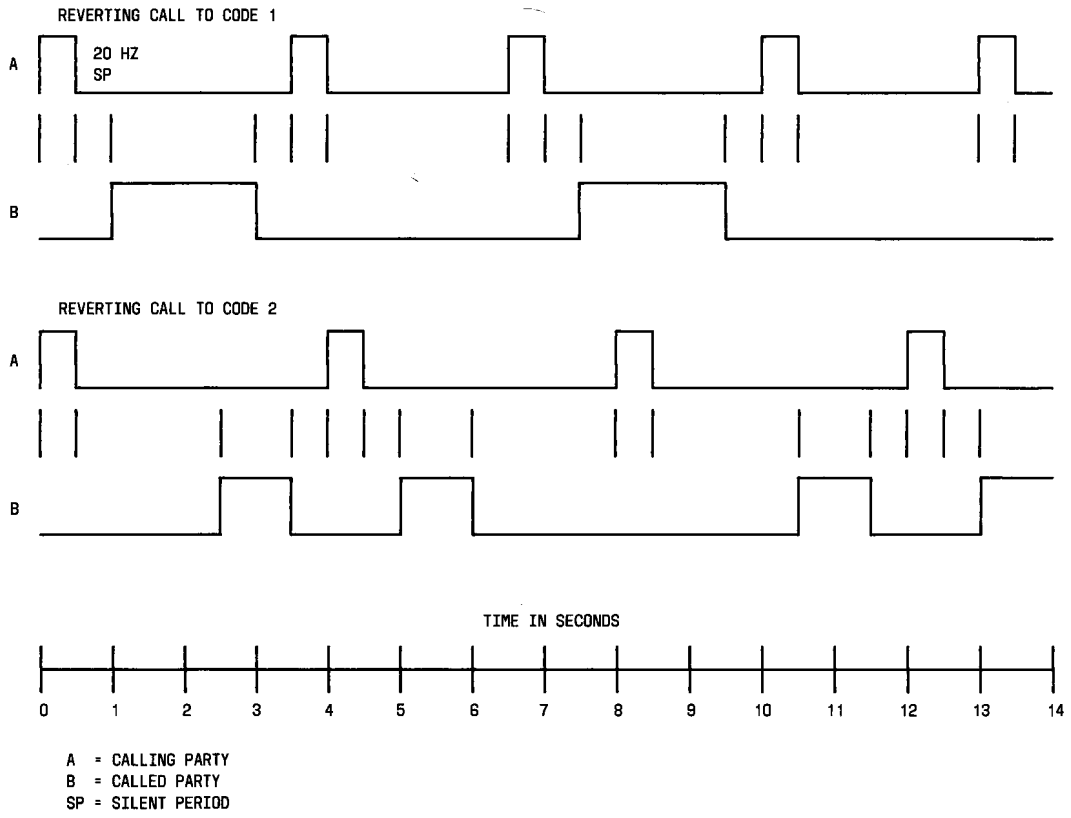

Fig. 2—AC-DC Reverting Ringing Sequences

Option Word 0) of the Miscellaneous Office Parameters in Program Storage.

B. Regular Ringing

3.04 When the system detects the seven dialed digits of an intraoffice call, the dialed directory number is translated into the terminal equipment number (TEN) and terminating class information for the called line. The called line is then examined to determine if it is idle. If the called line is idle, a circuit junctor is selected and a talking path is reserved for the calling line in the network map.

3.05 An idle ringing circuit and a path to the called line through a wire junctor are required. If the called line is an individual, 2-party, coin, or PBX line, an SD-2H116 ringing circuit is selected for connection to the called line. Only the ac-dc ringing voltages are connected to this circuit. Figure 5 shows the trunk group and scan point number translations involved in selecting a ringing circuit.

3.06 The ringing and tone plant provides three equidistant phases in the 6-second time cycle (two seconds of ringing followed by four seconds of silence). Approximately one-third of the ringing circuits are connected to each phase. Therefore, a 2-second ringing period starts on one group of circuits just as it ceases on another group. When selecting a ringing circuit, the program gives preference to a ringing circuit from the group which has at least one second remaining in the present ringing phase, thus reducing the 1.33-second average delay found in other existing non-ESS systems.

3.07 The ringing circuit which can provide "immediate ring" and a path to the called line through a wire junctor are then selected. If the phase selected has no idle members, a ringer is selected from the next sequential phase. Network and peripheral decoder orders are then given to

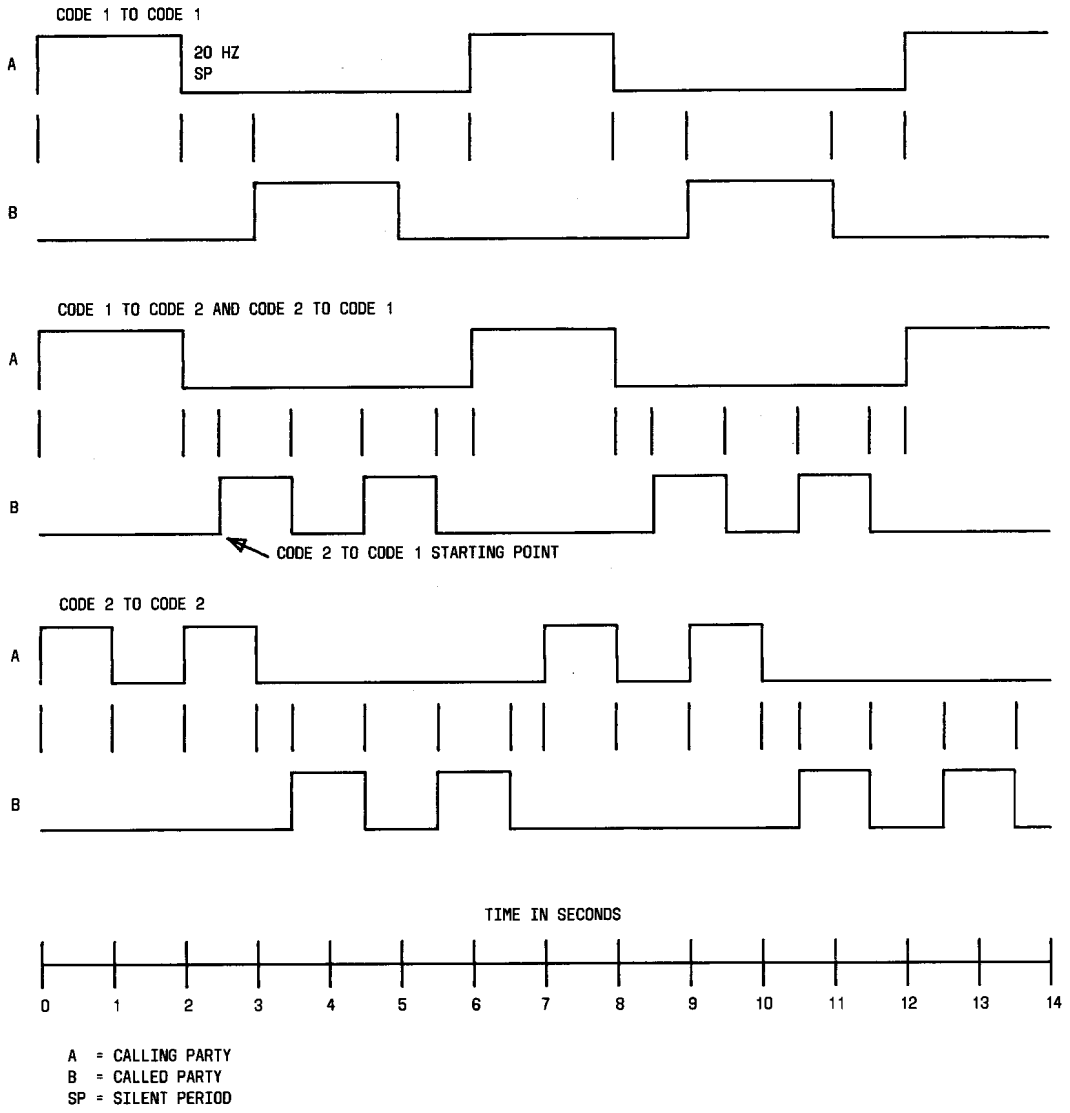

Fig. 3—Superimposed Reverting Ringing Sequences

connect the ringing circuit, to control the ringing circuit relays in the proper sequence, to allow pretrip test and code 1 ringing to the tip or ring side of the line, and to apply audible ringing tone to the called line through a relay in the circuit junctor. The ringing codes for 2-party lines are shown in Table A.

C. Special Ringing

3.08 Calls to individual and 2-party lines with special coded ringing and to multiparty (4- and 8-party) lines are processed as indicated in 3.04 and 3.05 except an SD-2H126 special ringing circuit is selected for connection to the called line. If superimposed ringing is specified, the superimposed voltages and the ac-dc ringing voltages are connected to this circuit.

3.09 A continuous source of ringing current is connected from the ringing and tone plant to the SD-2H126 ringing circuit. Coded ringing is provided in this circuit by a program controlled relay (F relay).

3.10 The ringing circuit and a path to the called line through a wire junctor are then selected. A talking path through the circuit junctor is reserved

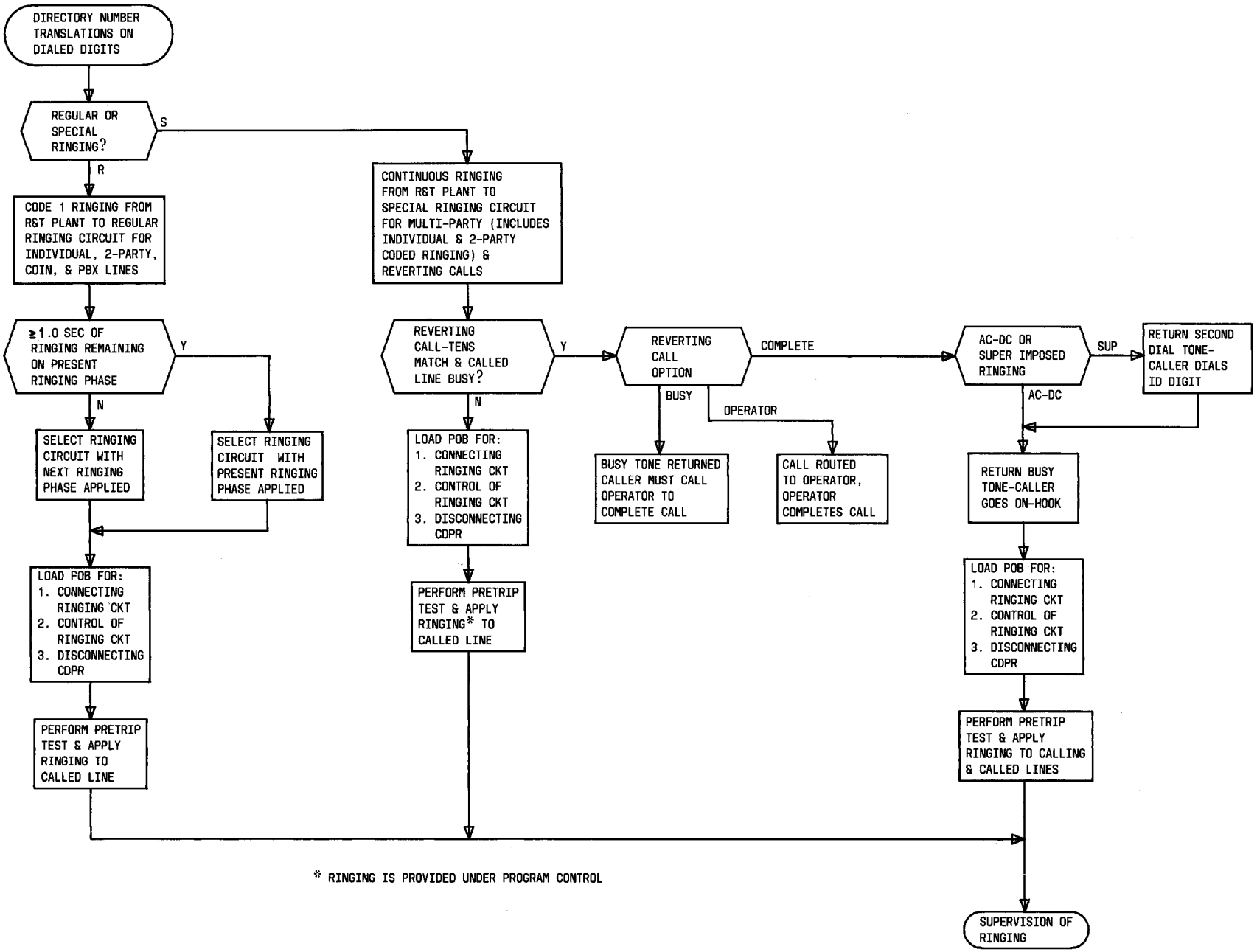

Fig. 4—Ringing Features Flow Diagram

to the called line. Network and peripheral decoder orders are then given to connect the ringing circuit, to control the ringing circuit relays in the proper sequence to allow pretrip tests and coded ringing (either ac-dc or superimposed) to the tip or ring side of the line, and to apply audible ringing tone to the called line through a relay in the circuit junctor. Table B shows the ringing codes for 4-party and 8-party lines for ac-dc and superimposed ringing.

3.11 A reverting call, as explained in 2.07, is a call between customers who share the same party line. The desired option for handling reverting calls is designated in OFFOF0 of the Miscellaneous Office Parameters in Program Storage.

3.12 If the ac-dc option is chosen for reverting calls, the system detects the seven dialed digits as previously stated. The directory number is translated into the TEN and terminating class information for the called line. When the called line is busy tested and found to be busy, then the call could possibly be a reverting call. If the calling line is a party line, and the calling and called line TENs are the same, then the call is a reverting call. The calling line is disconnected from the customer dial pulse receiver and busy tone is connnected to the calling line. At this time, the calling party goes on-hook.

3.13 An SD-2H126 ringing circuit and a path to the line through a wire junctor are then selected. A talking path through the circuit junctor is reserved for the line. Network and peripheral decoder orders are then given to connect the ringing circuit and to control the ringing circuit relays in the proper sequence to allow pretrip tests and coded ringing to the called party and a distinct reverting ringing (cycles of 0.5 seconds of ringing followed by an interval of silence) to the opposite (tip or ring) side of the line. Figure 2 shows the ac-dc reverting ringing sequence for code 1 and for code 2.

3.14 Superimposed reverting calls require the dialing of an additional identification digit upon return of a second dial tone. After this digit is dialed, busy tone is then returned which signals the calling party to go on-hook. The call proceeds as stated for ac-dc ringing. Figure 3 shows the superimposed reverting ringing sequence.

FEATURE ATTRIBUTES

4. APPLICABILITY

4.01 The ringing features are provided on a per-system and per-line basis. Selection of ac-dc ringing allows 4-party semiselective service and selection of superimposed ringing allows 4-party full selective and 8-party semiselective service.

5. LIMITATIONS AND RESTRICTIONS

OPERATIONAL

5.01 The ringing ranges of both the regular and the special ringing circuits are specified in Section 812-015-170.

5.02 The special ringing circuit (SD-2H126-01) has two trunk order codes. Trunk order code 62208 is used when the minimum line leak resistance is greater than 10,000 ohms but less than 15,000 ohms. Trunk order code 62209 is used when the minimum line leak resistance is greater than 15,000 ohms. This circuit is rated as A&M (Addition and Maintenance) and has been replaced by SD-2H126-02. The SD-2H126-02 circuit extends the tripping range to an external loop resistance of 3000 ohms.

ASSIGNMENT

5.03 Reverting calls of 2-party message rate customers are routed to an operator. If one 2-party message rate customer is assigned in an office with the LO-1 and EF-1 generic programs, reverting calls of all 2-party customers are routed to an operator.

5.04 A maximum of 28 regular ringing circuits (SD-2H116) can be assigned to each of the three code 1 phases from the ringing and tone plant. The Z option should be provided in offices that have the EF-1 generic program. The regular ringing circuits can be assigned to either the fast scan field (TOC 61266) or the slow scan field (TOC 61267). Assignment to the fast scan field reduces the answer detection and connection delay time by approximately 100 milliseconds. An office can have a mixture of fast and slow scan points assigned.

5.05 A maximum of 24 special ringing circuits (SD-2H126) can be assigned. The Z wiring straps on the circuit should be removed during installation if superimposed ringing is used. The

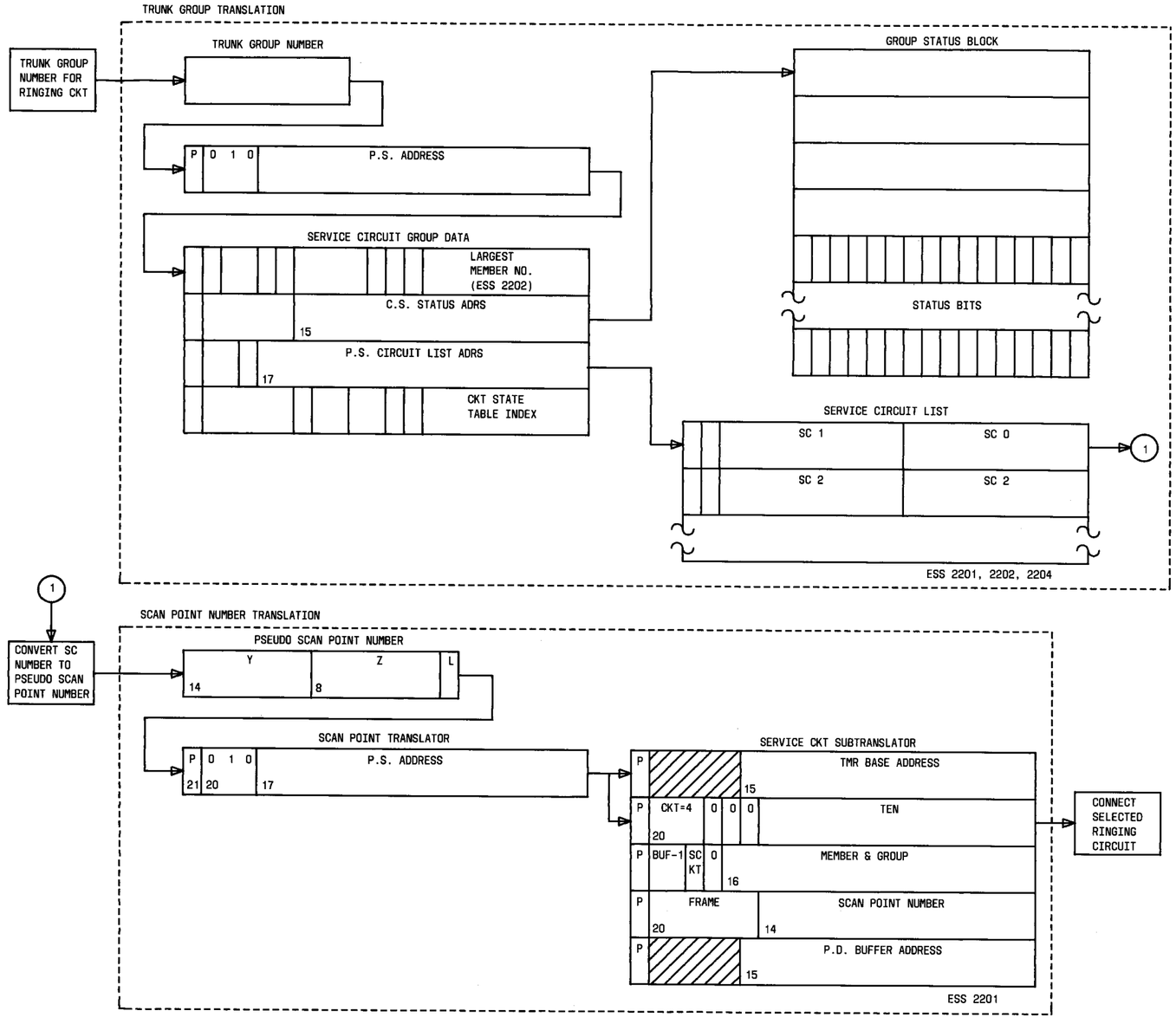

Fig. 5—Translations for Selecting Ringing Circuits

SD-2H126-02 special ringing circuits can be assigned to either the fast scan field (TOC 67366) or the slow scan field (TOC 67367). The SD-2H126-01 special ringing circuits (TOC 62208 or TOC 62209) are assigned to the slow field.

5.06 It is recommended that new offices use the fast scan field and that presently installed circuits using the slow scan field not be changed to the fast scan field.

5.07 The ringing and tone plant (SD-81870-01) is always provided with the Z option for ac-dc ringing. If superimposed ringing is required, the Y option must also be specified.

6. COMPATIBILITY AND INTERACTIONS

6.01 The subscriber telephone sets must be equipped with the appropriate type of ringer for ac-dc or superimposed ringing. Ringing Limitations (Section 500-114-100) contains data on the maximum number and different types of ringers used in various service arrangements.

7. COST FACTORS

PROGRAM STORE

7.01 The ringing circuits appear as service circuits on the No. 2 ESS network. Each of the four ringing circuit trunk groups (007 for the special ringing circuits and 008, 009, and 010 for the regular ringing circuits connected to each of the three phases from the ringing and tone plant) requires the following program store translation words:

(a) four service circuit group data words in the trunk group translator

(b) ten bits for each ringing circuit in the service circuit list in the trunk group translator

(c) the scan point translator requires four words in the service circuit subtranslator for each ringing circuit.

CALL STORE

7.02 Each group requires four words in the group status block plus one bit of a status word for each circuit.

HARDWARE

7.03 Each regular ringing circuit requires two master scanner or universal trunk scanner scan points and three peripheral decoder points. Each special ringing circuit requires two master scanner scan points and six peripheral decoder points.

8. AVAILABILITY

8.01 Ringing features are available in all issues of the generic program.

CONSIDERATIONS FOR INCORPORATION OF FEATURE INTO SYSTEM

9. PLANNING

9.01 Offices are arranged to provide ac-dc or ac-dc with superimposed ringing depending on the type of multiparty service to be provided. AC-DC ringing allows 4-party semiselective service. Superimposed ringing allows 4-party selective and 8-party semiselective service.

9.02 The following factors should be considered when only 4-party service is to be provided:

- What kind of ringers are installed in existing telephones? AC-DC ringing requires nongas tube ringers and superimposed ringing requires gas tube ringers.

- Is it desirable to have the calling customer dial an additional identifying digit on machine completed reverting calls? Superimposed ringing requires the dialing of an additional digit.

- Is it desirable to have selective or semiselective ringing? Customers on the same side of the line hear each other's ring with ac-dc ringing.

10. HARDWARE

10.01 The Ringing and Tone Plant (SD-81870-01) is wired for the Z option for ac-dc ringing or for the Y option and the Z option for superimposed ringing.

10.02 Two SD-2H116-01 regular ringing circuits (TOC 61266 or 61267) are provided per

unit which requires one mounting plate space on the miscellaneous trunk frame. The Z option should be provided in offices having the EF-1 generic program.

10.03 One SD-2H126-01 (TOC 62208 or 62209) or one SD-2H126-02 (TOC 67366 or 67367) special ringing circuit is provided as a one-circuit unit requiring one mounting plate space on the miscellaneous trunk frame.

11. DETERMINATION OF QUANTITIES

HARDWARE

11.01 The procedures for determining the number of regular ringing circuits and special ringing circuits are outlined in the Traffic Facilities Practices, Division D Section 12-c.

MEMORY

11.02 The memory requirements for the ringing circuit groups are detailed in Part 7, COST FACTORS.

12. ASSIGNMENTS AND RECORDS

Assignment Recommendations and Guidelines

12.01 Approximately one-third of the total number of regular ringing circuits should be assigned to each phase from the Ringing and Tone Plant.

Input and Record Keeping

A. Office Data Administration (ODA)

12.02 When an ODA run is required, the following completed forms must be submitted to the appropriate WECo Regional Data Center for processing:

- ESS 2201—The purpose of the Trunk Assignment Table is to associate the scan points, peripheral decoder points, and their associated central pulse distributor enable points with particular circuits.
- ESS 2202—The purpose of the Trunk Group Table is to provide the means of establishing a Trunk Group Number for each trunk group entering or leaving the office, for all service circuit groups, and for spare groups.
- ESS 2500—The purpose of the General Information Table is to provide information for the ODA about the type of ringing and the option for handling reverting calls.

B. Recent Change Message

12.03 The regular and special ringing circuits cannot be added to the system via recent change. However, the A RC:SVC input message can be used to change the TEN of a member of the group or to move a member to another group. If a member is moved, care must be taken to rewire it to the proper ringing phase. The A VY:SVC input message and the AR VY:SVC output message can be used to verify the change to a new TEN.

C. Record Keeping

12.04 The following translation administration records must be maintained by the operating companies after each ODA run:

- ESS 2201-R Trunk Assignment Record
- ESS 2202-R Trunk Group Record
- ESS 2500-5C-R MTI Capacity and Office Options Record

12.05 A record of all recent change messages must be maintained in addition to ESS-R forms.

13. NEW INSTALLATION AND GROWTH

13.01 The procedures for providing the regular and special ringing circuits are shown in Figure 6.

14. TESTING

14.01 The terminal equipment number, peripheral decoder buffer, directed scan point number, and the supervisory scan point number associated with either type of ringing circuit can be verified with the A VY:SVC input message and the AR VY:SVC output message.

14.02 The ringing circuits can be tested by following the procedures in Section 232-155-502 for the regular ringing circuit (SD-2H116) and in

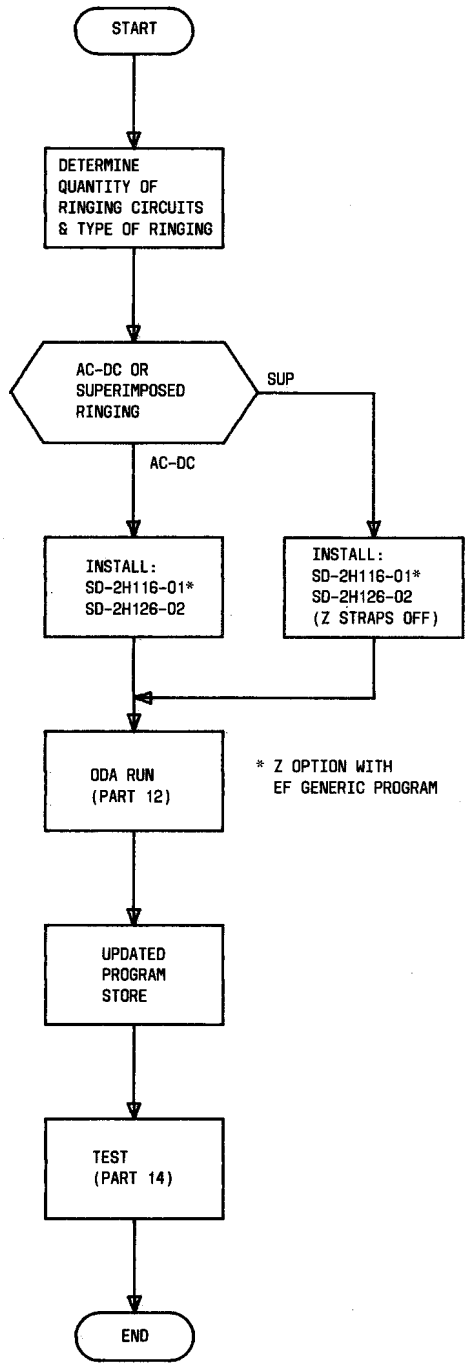

Fig. 6—Procedure for Installing Ringing Circuits

Section 232-155-503 for the special ringing circuit (SD-2H126).

15. MEASUREMENTS

15.01 Each service circuit group in the No. 2 ESS office has a set of four traffic registers assigned to it. These registers include peg, usage, overflow, and maintenance busy counts. These counts are collected continuously for service circuit groups. The registers can be read when a TTY printout is requested or when traffic data is automatically printed out in accordance with an assigned schedule in the Traffic Work Table. Section 232-120-301 (Traffic and Plant Measurements) contains additional information.

16. CHARGING

16.01 Not applicable.

SUPPLEMENTARY INFORMATION

17. GLOSSARY

17.01 The following list identifies terms and abbreviations used in this feature document:

- AC-DC Ringing—Ringing which utilizes ac voltage and negative dc voltage. The No. 2 ESS utilizes 20 Hz 86 volts ac in series with -48 volts dc. AC-DC ringing is used to ring individual and 2-party lines; and, at operating company option, to ring multiparty lines.

- Brush—Code 1 output of the ringing and tone plant ringing generators. Outputs from a ring counter provide a sequence two seconds on and four seconds off to each of three brushes. The term comes from equally spaced brushes around an ac generator in electromechanical offices.

- Office Data Administration (ODA) Run—Mechanism by which translation information may be assembled or changed for a No. 2 ESS. Information from the ESS input forms is inputted into the regional ODA computer, assembled, then sent back to the No. 2 ESS.

- Recent Change (RC) Messages—Mechanism for making changes to information stored in the program store. These changes are accomplished via TTY input messages and are stored in the recent change area of call store until some later time when the program store can be updated.

- Reverting Calls—Calls between two customers served by the same 2-party or multiparty line.

- Selective Ringing—Party-line ringing in which only the ringer(s) of the desired customer respond.

- Semiselective Ringing—Party-line ringing where the ringers of only two of the customers respond simultaneously, differentiation being by the number of rings.

- Superimposed Ringing—Ringing which utilizes a combination of ac voltage and either positive or negative dc voltage to obtain selectivity. The No. 2 ESS utilizes 20 Hz 86 volts ac in series with ±38 volts dc. Superimposed ringing is used, at operating company option, to ring multiparty lines.

- Terminal Equipment Number (TEN)—A 6-digit number representing the physical location of a line, link, trunk, or service circuit in the switching network.

18. REASONS FOR REISSUE

18.01 This is the initial issue of this document.

19. REFERENCES

19.01 The following documents may be referred to for supplementary information concerning ringing features:

- Input Message Manual No. 2 ESS IM-2H200

- Output Message Manual No. 2 ESS OM-2H200

- Office Data Tables Layout Specification No. 2 ESS PA-2H200

- Ringing and Answer Detection Program PD-2H205-01, PF-2H205-01, and PR-2H205-01

- Ringing and Tone Plant (841A) CD-81870-01 and SD-81870-01

- Ringing Circuit for Coded, Superimposed Reverting, and Off- and On-Hook Ringback CD-2H126-01, SD-2H126-01, CD-2H126-02, SD-2H126-02 and Section 232-155-503

- Ringing Circuit for Individual, Two-Party, Coin, and PBX Lines CD-2H116-01, SD-2H116-01, and Section 232-155-502

- Ringing Limitations Section 500-114-100

- Ringing Ranges and Ringing Bridge Limitations for Lines in Dial Offices Section 812-015-170

- Traffic and Plant Measurements Section 232-120-301

- Translation Guide, TG-2H

- Traffic Facilities Practices No. 2 ESS TFP-Division D, Section 12

- Trunk and Service Circuit Engineering Specification J2H031A-1

- Two-Party and Multiparty Service Section 232-190-132