

**MODIFICATION REQUIREMENTS
FOR EXTENDED SUBSCRIBER LOOP RANGES
EQUIPMENT DESIGN REQUIREMENTS
PANEL SYSTEMS**

1. GENERAL

Scope

1.01 This specification, together with the supplementary information listed herein, covers the general information requirements for the modification of existing panel offices for extended subscriber loop ranges.

1.02 This specification is reissued for the following reasons:

(a) To revise paragraph 4.36 to explain the adaptability and limitations of the test equipment during the conversion period, so that the best choice of procedures may be made for cases arising in the future.

(b) To incorporate changes covered by Appendices 1 to 4 of J29207, Issue 3-D.

Capacity

1.03 The capacity of the various frames in the existing offices is not affected by the modification. The additional equipment necessary for this modification can be mounted in unused space on the unit or frame affected.

Description

1.04 The term "extended range" means the extension of the range of subscriber supervision from the present limit of 750-ohm maximum external loop resistance to new ranges varying up to a maximum of 1500 ohms.

1.05 The term "conductor loop" means the allowable external loop exclusive of the subset resistance or any supervisory or holding bridge resistance, such as in PBXs. The circuits listed herein now show, in all cases, the maximum external loop resistance.

1.06 The increased supervisory loop resistance permits the dialing range to be increased and the limits of existing wire centers to be extended.

1.07 The present 750-ohm loop may be extended to 900, 1200, or 1500 ohms by the following means:

	Reqd for 900 ω	Reqd for 1200 ω	Reqd for 1500 ω
(1) Providing new adjustment for line relays	No	No	Yes
(2) Modifying district and incoming selectors for 48-volt talking battery	No	Yes	Yes
(3) Providing new adjustment for subscriber supervisory relay in district and incoming selectors	No	Yes	Yes
(4) Providing new adjustment for party test relay and adding resistance in 2-party message rate district selectors	No	No	Yes
(5) Replacing the tripping relay in incoming selectors and other ringing circuits	No	No	Yes
(6) Providing new adjustment of the C relay in final selector circuits in BCO offices	No	No	Yes
(7) Changing resistance and sequence switch cam in final selectors in GCO offices (see note A)	No	Yes	Yes
(8) Changing the dial pulse circuit in subscriber sender (see note B)	No	Yes	Yes
(9) Arranging the power plant for 48-volt supply	No	Yes	Yes

	Reqd for <u>900Ω</u>	Reqd for <u>1200Ω</u>	Reqd for <u>1500Ω</u>
(10) Arranging the power plant for new ringing voltage (see note C)	Yes	Yes	Yes
(11) Providing tube subsets for 4-party full selective lines	No	Yes	Yes
(12) Providing new adjustment for the A relay in "A" board cord circuits and recording completing trunks	No	No	Yes
(13) Providing new coin control current supply equipment	Yes	Yes	Yes
(14) Closer regulation of the 24-volt talking battery voltage	Yes	No	No
(15) Replacing N and R resistances (SD-21194-01)	Yes	Yes	Yes

Notes

- A. In final circuits of the earlier type such as ES-207389, where an 18-type resistance is used in connection with the called party release test only, it will only be necessary to replace this resistance. However, in the later-type circuits such as ES-239664, where this same resistance is also used for flashing the incoming supervisory relay when the final selector is in the busy-back position, the resistance cannot be changed to give satisfactory operation. In these circuits, in addition to replacing the present 18- with a 19-type resistance, it will be necessary to change one sequence switch cam to differentiate between the busy-back and the called subscriber release test positions.
- B. The new dial pulse circuit is not required for extended loops up to 1000 ohms maximum in decoder- or sender selector-type senders.
- C. In offices arranged for superimposed ringing voltage of 72 to 80 volts ac and 42 to 46 volts dc and using relay-type subscriber sets, tripping during the ringing period is satisfactory for 900-ohm loops. However, it is necessary to increase the silent

interval battery to 66 volts minimum, instead of 60 volts minimum to insure tripping in the silent interval. In offices arranged for semiselective ringing, with a voltage of 95 to 103 volts ac and 16 to 19 volts dc, the voltage must be changed to the new limits of 84 to 88 volts ac with the central office 48-volt battery as the dc component, in order to extend the loop to 900 ohms. Silent interval tripping voltage supplied from the central office 48-volt battery will be satisfactory on the maximum loops with average condition of tripping relay adjustment.

1.08 It will be noted that the 750-ohm loop may be extended to 900 ohms by a closer regulation of the 24-volt talking battery voltage and increase in ringing and coin voltages, as outlined in paragraphs 1.07, 6.02, and 6.03. This means that if a minimum of 24.5 volts can be maintained at the equipment, and higher ringing and coin voltages obtained, the loop can be extended to 900 ohms without making any circuit changes. On this basis, any note on any circuit which states that "when the maximum loop exceeds 750 ohms, etc." may be interpreted as reading: "when the maximum loop exceeds 900 ohms, etc."

1.09 When subscriber loops exceed 900 ohms but the maximum loop does not exceed 1200 ohms, it will be noted that some of the circuits listed in paragraph 1.07 do not require changes; that is, the 750-ohm loop requirements may be used.

1.10 The notes giving the maximum circuit loop conditions on some circuits indicate only 750- and 1500-ohm loop requirements. These circuits may be used for offices having maximum ranges of 900 and 1200 ohms by using the 750- and 1500-ohm loop requirements as follows.

(a) Where no change is required to use the circuit for either 900- or 1200-ohm loops, the 750-ohm requirements shall apply.

(b) Where circuit changes (noted in paragraph 1.07) are required for 1200-ohm loops, the 1500-ohm requirements shall apply.

1.11 With the 24-volt talking battery regulated and the ringing and coin voltages increased as outlined in Part 6, except as noted below in paragraph 1.12, the test circuits associated with the circuits referred to in paragraph 1.07 do not require any change for extended loops up to 900 ohms. When this is exceeded, however, changes should be made as directed in paragraph 1.12 and notes on the respective circuits.

1.12 The following testing equipment should be modified for use in extended loop offices:

Test Equipment Affected	Reqd	Reqd	Reqd
	for 900 ω	for 1200 ω	for 1500 ω
Subscriber line test set	No	No	Yes
District selector test frame	No	Yes	Yes
Final selector test frame	No	Yes	Yes
Final selector test set - wagon type	No	Yes	Yes
Subscriber sender test frame	See Note A	Yes	Yes
Final multiple test lines	See Note B	Yes	Note C
Tripping relay adjust set	See Note B	Yes	Note D
Recording completing trunk test set	No	Yes	Yes
Coin control test set	See Note A	See Note A	See Note A
Message register test set	No	No	Yes
Station ringer test circuit	See Note E	Yes	Note C
Dial test circuit	No	See Note F	See Note F
Test circuit at sender MB frame in offices not having DSA swbd	No	No	Yes
Line finder brush continuity test set	No	No	Yes
Incoming selector test frame	No	No	Note G

Notes

- A. Where the range of coin lines is extended, modifications will be required in the coin control test set. Where coin senders are used, modifications will be required in the coin control test set. Where coin senders are used, modifications will be required in those portions of subscriber sender test frames which are involved in testing the sender coin features.
- B. Final multiple test line and tripping relay adjust set circuits in 900-ohm ac-dc ringing offices will require changes as outlined in paragraph 4.16.
- C. Final multiple test line and station ringer test set circuits in offices modified for 1500-ohm loops must be replaced as outlined in paragraphs 4.15 and 4.17.
- D. Tripping relay adjusting test sets will not be required in offices where the loop is extended to 1500 ohms.
- E. Station ringer test circuits in 900-ohm loop offices with 4-party full selective ringing will require change as outlined in paragraph 4.18.

F. The following types of panel offices in which the subscriber loops are extended above the 750-ohm limit require that the dials be maintained within the present speed requirements: (1) 900- and 1000-ohm offices and (2) new or converted offices employing the new-type sender dial pulsing circuit but with some lines having 4-mf bridges. (See paragraphs 4.22 and 4.23.)

G. If the final multiple test lines that are replaced as outlined in paragraph 4.15 are of the nonsynchronizing type, it will be necessary to change the cross connection in those incoming selector test frames wired according to ES-20042-01 or similar circuits in other offices which test incoming circuits in the office being modified. The cross connection involved is the one which discriminates between synchronizing and nonsynchronizing test lines.

2. SUPPLEMENTARY INFORMATION

815-000-000 - Panel Systems Index

AA128.006 - List of General Equipment

Requirement Sections

X-61200 - List of Equipment Design Requirement Specifications for Offices Having Ground on the Cutoff Relays

X-61400 - List of Equipment Design Requirement Specifications for Offices Having Battery on the Cutoff Relays

J86207 (AA362.008) - Regulated Tube Rectifiers

J86423 (AA367.108) - 103B Power Plant - 75-volt, 0.6-ampere Supply - Using Regulated Tube Rectifier With Dry Cell Reserve

J86555 (AA367.809) - Machine Ringing Equipment for 803C Plants

3. DRAWINGS

Key Sheets

- SD-21300-01 - Panel Link Equipment - Battery Cutoff Relay Offices
- SD-21680-01 - Panel Link Equipment - Ground on Cutoff Relay Offices
- ES-262532 - Sender Selector Equipment - 3-digit Areas
- ES-262647 - Sender Selector Equipment - 2- & 2-, 3-digit Areas
- ES-262829 - Rotary Link Equipment - 3-digit Areas
- ES-262849 - Rotary Link Equipment - 2- & 2-, 3-digit Areas

Index to Circuits

Note: The following circuits have been changed to provide for operation with extended loop ranges. For equipment drawings associated with district and incoming selector circuits, refer to subheadings Framework, Equipment, and Wiring and Cabling.

Subscriber Line Circuits

<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>
ES-207196	- Line and Trip Ckt	Not Affected
ES-226909	- Line and Trip Ckt	
ES-240292	- Line and Trip Ckt	
SD-20126-01	- Subscriber Line Ckt	
SD-20294-01	- Line, Trip, & Start Ckt	
ES-20298-01	- Line, Trip, & Panel Link Ckt	
SD-21460-01	- Line, Trip, Start, & Link Ckt	
SD-21525-01	- Line Switch Ckt (Mod of ES-207698)	
SD-21546-01	- Line Switch Ckt	
SD-21626-01	- Line, Trip, Start, & Link Ckt	
SD-21712-01	- Subscriber Line Ckt	
SD-21715-01	- Subscriber Line Ckt	

District Selector Circuits

ES-207199	- Noncoin	See Note
ES-226378	- Coin	
ES-226940	- "A" Position	
ES-240071	- Noncoin	
ES-20640-01	- 2-party MR	
ES-21030-01	- FR & MRI	
SD-21030-02	- FR & MRI	
ES-21031-01	- Coin	
SD-21031-02	- Coin	
SD-21032-02	- 2-party MR	
SD-21032-03	- 2-party MR	
SD-21077-01	- FR & MRI	
SD-21078-01	- Coin	
SD-21079-01	- 2-party MR	
SD-21221-01	- Misc Ckts for Dis- trict Frames	
SD-21350-01	- Coin	
SD-21627-01	- FR & MRI	
SD-21628-01	- Coin	
SD-21628-02	- Coin (Mod of SD-21628-01)	
SD-21629-01	- 2-party MR Without Z & OT	
SD-21630-01	- FR & MRI With Z & OT	
SD-21631-01	- Coin With Z & OT	
SD-21726-01	- 2-party MR Without Z & OT	
SD-21818-01	- 2-party MR (Mod of SD-21629-01)	
SD-21821-01	- 2-party MR Without Z & OT	
SD-21882-01	- 2-party MR With Z & OT	
SD-21867-01	- 2-party MR (Mod of SD-21726-01)	

Incoming Selector Circuits(1) General:

SD-21229-01	- Misc Ckts for In- coming Frames	See Note
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(2) Panel Local or Tandem:

<u>Circuit</u>	<u>Type of Ringing</u>	<u>Eqpt Dwg</u>
ES-226524	- 4-party Semi-Sel	See Note
ES-20139-02	- 4-party Full Sel	
ES-20292-01	- 2-party Full Sel	
ES-20293-01	- 4-party Semi-Sel	
ES-21036-01	- 2-party Full Sel	
ES-21043-01	- 4-party Semi-Sel	
ES-21053-01	- 4-party Full Sel	
SD-21115-01	- 2-party Full Sel	
SD-21115-05	- 4-party Semi-Sel	
SD-21116-01	- 4-party Full Sel	

(3) Manual Local and Tandem:

ES-20070-02	- 4-party Full Sel	See Note
SD-21115-02	- 2-party Full Sel	
SD-21115-04	- 2-party Full Sel	
SD-21115-06	- 4-part Semi-Sel	
SD-21115-08	- 4-party Semi-Sel	
SD-21116-02	- 4-party Full Sel	
SD-21116-04	- 4-party Full Sel	
SD-21367-01	- 4-party Semi-Sel	
SD-21796-02	- 4-party Full Sel	
SD-21780-03	- 4-party Full Sel	
SD-21796-01	- 2-party Full Sel	
SD-21825-01	- 2-party Full Sel	
SD-21857-01	- 2-party Full Sel	
ES-21864-02	- 4-party Semi-Sel	

(4) Manual Long Distance:

ES-207598	- 4-party Semi-Sel	See Note
ES-20072-02	- 4-party Full Sel	
SD-21120-01	- 2-party Full Sel	
SD-21504-02	- 2-party Full Sel	
SD-21504-03	- 2-party Full Sel	
SD-21504-05	- 4-party Semi-Sel	
SD-21504-06	- 4-party Semi-Sel	
SD-21505-02	- 4-party Full Sel	
SD-21505-03	- 4-party Full Sel	
SD-21798-01	- 2-party Full Sel	
SD-21798-02	- 4-party Semi-Sel	
SD-21828-01	- 2-party Full Sel	

(5) Manual Key Indicator:

ES-207550	- 4-party Semi-Sel	See Note
ES-226713	- 4-party Full Sel	
ES-226886	- 2- and 4-party Semi-Sel	
ES-20139-01	- 4-party Full Sel	
ES-21043-02	- 2- and 4-party Semi-Sel	
ES-21053-02	- 4-party Full Sel	
SD-21115-03	- 2-party Full Sel	
SD-21115-07	- 4-party Semi-Sel	
SD-21116-03	- 4-party Full Sel	

(6) Key Indicator and Key pulsing
Long Distance:

ES-239665	- 2- and 4-party Semi-Sel	See Note
SD-21123-01	- 2-party Semi-Sel	

<u>Circuit</u>	<u>Type of Ringing</u>	<u>Eqpt Dwg</u>
SD-21124-01	- 4-party Semi-Sel	See Note
SD-21125-01	- 4-party Semi-Sel	
SD-21371-01	- 4-party Semi-Sel	
SD-21372-01	- 4-party Full Sel	
SD-21504-01	- 2-party Full Sel	
SD-21504-04	- 4-party Semi-Sel	
SD-21505-01	- 2-party Full Sel	

(7) Keypulsing "A" Switchboard:

SD-21693-01	- 2-party Semi-Sel	See Note
SD-21787-01	- 2-party Full Sel	
SD-21787-02	- 4-party Semi-Sel	
SD-21787-03	- 4-party Full Sel	

(8) Miscellaneous Incoming Selectors:

<u>Circuit</u>	<u>Title and Type of Ringing</u>	<u>Eqpt Dwg</u>
ES-239590	- Local Test Desk - No Ringing	See Note
SD-20029-01	- Local Test Desk - No Ringing	
ES-20069-01	- "A" Swbd via "B" Swbd - 4-party - Semi-Sel	
SD-21511-01	- "A" Swbd via "B" Swbd - 2-party - Full Sel	
SD-21564-01	- Central "A" Swbd via Central "B" Swbd - 2-party - Full Sel	
SD-21564-02	- Central "A" Swbd via Central "B" Swbd - 4-party - Semi-Sel	
SD-21564-03	- Central "A" Swbd via Central "B" Swbd - 4-party - Full Sel	
SD-21620-01	- "A" Swbd via Central "B" Swbd - 2-party - Full Sel	
SD-21620-02	- "A" Swbd via Central "B" Swbd - 4-party - Semi-Sel	
SD-21620-03	- "A" Swbd via Central "B" Swbd - 4-party - Full Sel	
SD-21780-01	- "A" Swbd Dialing - 2-party - Full Sel	
SD-21780-02	- "A" Swbd Dialing - 4-party - Semi-Sel	
SD-21789-01	- "A" Swbd via "B" Swbd - 2-party - Full Sel	
SD-21789-02	- "A" Swbd via "B" Swbd - 4-party - Semi-Sel	
SD-21789-03	- "A" Swbd via "B" Swbd - 4-party - Full Sel	
SD-21799-02	- "A" Swbd via "B" Swbd - 4-party - Semi-Sel	

<u>Subscriber Sender Circuits</u>		
<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>
ES-226610	- 2-digit - Noncoin	Not Affected
ES-20008-01	- 2-digit - Noncoin	ES-373157
ES-20009-01	- 2-digit - Coin	ES-373157
SD-20083-01	- 2-digit - Noncoin	Not Affected
SD-21193-01	- 3- or 3-, 2-digit - Noncoin	ED-20129-01 ED-20129-03
SD-21193-02	- 3- or 3-, 2-digit Area - Noncoin Sender Selector Type	ED-20492-01
SD-21193-05	- 3- or 3-, 2-digit - Noncoin - Timed Release	ED-20129-02 ED-20129-04
SD-21194-01	- 3- or 3-, 2-digit - Coin	ED-20129-01 ED-20129-03

Final Selector Circuits

ES-226764	} - Arranged Not to Await Called Sub Release on No Test Calls	Not Affected
ES-226874		
ES-207389	} - With Marginal Relay Test Time	
ES-207959		
ES-239664	} - Measure Release on Perm Sig	
ES-239665		
SD-21200-01	- Regular	
SD-21200-02	- Test	

Sender Test Circuits

ES-239675	- 2-digit Sub	Not Affected
ES-20010-01	- 2-digit Sub	ES-373022 ES-373028
ES-20013-01	- 3-digit Sub	ES-373251 ES-299998
SD-21026-01	- 3-digit Sub	ED-20158-01
ES-21107-01	- "B" Swbd & Pos Test	ED-20794-01
ES-21107-02	- Central "B" Swbd & Pos Test	ED-20794-01
ES-21186-01	- Sub & Key Pulsing	ED-20651-01 ED-20651-02 ED-20652-01
ES-21837-01	- Relay Int Ckt - Revertive Pulsing	ED-20867-01
ES-21838-01	- Relay Int Ckt - Key Pulsing	ED-20867-01
ES-21856-01	- Relay Int Ckt - Dial Pulsing	ED-21856-01

Local Test Desk and Local Test Cabinet Circuits

ES-207761	- Pri & Sec Ringing Ckt	Not Affected
ES-226027	- Pri & Sec Ringing Ckt	
ES-239388	- Test Ckt	
		ES-420038 ES-420195

<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>	<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>
ES-239415	- Test Line From Dist or Off. Fr	Not Affected	SD-20043-01	- Final Sel Test	ED-20469-01
ES-239441	- Sec Ringing Ckt		SD-20050-01	- Inc & Final Sel Test	ED-20335-01
ES-239767	- Test Line to MDF, IDF, or RR	ES-420038 ES-420195	ES-20054-01	- Message Register Test Set	Not Affected
ES-261158	- Test Ckt		SD-20127-01	- Tripping Rel Ad- justing Test Set	No ES- or ED-
ES-358038	- Telephone Ckt	Not Affected	SD-20147-01	- Coin Control Test	ED-20450-01
ES-359373	- Test Ckt - Sup- plementary		ES-20149-01	- Final Sel Test	ES-373350 ES-373528 ES-299885
SD-15262-01	- Sec Ringing Ckt	ES-420038 ES-420195	ES-20150-01	- Off. Inc & Final Sel Test	ED-21385-01
ES-20163-01	- Test Line From MDF, IDF, & RR		SD-20154-01	- 51-type Dial Tester	
ES-20176-01	- Test Line From Dist or Off. Fr	No ES- or ED- Not Affected	SD-20173-01	- Message Register Test Set	Not Affected
ES-20563-01	- Testing Ckt		SD-20205-01	- Final Mult Test Line	
SD-20629-01	- Pri & Sec Test Ckt	ED-20746-01	SD-20205-02	- Final Mult Test Line	ED-20579-01
SD-20635-01	- Test Trk Ckt		SD-20240-01	- Dist Sel Test W/O Loc Cont ZR	
SD-21332-01	- Test Trk Ringing Ckt - Ind	Not Affected	SD-20240-02	- Dist Sel Test With Loc Cont ZR	ED-20579-02 ED-20356-02 ED-20893-01
SD-21333-01	- Test Trk Ringing Ckt - Semi-Sel		SD-20240-03	- Dist Sel Test W/O Loc Cont ZR, NZO, & RCZR	
SD-21334-01	- Test Trk Ringing Ckt - 4-party	ED-90764-01 ED-90239-01	SD-20444-01	- "A" Swbd Cord Test	Not Affected
SD-21335-01	- Test Trk Ringing Ckt - 2-party		SD-21094-01	- Fin Mult Test Line	
SD-21341-01	- Test Trk From Off on Dist Mult	Not Affected	SD-21094-02	- Fin Mult Test Line	ED-21385-01
SD-90018-01	- Trunk Ckt		SD-21096-01	- Fin Mult Test Line	
SD-90053-01	- Pri & Sec Test Ckt	ED-90292-01	SD-21304-01	- LF Brush Cont Test Set	ES-225559
SD-90061-02	- Ringing Ckt - 2-party Sel		SD-21319-01	- Fin Mult Test Line	
SD-90223-01	- Test Set Ckt - Local Test Cab. No. 1	Not Affected	SD-21385-01	- 51-type Dial Tester	ED-20727-01
SD-90061-05	- Ringing Ckt - 2- & 4-party Sel		SD-21623-01	- Sub Line Test Set	
SD-90429-02	- Ringing Ckt - 2-party Sel	ES-90684-01	SD-21647-01	- Sub Line Test Set	ED-20122-02 ED-91138-01
SD-90429-03	- Ringing Ckt - 4-party Semi-Sel		SD-21697-01	- Sender MB Test	
SD-90429-04	- Ringing Ckt - 4-party Semi-Sel	ED-90759-01	SD-90411-01	- Test Ckt for 209FA & 209FD Rels	ED-96096-01
SD-90497-01	- Pri & Sec Test Ckt		SD-90470-01	- Recording Comp Trk Test	
<u>Miscellaneous Test Circuits</u>			SD-96096-01	- Final Mult Test Line	ED-96121-01
ES-239371	- Final Mult Test Line	No ES- or ED-	SD-96121-01	- 209FF Relay Test	ED-96218-01
ES-239382	- Final Sel Test		ES-225559 Not Affected	SD-96218-01	- Sta Ringer Test
ES-239515	- Dist Sel Test	No ES- or ED-		<u>Service Observing Circuits</u>	
ES-239535	- Final Sel Test		SD-21424-01	- Serv Obs Line	ED-20534-01
ES-239832	- Sub Line Test	ES-225559 Not Affected	SD-21425-01	- Serv Obs Line	ED-20534-01
ES-239844	- Off. Inc & Final Sel Test		SD-21849-01	- Dial Pulse Re- cording Ckt	ED-21849-01
ES-261007	- Final Mult Test Line	No ES- or ED-	SD-90558-01	- Dial Pulse Amp	ED-90845-01
ES-261022	- Final Mult Test Line		SD-90580-01	- Serv Obs Ckt No. 10 Serv Obs Desk	ED-90944-02

<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>	<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>
SD-90647-01	- Serv Obs Ckt - Central Serv Obs Desk	ED-91320-01	SD-21546-01	- Manual Sub Line Switch Ckt	} Not Affected
SD-96079-01	- Serv Obs Ckt - Central Serv Obs Desk	ED-90356-01	SD-21548-01	- Coin Control Ckt Central "A" Swbd	
SD-96080-01	- Dial Recorder Ckt Central Serv Obs Desk	ED-96080-01	SD-21560-01	- Trk Fdr and OGT to Central "A" Swbd	
			SD-21600-01	- Spl Service Trk Ckt	
<u>"A" Switchboard Circuits</u>			SD-21705-01	- Coin Control Ckt for Inc Sel and Rec Comp Trks	} Not Affected
ES-207716	- Plugging-up Line Ckt Sender Monitor	Not Affected	SD-21721-01	- Line Fdr and Trk Ckt	
ES-226044	- Sdr Mon Cord Ckt	No ES- or ED- Not Affected	SD-21778-01	- Manual Sub Line Ckt	} Not Affected
ES-226194	- Inc Trk to O or 2 No Operator		SD-21795-01	- Manual Sub Line Ckt	
ES-226316	- Sdr Mon Howler Ckt	No ES- or ED- Not Affected	SD-21823-01	- Oprs Rec Comp Trk Ckt	ED-21823-01
ES-226618	- Incpt & Spl Serv Cord Ckt	No ES- or ED- Not Affected	SD-90452-01	- Recording Comp Cord Ckt	} Not Affected
ES-240057	- "A" Swbd Sub Line Ckt		SD-90453-01	- Spl Serv Cord Ckt	
SD-20374-01	- "A" Swbd Sig Ckts	Not Affected	SD-90454-02	- Incptg & Asst Oprs Cord Ckt	} Not Affected
SD-20376-01	- Plugging-up Line Ckt		SD-90459-01	- "A" Swbd Coin Cont Ckt	
SD-20464-01	- 2-way Rec Comp Trk Ckt		<u>Miscellaneous Circuits</u>		
SD-20545-01	- 2-way Rec Comp Trk Ckt	ED-20500-02	ES-226189	- Misc Alms - G on CO	No ES- or ED- ES-299702
ES-20551-01	- Incpt & Spl Serv	Not Affected	ES-239542-	- SM Cord & Dist Ckt	} Not Affected
SD-21011-01	- Cord Ckt		ES-240206	- Link & Sel Time Alarm Ckt	
SD-21013-01	- Spl Serv Cord Ckt		ES-10551-01	- Ringing Ckt for Rep Clks Desk	} Not Affected
ES-21073-01	- Spl Serv Cord Ckt	No ES- or ED- Not Affected	ES-10724-01	- Ringing Ckt for Chief Operator's Desk	
ES-21074-01	- Spl Serv Cord Ckt		SD-20211-01	- "B" Pos Ringing Ckt	} Not Affected
SD-21130-01	- 2-way Rec Comp Trk - Coin	ED-21130-01	ES-20220-01	- Ringing Ckt for Tlb Desk or OGT Swbd	
SD-21349-01	- 2-way Rec Comp Trk - Noncoin	ED-21349-01	SD-21201-01	- Fl Alm Swbd Fuse and Time Alm Ckt	} Not Affected
SD-21435-01	- Spl Serv Cord Ckt		SD-21204-02	- Power Alm Ckt for Ringing Coin Control, Tone, & Assoc Leads AC-DC	
SD-21436-01	- Rec Comp Cord Ckt		SD-21204-04	- Power Alm Ckt for Ringing, Coin Control, and Tone Leads - Sup	} Not Affected
SD-21443-01	- Plugging-up Line Ckt		ES-20233-01	- Time Alm Ckt	
SD-21451-01	- Oprs Rec Comp Trk Ckt	Not Affected	ES-20241-01	- Misc Alms - G on CO	} Not Affected
SD-21454-01	- Spl Serv Cord Ckt		SD-21272-01	- Fuse Alm Ckt for Fuse Swbds and Bat. Dist Fuse Swbds	
SD-21459-01	- Spl Serv Cord Ckt		SD-21296-01	- Free Line From Final Mult	Not Affected
SD-21509-01	- Incpt Cord Ckt				
SD-21527-01	- Spl Serv Cord Ckt				
SD-21529-01	- Incpt & Spl Serv Cord Ckt				
SD-21542-01	- Spl Serv OGT Coin				
SD-21544-01	- Spl Serv OGT - Noncoin				

<u>Circuit</u>	<u>Title or Type</u>	<u>Eqpt Dwg</u>
SD-21446-01	- Free Line Ckt From Final Mult	ED-20612-01
SD-21645-01	- Terminating Sender Ckt	ED-20771-01
SD-21666-01	- Misc Int Ckt - B on CO	ED-21666-01
SD-21667-01	- Misc Int Ckt - G on CO	ED-21666-01
SD-80420-01	- Ringing Ckt - 800-type Power Plants	
SD-80441-01	- Bat. Distg Ckt - Grouping of Frames and Racks	
SD-80577-01	- Discharge Ckt - 300-type Power Plants	
SD-80594-04	- Ringing Ckt - 800-type Power Plants	
SD-80658-01	- Bat. Distg Ckt Power Plants Without Com- mon Power Filter	No ES - or ED -
SD-80693-01	- Ringing Ckt - Mod of Existing 803B and 804A AC-DC Ringing Plants for Ex- tended Loop Signaling	
SD-80699-01	- Ringing Ckt - Mod of AC-DC Ringing Plants for Extended Loop Signaling	
SD-96128-01	Private Line Ckt	ED-91255-01
SD-96139-01	- 10-party Aux Line Ckt	ED-91633-01
SD-96146-01	- Private Line Ckt	ED-91326-01
SD-96211-01	- Filter Ckt	ED-91504-01

Framework

ED-20177-01	- Assembly of Selector Frames
ED-20177-02	- Assembly Details of Selector Frames
ED-20865-01	- Assembly of Trans Battery Filter Panel
ED-25081-01	- Relay Rack Unit Framework
ED-25260-01	- Steel Panels
ED-91275-01	- Assembly of Resistance Lamp Panel for 11-type Resistance Lamp on Fuse Boards - Single Row Panels
ED-91276-01	- Assembly of Resistance Lamp Panel for 11-type Resistance Lamps on Fuse Boards - Double Row Panels
ED-91504-01	- Assembly of Filter Panels for Fuse Board and RR Fuse Bay

Equipment

ED-20178-01	- Equipment for District and In- coming Selector Frames
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ED-20178-02	- Equipment Details - District Frame
ED-20178-04	- Equipment Details - Incoming Frames - B on CO
ED-20267-01	- Equipment Details - District Frames - W/O Loc Cont ZR Grd on CO
ED-20267-02	- Equipment Details - District Frames - With Loc Cont ZR Grd on CO
ED-20278-01	- Equipment Details - Incoming Frames - G on CO
ED-20865-01	- Equipment of Transmission Battery Filter Panel
ED-91310-01	- Filter Panel for Swbd Cable Turning Section

Wiring and Cabling

ED-20623-01	- Method of Running and Support- ing Frame Battery and Ground Leads for Double-sided Frames
ED-20781-01	- Local Cable - Selector Frames
ED-20781-02	- Local Cable - Coin District Selector Frame
ED-20781-03	- Local Cable - FR and IMR Dist Frame Arranged for Loc Cont ZR
ED-20781-04	- Local Cable - 2-party MR Dist Frame Arranged for Loc Cont ZR
ED-20782-01	- Local Cable - Ind 2-party MR Dist Frame Arr for Loc Cont ZR - G on CO Offices
ED-20782-02	- Local Cable - Coin District Frame - Arr for Loc Cont ZR - G on CO Offices
ED-91504-01	- Power Wiring for Filter Panels on Fuse Boards

4. GENERAL NOTES

4.01 The list of circuits given in Part 3 under "Index of Circuits" is complete as of the date of issue of this specification. However, since circuits that are rated "A and M Only" or "Mfr. Disc." have been and will continue to be changed for extended loop ranges on an order basis, it follows that this list will have to be supplemented from such time as orders for conversion of other offices are received.

4.02 The following paragraphs cover additional information that is not contained in paragraphs 1.07 and 1.12 and under "Index of Circuits." This information is required for use in modifying existing panel offices for extended loop ranges.

District and Incoming Selectors

4.03 When modifying district and incoming selectors for operation with maximum external circuit loops that exceed 900 ohms, the talking battery shall be changed to 48 volts by adding a transmission battery filter panel per frame and an 11-type resistance lamp per circuit. The wiring arrangement for this equipment shall be as shown on the following circuits and the equipment drawings listed herein:

SD-21221-01 - Misc Ckts for Dist Frames
SD-21229-01 - Misc Ckts for Inc Frames

4.04 When mounting 11-type resistance lamps below repeating coils, where the coils are mounted on the horizontal center line of the mounting plate, a shield shall be mounted between the coils and the resistance lamps to prevent overheating the coils and condensers. The shields and resistance lamp panels that are available are as follows:

<u>Inches</u>	<u>Shield</u>	<u>Lamp Mounting Plate</u>
14	D-156865	D-156860
14-1/2	D-156866	D-156861
16-1/2	D-156215	154A
18	D-156867	D-156862
19	D-156413	155A
21	D-156868	D-156863
23	D-156414	156A
24	D-156869	D-156864
25	D-157156	D-157067

4.05 Where space is not available for the resistance lamps on district and incoming frames, as in the case where repeating coils and condensers are mounted on coil racks, the talking battery fuse panels on the fuse board shall be replaced with lamp panels containing the same number of 11A resistance lamps as fuses replaced and the 24-volt talking battery changed to 48-volt talking battery. The circuits will function with the resistance lamp panels reconnected temporarily to the 24-volt talking bus bars until all of the fuses have been replaced by lamps, at which time the change-over to a 48-volt talking battery supply can be made for all of the lamp panels. Single-row fuse panels shall be replaced with lamp panels per ED-91275-01; double-row fuse panels shall be replaced with lamp panels per ED-91276-01. The wiring for this arrangement shall be in accordance with Figs. 76 and 77 on ES-226189 for ground on the cutoff relay offices and in accordance with Fig. 1 on SD-21272-01 for battery on the cutoff relay offices.

4.06 In the case of the older type of incoming frames, where 90-type condensers are mounted on 969A mounting plates and space is not available for the resistance lamps, these lamps shall be mounted in condenser drillings by means of adapters as shown on ED-20900-01, replacing the 90-type with 437-type condensers, if necessary.

4.07 When talking battery fuse panels on fuse boards have been replaced by resistance lamp panels as outlined in paragraphs 4.05 and 4.06, a second equipment guard shall be provided and mounted midway between the bottom lamp panel and the regular equipment guard generally furnished. This second guard shall not be furnished, however, if there are four or less resistance lamp panels below the regular equipment guard.

4.08 When all district and incoming selector frames in an office are equipped with transmission battery filter panels and all selectors on the frames are equipped with 11-type resistance lamps mounted on the frames, the district and incoming fuse boards are no longer required and may be removed.

4.09 On incoming selector circuit ES-20070-02 and similar circuits, it will be necessary, for circuit reasons, to retain 24-volt battery for the relay and lamps equipment. This may be either quiet or signaling battery, whichever is the more convenient. Where the 11-type resistance lamps are mounted on the incoming frame, the present 24-volt fuses that have been replaced by the 48-volt transmission battery filter panel on the frame can be reused for this purpose. However, where the resistance lamps have replaced the 24-volt fuses on the coil rack fuse board as outlined in paragraph 4.05, it will be necessary to provide new 24-volt fuses for these incoming selector circuits.

4.10 On incoming selector circuit SD-21053-01 and similar circuits that are modified for extended loops exceeding 900 ohms and provided with common fusing for the repeating coil battery, it is necessary to continue to provide either 24- or 48-volt talking battery (depending on the type of incoming) for the A relay. The present wiring and cabling to the 24- or 48-volt talking fuses for this equipment should, therefore, be retained. However, if the district or incoming fuse boards have been removed under the conditions outlined in paragraph 4.08, it will be necessary to run new switchboard cable from the incoming frame to new fuses at the relay rack fuse bay or fuse board.

4.11 On incoming selector circuit SD-21511-01 and similar circuits which do not require repeating coil transmission, it is necessary to retain 24-volt talking battery and ground for the relay equipment in the circuit. The same procedure as outlined in the preceding paragraph should be followed when these circuits are modified for extended loops exceeding 900 ohms.

Subscriber Senders

4.12 On regular noncoin senders per SD-21193-01 and coin sender per SD-21194-01 which have been installed in accordance with ED-20129-01, the equipment changes required to extend the loop range shall be in accordance with ED-20129-01. On timed release senders per SD-21193-05 which have been installed per ED-20129-02, the equipment changes shall be as shown on this drawing. In some recent panel offices, the equipment arrangements for regular noncoin and timed release senders are in accordance with ED-20129-03 and ED-20129-04, but the

senders may be arranged for only 1000-ohm loop operation. To modify these senders for operation with 1500-ohm subscriber loops, it is only necessary to provide the additional equipment required, since these senders are universally wired for both 1000- and 1500-ohm loop operation. It is necessary to modify the coin sender per SD-21194-01 for extended range and to replace the N and R resistances as indicated by the coin test working limits shown on the circuit. When this is done, a corresponding change must be made in the associated sender test circuit to insure proper operation.

4.13 The following relay interrupter units are for use with all of the test circuits listed in paragraph 3.06, except ED-239675, and shall be furnished as required:

- J29201UA - Revertive Pulsing Interrupter Unit
- J29201UB - Keypulsing Interrupter Unit
- J29201UC - Dial Pulsing Interrupter Unit

These are relay rack mounted units, the requirements for which are included in J29201.

Test Panels for 209-type Relays

4.14 A test panel per J93006E shall be furnished for testing 209FF relays in the relay interrupter circuits. In offices where circuits are equipped with 209FA and 209FD relays, a test panel per J93006A shall be furnished in addition to panel per J93006E.

Final Multiple Test Line Circuit

4.15 Final multiple test line circuit SD-96096-01 shall be specified for use in panel offices that are modified for operation with a maximum external circuit loop of 1500 ohms. The equipment for this circuit is mounted on a relay rack unit and the requirements are covered by J93006B, which is included in specification J93006. This circuit is required, in connection with 1500-ohm subscriber loop operation, to test the 114KA tripping relay in the incoming selector circuits. It replaces final multiple test line circuit SD-21319-01, tripping relay adjusting test circuit SD-21027-01, and similar circuits which are arranged for operation with a maximum loop of 1200 ohms.

4.16 In ac-dc offices arranged for a maximum external loop of 900 ohms or in ac-dc sender selector type offices arranged for 1200 ohms, where the ringing voltage is converted to 84 to 88 volts ac and with the 48-volt battery used as the dc component, resistance changes will be required in the final multiple test lines. These changes affect only the test resistances used for testing the tripping and supervisory relays.

In 900-ohm full selective offices, no changes are required in the final multiple test line circuits. However, in 1200-ohm full selective offices, tube sets are required in all 4-party stations and changes are required in the final multiple test lines and tripping relay adjusting test sets.

Station Ringer Test Circuit

4.17 Station ringer test circuit SD-96218-01 shall be specified for use in panel offices that are modified for operation with maximum 1500-ohm loops. The equipment for this circuit is mounted on a relay rack unit and the requirements are covered by J93006C, which is included in specification J93006. This circuit is for use in offices in which the senders are equipped with 239-type pulsing relays, and therefore, replaces station ringer test circuits SD-21094-01, SD-21094-02, and similar circuits which are for use in offices in which senders are equipped with E- or L-type pulsing relays in offices arranged for a maximum external circuit loop of 1000 ohms.

4.18 In 4-party full selective ringing offices arranged for a maximum external loop of 900 ohms, it will be necessary to change the tripping relay in series with the ringer adjusting voltage in the station ringer test circuit to a 114AK relay, adjusted as outlined on the respective circuits. In sender selector offices arranged for a maximum external loop of 1200 ohms, a new adjustment is required for the trip relay in the station ringer test circuits.

Miscellaneous Interrupter Frame

4.19 The interrupter contacts for use with final multiple test line and station ringer test circuits, referred to in paragraphs 4.15 and 4.16, shall be added in accordance with miscellaneous interrupter circuits SD-21667-01 and SD-21666-01 and equipment drawing ED-21666-01.

Coin Control Test Set

4.20 Minor changes in wiring and resistances shall be made in this circuit in order that it will test coin control circuits with the new minimum coin voltage. The changes vary depending on whether or not the control circuits are arranged for click reduction.

4.21 The subscriber line test set requires changes in resistances and the addition of a key, which is used to enable this circuit to test line relays whether or not they are adjusted to function over 1500-ohm loops.

51-type Dial Test Circuits

4.22 Dial testing may be waived entirely in those offices in which the subscriber

senders are equipped with the new type dial pulsing circuit, and all lines are limited to 2 mf (3 mf is permitted on PBX through dialing). However, in those cases where other offices in the area do not have this range limitation, other considerations may make it desirable to continue dial testing. In this connection, the maintenance of PBX dials to speed requirements will still be required to insure satisfactory operation with the dial PBX switches.

4.23 If the 51-type dial test circuit SD-21385-01 is required to function with external circuit loops in excess of 900 ohms, "Y" wiring and apparatus should be provided if it is not already so equipped. This extends the circuit range to 1650 ohms based on a minimum of 47.5 volts at the equipment

Local Test Cabinet No. 1

4.24 When it is required to make continuity tests of subscriber lines that are equipped with tube subsets, test set circuit SD-90223-01 shall be changed in accordance with its associated equipment drawing and notes on the circuit.

Local Test Desk No. 12B

4.25 The features in this desk are affected by increases in subscriber loop ranges as follows.

(a) Talking Battery and Supervision: There is no change for 900-ohm loops. For 1200-ohm loops in sender selectors and 1500-ohm loops in any type office, the talking battery should be changed to 48 volts, as indicated on ES-261158 or similar circuits.

(b) Sounder or Buzzer Test Feature: In offices that are arranged for a maximum external loop of 1500 ohms, a change in the adjustment of the BR relay is required if the desk is equipped with a sounder, and an additional relay is required if the desk is equipped with a buzzer. These changes are not required for the lower extended loop ranges.

(c) Machine Ringing: In 4-party full selective offices, the 900-ohm range can be obtained with lines equipped with relay sets by making the following changes. Replace the 198C relay connected in series with the central office machine ringing current by two 114EB relays with their back contacts wired in series. Replace the 198C relay, connected in series with the ringer adjusting voltage of approximately 60 volts ac and 20 volts dc, by two 114AK relays: one wired in series with the positive superimposed ringing voltage and the other in series with the negative superimposed ringing voltage, with the back contacts of the two relays

wired in series. The two 114AK relays should be tested and readjusted in series with a resistance of 1035 ohms for non-operate and a resistance of 900 ohms for operate. For subscriber loop ranges in excess of 900 ohms, it is necessary to employ tube-type subscriber sets, and for this condition, the bell adjusting feature is not required. The 198C relay in series with the central office ringing voltage should be changed to two 114KA relays with their back contacts wired in series in a manner similar to that shown on SD-15262-01.

(d) Test Trunk Signaling Feature: The various test trunks that employ signaling relays, required to operate over subscriber loops, should be checked for the proper operating capabilities of these relays. Most of the circuit drawings involving these signaling relays have already been changed to provide for operation over 1500-ohm subscriber loops. The test lines to MDF and IDF for detecting intermittent trouble are included in this classification.

(e) Dial Test Feature: Desks equipped with 50-type dial testers will operate satisfactorily over 1200-ohm subscriber loops, but for 1500-ohm loops it will be necessary to use the 51-type dial tester as outlined in paragraph 4.23.

Local Test Desk No. 14

4.26 The features in this desk are affected by increases in subscriber loop ranges as follows.

(a) Talking Battery and Supervision: No change is required for this desk to function in offices with 900-ohm loops, provided the test desk battery supply is obtained from a dial office operating under this range condition. No other change is required in the battery supply and supervision arrangements unless (1) the subscriber loop of one or more offices in the building exceeds 950 ohms or (2) the maximum subscriber loop, in one or more offices external to the building where the desk is located, plus the test trunk loop exceeds an external circuit loop of 1500 ohms. If either of these ranges is exceeded, a change should be made as outlined in SD-90497-01.

(b) Line Relay Test Feature: No change is required for this desk to function in offices with 900-ohm loops. For ranges exceeding 900 ohms, changes should be made as outlined in SD-90497-01.

(c) Sounder or Buzzer Test Feature: No change in the sounder or buzzer test feature is required unless the test trunk loop plus the maximum external circuit subscriber loop exceeds 1500 ohms. If this is exceeded, changes should be made as indicated on SD-90497-01.

(d) Machine Ringing: The employment of trip relays for extended range conditions are practically the same as outlined on the various incoming selector circuits. Tripping relays should be returned or replaced as outlined by notes on the respective circuits. The test trunk ringing circuits, converted for extension of subscriber loop ranges, require no changes except when the range is 1500 ohms, in which case it will be necessary to use the 114KA relay. From a tripping standpoint, conflicting conditions may be encountered in offices tested from the same test desk such as: (1) a 1500-ohm range office which requires a 114KA trip relay and an existing office with a ringing voltage of 95 to 103 volts ac and 16 to 19 volts dc which requires a 114KA relay or (2) a 1500-ohm range full selective office which requires a 114KA relay and some other office having some lines equipped with relay-type subsets, which condition requires a 114EB relay. In such cases, the desk should be equipped with the type of ringing employed in the largest number of offices which would otherwise not require test trunk ringing circuits; test trunk ringing circuits should be employed in the test trunks in the offices having a different type of ringing. In addition to the above condition which requires the use of test trunk ringing circuits, these circuits should be employed in offices in other buildings under the following conditions:

(1) When the total external loop, consisting of the test trunk loop and the maximum external circuit subscriber loop, exceeds the tripping range of the trip relay in the secondary ringing circuit.

(2) When the test trunk loop to semi-selective offices or full selective offices, in which all the 4-party lines are equipped with tube subsets, exceeds 300 ohms; and full selective offices in which some of the lines have relay subsets when the test trunk loop exceeds 200 ohms regardless of the length of the maximum subscriber loop in the office. The use of test trunk ringing circuits under this second condition is desirable to provide adequate margins when adjusting ringers and for satisfactory checking of ringing troubles reported by subscribers.

(e) Test Trunk Supervisory Feature: The test trunk circuits of the No. 14 test desk, which have relays that are required to operate over subscriber loops, are the test trunk at the test desk SD-90018-01 and the test trunk from the district or office multiple SD-21341-01. The latter circuit will require no change to function with 1500-ohm loops. However, if the test trunk loop plus the maximum

external circuit loop exceeds 1500 ohms, it will be necessary to change the L relay in SD-90018-01.

(f) Dial Test Feature: The No. 14 test desk is arranged to function with the 51-type dial tester, which is covered in paragraphs 4.23 and 4.24.

Recording Completing Trunk Test Circuit

4.27 The recording completing trunk test set requires resistance changes and the addition of a key. The key is required to enable the test set to be used for testing recording completing trunks whether or not they are arranged for 1500-ohm loop operation.

Message Register Test Set

4.28 The message register test set requires a new adjustment for the 11 relay to enable this circuit to be used for 1500-ohm loop operation.

Line Finder Brush Continuity Test Set

4.29 The line finder brush continuity test set requires a wiring change to make the test set function properly with the new subscriber sender arrangement which applies dial tone to the tip of the line.

Service Observing Circuits - Central Service Observing Desks

4.30 In those offices where service observing circuits are required to work with extended loop ranges, the dial recording equipment associated with centralized service observing shall be changed as covered in specifications J93808, J93810, and J93811.

Service Observing Set No. 6

4.31 For extended loop ranges, dial pulse recording circuit SD-21849-01 shall be specified for use with this equipment.

Talking Battery for Miscellaneous Circuits

4.32 When 48-volt talking battery at district and incoming selector frames is obtained by connecting to transmission battery filter panels on the frames, only signaling battery is available for circuits other than district or incoming selectors. In this case, when either 24- or 48-volt talking battery is required for circuits which are fused from fuse boards or relay rack fuse bays, it may be supplied by adding transmission battery filter panels per ED-91504-01, which shall be wired in accordance with Fig. 1 or 2 per SD-21272-01 in the manner shown on ED-91325-01.

Fuses on Ringing Fuse Panels

4.33 Panel offices employing ac-dc ringing, at present, connect all circuits

requiring audible ringing and some of the circuits requiring continuous ringing to a 100-volt \pm bus bar at the fuse board. This ringing source is discontinued in the arrangements for long loops, but an 84- to 88-volt ac and 42- to 52-volt dc audible source is made available for circuits requiring audible ringing. The 105-volt \pm supply used for PBX ringing is retained and is suitable for circuits requiring continuous ringing.

4.34 Since the 100-volt \pm supply is to be discontinued, it becomes necessary to distribute circuits at present connected to this source on the new audible supply or the 105-volt \pm , as required. These circuits may be classified under three general headings.

- (1) Circuits having leads now designated \pm , in which the ringing current is used to ring subscriber lines, should connect to ac-dc AUD.
- (2) Circuits having leads designated \pm or \pm -AUD, in which ringing current is used to return a ringing signal to the calling subscriber, should be connected to ac-dc AUD.
- (3) All other circuits having leads designated \pm , including those in which ringing current is supplied to a 4C buzzer as shown on ES-239625 and similar circuits and those supplying ringing current to a PBX, should be connected to 105 volts \pm .

4.35 Primary ringing circuits for the local test desks should connect to 105 volts \pm in order to provide as high a ringing voltage as possible. These circuits may supply ringing to other desk circuits which require ringing current without a dc component.

4.36 When modifying existing offices for 1500-ohm range, the installation work may be done in the following sequence or as directed by the telephone company.

- (1) Change the power plant.

- (a) Provide the new ringing voltages.

In full selective offices, increase on a temporary basis both positive and negative silent interval voltages to the silent interval voltage limits used in the replaced ringing power plant. This is required to insure that the 114EB or 114BL trip relays will trip during the silent interval on the longer subscriber loops. When the conversion of the incoming trunks has been completed, the silent interval voltages should be reduced to the standard limits of 46 to 52 volts.

- (b) Provide 48-volt battery and ground supply.

(2) Install new final multiple test lines per SD-96096-01. If the telephone company requires final multiple test line facilities for maintaining the nonconverted trunks, the existing test lines must be retained during the conversion period. In some cases, however, the test lines require modifications after the ringing voltages are changed. The new test lines can be used for testing the converted trunks under some but not all conditions. Where the conditions are such that the new test lines can be used for testing converted trunks, the telephone company should decide whether both old and new groups of test lines should be used during the conversion period, since number assignments are involved which determine the cross connections to be placed. The automatic test frame will test to only one group, and if two groups of test lines are used, the tests to one group must be made from the outgoing trunk test board or with the wagon test set. The existing test line applies the test to the trip relay in the ringing interval, and where it is used, the relays are readjusted with the trip relay adjusting set. The new test line applies the test to the trip relay in the silent interval and readjusting is done with a 35-type test set or equivalent. The use of the new test lines and the existing test lines during the conversion period depends upon the following factors.

- (a) The new test line cannot be used to test incoming trunk circuits which have not been converted to use the 114KA relay.

(b) The new test line cannot be used for testing trunks equipped with the 114KA relay, unless the silent interval voltage is within the standard limits (46 to 52 volts).

(c) The existing test line for 750- or 900-ohm range in full selective offices can be used to test 114EB and 114BL relays in incoming trunk circuits after the ringing voltages are changed as per (1)(a) above. Comparatively few of the relays may fail on the test lines. For readjusting, the trip relay adjusting set is used. This test line cannot be used for testing converted trunks because the 114KA relay will fail on the pretrip test. If it is desired to make test line tests of the converted trunks, it will be necessary to modify one or more of the existing final multiple test lines to provide resistance values in accordance with Table C of Section 040-220-701 for testing the 114KA relay. (Refer to (e) below.) The use

of the modified test line for testing nonconverted trunks would necessitate the readjustment of practically all of the 114EB or 114BL relays.

(d) In extending the range in existing ac-dc offices using ringing voltages 95 to 103 volts ac, 16 to 19 volts dc, and 46 to 52 volts dc silent interval, if the telephone company wishes to have test line facilities for nonconverted trunks, change the test line and trip relay adjusting set to provide the trip relay resistance values in accordance with Table C of Section 040-220-701. Only a small percentage of the relays may require readjustment with the modified readjusting set.

(e) If the ringing interval voltages are already in accordance with the standard (84 to 88 volts ac, 46 to 52 volts dc, or 84 to 88 volts ac \pm 37 to 40 volts dc), the existing test lines can, of course, be used without change for maintaining nonconverted trunks. If the trip relay resistance values are in accordance with Table C of Section 040-220-701, existing test lines may be used for maintaining the 114KA relays in converted trunks. The telephone company may elect to do this if the silent interval tripping voltage is not within the present standard limits, which prevents the use of the new test line until the trunk conversion is completed. Comparatively few of the 114KA relays will fail to meet the test line and require readjustment with the trip relay adjusting set.

(3) Change the district test frame.

(a) The district test circuit will test both short- and long-range districts during the transition period, provided the proper figure is used.

(4) Change district and incoming frames.

(a) Provide 48-volt talking battery.

(b) Provide new adjustment for supervisory relay.

(c) Provide new adjustment for party test relay and add resistance in 2-party message rate districts.

(d) Replace the tripping relays in incoming circuits.

(5) Change subscriber sender test frame.

(a) If possible, testing facilities should be left unmodified to test short-range senders during the transition period.

(6) Change subscriber senders.

(7) Change all "A" switchboard circuits requiring change.

(8) Provide new adjustment for line relays.

(9) Provide new adjustment for C relay in final selectors in BCO offices, and make other modifications in final selectors if in GCO offices.

(10) Change final selector test frame.

(11) Modify all other test and miscellaneous circuits.

4.37 When it is necessary to change PBX circuits as determined by the standard range charts, the local test desk should be modified first so that it may be used to test the PBX circuits after they are changed. All the necessary circuit changes in the PBX circuits should be made before the first modified subscriber sender is placed in service.

5. WIRING AND CABLING

Local Cable

5.01 In order to prevent crosstalk, no deviation from the drawings listed herein shall be made in the size of wire or the method of wiring between the transmission battery filter panel and the resistance lamps on district and incoming selector frames.

6. POWER

General

6.01 The extent of the modifications to power plants supplying existing offices for operation with a maximum of 1500-ohm subscriber loop will depend on the particular office arrangement. The following recommendations will cover, in general, the changes required to the existing battery and ringing equipment required for the various circuits and equipment arrangements modified for extended range operation.

Central Office Battery Supply

6.02 The present 750-ohm loop ranges are based on a minimum of 21 volts at the equipment. The 900-ohm loop ranges with 24-volt transmission are based on a 23-cell power plant operated on a full-float basis with automatic voltage regulation. A minimum of 24.5 volts at the equipment may be expected with the 23-cell arrangement, except under power service failure conditions.

6.03 On 24-cell, 48-volt plants, it will be necessary for the telephone company to determine whether the minimum of 24.5 volts at the equipment can be maintained. In the event that the 24.5 volts cannot be maintained and the telephone company so specifies, the plant should be converted to the 23-cell arrangement.

6.04 The 1200-ohm and 1500-ohm loop ranges with 48-volt transmission may be used with power plants in which the battery is operated on a full-float basis and automatic voltage regulation, thereby maintaining the battery voltage within the limits of 49 to 50 volts under normal operating conditions.

6.05 On plants using the duplicate string battery arrangement when the talking supply is changed from 24 to 48 volts, the increased drain may necessitate increasing the capacity of both the 24- and 48-volt sections of the batteries, as well as providing additional charging machine capacity. In the case of those plants using the single string arrangement with separate 24- and 48-volt batteries, changing to a 48-volt talking supply will not affect the 24-volt battery, therefore, only the capacity of the 48-volt battery and charging generators need be considered.

6.06 Changes in battery and machine equipment should be made only when specified for the particular installation.

Discharge Filters and Condensers

6.07 The changes and additions to discharge leads and filters depend on the location of the repeating coils associated with the district and incoming selectors; that is, whether they are mounted on these latter frames or a separate coil rack as outlined below. It is expected that, in the majority of cases, the existing discharge conductors will be of ample capacity to take care of the added 48-volt talking drain. Therefore, no increase in lead sizes should be made unless specifically ordered for the particular installation.

Individual Frame Filters

6.08 When the repeating coils and resistance lamps for the incoming or district selector circuits are mounted on their associated frame, an individual filter will be provided for each incoming or district frame. The battery supply for this filter shall be taken from the 48-volt signaling leads which supply battery to the existing frame fuse panels.

6.09 In those cases when the leads between the BDFB and frames are run down the end of row of frames and thence along the bottom of the frames under the guard rail, a pair of leads shall be run along the top of the frames for supplying the individual filters. The leads shall be connected to the other leads, described above, at the end of the row of frames.

6.10 Where the leads from the BDFB are run along the top of the row of frames, the filter shall be connected directly to these leads and no additional leads will be required.

6.11 The circuit arrangement for connecting the 48-volt signal supply to the battery filter panel is shown in Fig. 18 of SD-80441-01.

Common Power Filter

6.12 When the repeating coils are mounted on a coil rack and the fuse panels on the fuse board replaced by resistance lamp panels, the common power filter located at the power board will be retained. Under this condition, it will usually be necessary to increase the capacity of the 48-volt choke coil. This can be accomplished in some cases by interchanging the 24- and 48-volt choke coils, since the drain through the 24-volt choke coil will be reduced. In other cases, it may be necessary to provide a new choke coil.

6.13 The fuse which supplies 24-volt talk supply to the fuse board should be disconnected from the 24-volt bus bar and connected to the 48-volt talk bus bar in the rear of the battery control board.

6.14 Since there may be other circuits fused at this fuse board which continue to require 24-volt talking battery supply, a new set of 24-volt discharge leads between the battery control board may be required, and if so, should be provided as required. Since the existing 48-volt talking battery supply leads will not be required when the 24-volt discharge leads are transferred to 48 volts, the existing 48-volt talking supply leads may be used for 24-volt talk supply, provided they are of sufficient capacity.

6.15 On a number of installations, it will be found that some frames will use individual frame filters while the other frames will be supplied from the common power filter by means of the fuse board. Under this condition, the requirements outlined above for both individual and common power filters will apply to a single installation.

Ringling and Tripping

AC-DC Offices

6.16 In ac-dc offices arranged for 95 to 103, 98 to 103, or 99 to 103 volts ac and 16 to 19 volts dc, no difficulty will be encountered in changing to the 88-volt ac and 45 to 50 volt dc voltages. The following procedure should apply.

6.17 In ac-dc offices equipped with P or commercial-type ringling machines and arranged for 95 to 103 volts ac and 16 to 19 volts dc (or closer ac limits), the 84 to 88 volts ac can be obtained by replacing the ringling transformer with a new one, as shown on SD-80693-01 and SD-80699-01. In 803C ringling power plants with duplicate

transformers, the connections for the new voltages are shown on SD-80594-01. The voltage regulator should then be readjusted for the new voltage and put in good order in accordance with the BSP, in order to maintain the closer voltage limits.

6.18 In 4-party semiselective ringing offices equipped with double winding P-type ringing machines without transformers and arranged for 95 to 110 volts ac, these machines can be converted to deliver the 84 to 88 or 80 to 88 volts by ordering new transformers per SD-80699-01, by readjusting the generator field rheostat or replacing it with new ones with increased resistance and resetting the voltage regulator. Whether new rheostats or transformers are required can be determined locally by testing the machines in accordance with GEC 1749, except using values of 80 to 88 volts. On 75- to 110-volt dc generators which have no voltage or speed regulators, transformers should be added.

6.19 If required to obtain extended loop with existing tripping relays in ac-dc offices, the 63-volt minimum silent battery (63 to 75 volts) can be obtained by placing the 18-volt battery, formerly supplying the dc component of the ringing interval, in series with the 48-volt central office battery lead to the machine ringing interrupter as shown on SD-80693-01 and SD-80699-01. Due to the increased voltage and the fact that the load is connected during the longer silent interval, the drain on this battery will be three to four times as great as before. This drain will be in the order of 400-ampere hours per year in offices having a calling rate of 10,000 busy-hour calls and in proportion for other traffic. In offices equipped with KS-5250 rectifiers and 2-rate charge circuit such as shown on SD-80420-01, the charge can be increased accordingly. In older offices, where this battery was charged from the central office battery, the procedure covered in paragraph 6.20 shall be followed.

6.20 In offices where no such 18-volt battery has been used, nine KS-5361, 10-ampere hour storage cells floated by a J86207A rectifier are recommended for connection in series with the central office battery for supplying the 63-to 75-volt silent interval battery.

Superimposed Offices

6.21 In superimposed offices equipped with combined ringing and coin control generators where the new 84-to 88-volt ac, 37- to 40-volt dc voltages are to be used, the 72 to 80, 75 to 80, or 76 to 80 volts ac should be changed by connecting the load to existing tap No. 6 on the ringing transformer and overhauling the voltage regulator, as outlined in paragraph 6.17.

6.22 In superimposed offices equipped with double-wound P-type ringing machines without transformers and arranged for 64 to 80 or 72 to 80 volts ac, the procedure outlined in paragraph 6.18 which provides 84 to 88 volts ac will apply.

6.23 In the 80B ringing power plant, the 42- to 46-volt superimposed battery should be changed to 18 instead of 21 cells. This will involve replacing or readjusting the voltage relays in the 2-rate charge circuit so that they operate on 38- to 40-volt limits, instead of 44 to 46 volts and readjusting the charging rectifier rheostat. This will provide the standard 37- to 40-volt superimposed batteries.

6.24 In earlier plants using superimposing batteries maintained on a charge-discharge basis, they can be changed to the floated system using 18 cells and J86207A rectifier, in accordance with SD-80594-04, or the existing charge-discharge system may be continued using 20-cell groups and modifying the charging practice accordingly.

6.25 Since both positive and negative silent interval batteries are required in superimposed offices, it has been the practice to furnish two complete No. 6 dry-cell batteries instead of building out the central office battery for the negative supply. These batteries have heretofore been maintained between limits of 60 to 75 volts and no difficulty should be encountered in operating them to a 66-volt minimum where required to extend the loop with existing tripping relays. Ordinarily, the load on the dry-cell silent interval battery in 4-party superimposed panel offices has not been too great for the No. 6 dry cells, since superimposed panel offices have not generally been used in heavy traffic areas.

6.26 When the voltage limits are changed, the change in the ringing voltage will result in a reduction of several volts in the effective operating voltage at the tripping relays in incoming selector circuits under the most unfavorable circuit conditions. Some of the tripping relays may therefore have to be readjusted, especially in those cases where the relays have been operating satisfactorily on the old ringing voltage, but with a borderline adjustment.

Coin Control Equipment

6.27 To provide for increased loop or adverse ground potential on coin lines, a minimum coin voltage higher than the 100 volts heretofore standard is required, as covered on the coin district, coin control, and coin control test circuits listed herein. The following methods for obtaining this increased minimum voltage are required.

6.28 In offices equipped with combined ringing and coin control generators, the existing machines can usually be re-adjusted to provide a 110-volt minimum coin voltage without exceeding the standard maximum voltage. Where a higher minimum than can be obtained is required, the J86555F regulated rectifier supply is recommended. This supplies a 116- to 120-volt coin voltage.

6.29 In offices equipped with coin batteries, dry battery coin supplies can be maintained within the limits of 112 to

120 volts, although somewhat more battery replacements will result. The testing procedure should be modified, however, in accordance with SD-80634-01. Storage cell coin supplies equipped with 54- and 55-cell batteries will have to have additional cells to obtain 112 or 116 volts minimum and the charging routing modified accordingly.

6.30 Offices equipped with separate coin generators will have to be considered individually, and tests made locally to determine what limits can be established.

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