

P 70.550

ENGINEERING SPECIFICATION FOR LOW-SPEED DATA-PHONE
FOR TELETICKETING APPLICATION

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NOTE: THIS IS A CORRECTED COPY AS OF 4-22-60.

CORRECTIONS HAVE BEEN MADE BY THE PACIFIC

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ENGINEERING SPECIFICATION FOR LOW-SPEED DATA-PHONE
FOR TELETICKETING APPLICATION

SECTION I

GENERAL DESCRIPTION AND ENGINEERING REQUIREMENTS

1. GENERAL DESCRIPTION

- a. This specification concerns the equipment used in the Teleticketing application of Low-Speed DATA-PHONE service. This equipment is divided into two types, one to be used in a sending station, and one in a receiving station.
- b. The sending station will be comprised of one or the other of the following groups of equipment, in addition to a telephone set:
 - (1) Model 28 Automatic Send-Receive Set (ASR) including a typing unit (LP), a typing reperforator (LPR), a transmitter-distributor (LXD), a keyboard base (LAK), console (LAAC) and control equipment.
 - (2) Model 28 Keyboard Send-Receive Set (KSR), including a typing unit (LP), a keyboard (LK), console (LAC), and control equipment. This station will also have an external transmitter-distributor (LXD).
- c. The receiving station will be a Model 28 Receiving-Only printer in a console, with the necessary control equipment and a telephone set.
- d. The control equipment consists of:
 - (1) A 130C1 Teletypewriter Subscriber Subset with 43A1 Carrier Terminal equipped with a 2W Line Coil unit and either a 454E receive network or a 453E send network (depending on whether the installation is a receiving or sending station) and
 - (2) A relay control set of parts (which includes a 164503 rectifier unit. The control equipment is rack-mounted in the lower portion of the printer console.
- e. The 130C1 Teletypewriter Subscriber Subset, 43A1 Carrier Terminal, 2W Line Coil Unit, 453E and 454E networks and the telephone set are manufactured by Western Electric Company, and will be supplied by the individual operating companies. All other components are supplied by Teletype Corporation.
- f. This equipment will be used initially for transmission of airline tickets between an airline office (sending station) and a customer (receiving station).

2. ENGINEERING REQUIREMENTS

- a. The equipment shall be operable at regular teletypewriter transmission speeds of up to 100 words per minute.
- b. All Teletype Corporation units used shall be of the Model 28 line. Standard equipment shall be used, wherever possible, and necessary modifications kept to a minimum.
- c. Standard adjustments and lubrication shall be maintained for the Teletype apparatus.
- d. Local line current (.060 amperes) at the sending station shall be furnished by the sending station 130C1 Subset. The receiving station shall operate on .030 amperes line current, furnished by the 130C1 Subset.
- e. Either the keyboard or transmitter-distributor of the ASR or KSR sets may be used for line transmission.
- f. The ASR and the KSR sending station may be used for off-line operation.
- g. The control features necessary to achieve Low-Speed DATA-PHONE operation can be accommodated within the physical dimensions of standard Teletype equipment.
- h. The equipment is intended for office installations, and environmental requirements are limited to those normally encountered in such installations.
- i. The equipment is designed for $115 \pm 10\%$ volts, 60-cycle, A.C. power input.

SECTION II

DETAILED DESCRIPTION AND THEORY OF OPERATION

1. DETAILED DESCRIPTION

- a. There are two types of equipment used in Teleticketing operation; receiving and transmitting. The former is basically a Model 28 receiving-only printer with control equipment. The latter has two versions:
- (1) Keyboard send-receive set (KSR) with control equipment and external transmitter-distributor (LXD).
 - (2) Automatic send-receive set (ASR) with control equipment. The ASR set is of the LPR-LAD variety.
- b. The RO unit has the following main components:
- (1) LP69RX/AGC Typing Unit (Similar to 28C, with 8" platen)
 - (2) LB8/253 Base (Similar to 28B, with two control push buttons for telephone and teletypewriter operation).
 - (3) LAC204AB250 Console (28D240)
 - (4) LESU45 Electrical Service Unit
 - (5) Control Unit, consisting of:
 - (a) 130C1 Teletypewriter Subscriber Subset
 - (b) 43A1 Carrier Terminal
 - (c) 2W Line Coil
 - (d) 454E Receive Network
 - (e) 163805 Control Set of Parts (Includes 164503 rectifier)
 - (6) 163796 Telephone Shelf
 - (7) LMU3 Motor Unit (28A)
- c. The KSR unit contains the following main components:
- (1) LP69RX/AGC
 - (2) LK20ARA (Similar to 28D with three control push buttons for telephone, teletypewriter, and transmitter operation).
 - (3) LAC204AB250 (28D240)
 - (4) LESU46
 - (5) Control Unit, consisting of:
 - (a) 130C1 Teletypewriter Subscriber Subset
 - (b) 43A1 Carrier Terminal
 - (c) 2W Line Coil
 - (d) 453E Send Network
 - (e) 163806 Control Set of Parts (Includes 164503 rectifier)

- (6) 163796 Telephone Shelf
 - (7) LMU3 Motor Unit (28A)
 - (8) LXD4 Transmitter-Distributor (28H); with LXDB3 and LXDC200AB Mounting and Cover Assembly (28H), and LMU3 (28A)
- d. The ASR unit contains the following main components:
- (1) LP69RX/AGC
 - (2) LAK16ARK with LPR10ARA (Similar to Bell 28D base with 3 push buttons for telephone, teletypewriter, and transmitter operation).
 - (3) LAAC209AB (28G40)
 - (4) LESU44
 - (5) LCXB8 Transmitter Distributor Base (28H)
 - (6) LXD4 (28H)
 - (7) Control Unit consisting of:
 - (a) 130C1 Teletypewriter Subscriber Subset
 - (b) 43A1 Carrier Terminal
 - (c) 2W Line Coil
 - (d) 453E Send Network
 - (e) 163806 Control Set of Parts (Includes 164503 rectifier)
 - (8) 163796 Telephone Shelf
 - (9) LMU12 Motor Unit (28C)
- e. The 163805 and 163806 Control set of parts consist basically of a relay (165021), a repeat-coil (163795) a 164503 rectifier unit, and associated circuit components, together with appropriate receptacles and cables for connection with the 130C1 Subset and cabinet terminals.
- f. Marking and spacing signals are converted to audio frequencies by the 130C1 Subset. The Subset generates audio frequencies at approximately 1300 (Marking) and 1240 (Spacing) c.p.s. This operation is reversed at the receiving end. Local line battery for the Teletype equipment is provided by the 130C1 Subset.

2. THEORY OF OPERATION

a. Operating Procedure

- (1) Normally the telephone set is connected to the telephone line and may be used to originate or receive regular telephone calls.
- (2) When a telephone connection has been established between the sending and receiving stations, and both parties have agreed to TTY (teletypewriter) operation, the following procedure shall be used:
 - (a) The sending station attendant momentarily depresses the TTY (red) push button. This causes a steady tone of about 1300 cps to be transmitted to the receiving station.
 - (b) The receiving station attendant, on receipt of the tone, momentarily depresses the TTY (red) push button.

- (c) Both stations are now ready for on-line teletypewriter operation. The sending station attendant shall wait three seconds before starting to send the message. In the ASR set, the K-KT-T switch must be in K position).
 - (d) Under normal operating conditions both the sending and receiving station attendants will hang up the telephone handset after the momentary operation of the TTY pushbutton (red).
 - (e) Upon the completion of the TTY message, disconnection is normally accomplished by the sending of the disconnect code (Figs. H) from the sending station. This turns off the equipment at both the sending and receiving stations and restores the telephone sets to the line.
- (3) In the event the attendants at the sending and receiving stations wish to resume telephone conversation upon completion of the TTY message, the following procedure should be used:
- (a) The attendants at both the sending and receiving stations should not hang up the telephone handsets after the momentary operation of the TTY push button.
 - (b) Upon completion of the TTY message, the sending of the disconnect code (Figs. H) from the sending station will turn off the teletypewriter equipment at both the sending and receiving stations and transfer the telephone sets back to the line so that conversation may be resumed.
- (4) In the event of an emergency or trouble condition the attendant at either the sending or receiving station can turn off his equipment and restore the telephone set to the line by momentarily operating the TEL push button (black).

b. Circuit Description - Sending Station

- (1) The equipment is normally idle; i.e., motor off, telephone on-line. When TTY operation is agreed to, and operation commences as in paragraph 2.a.(2) above, the depression of the red (TTY) push button initiates the following sequence in the sending equipment:
- (a) The normally open contact of the TTY button closes, completing a circuit from battery through the normally closed UCH stunt box contact, through the contact of the TTY button to the TB relay winding, operating the TB relay. The TB relay locks through its number 1 contact, the TEL push button contact (normally closed), and UCH stunt box contact.
 - (b) The number 4 contact of the TB relay makes, completing the circuit to the motor control relay (or relays in the case of the KSR), causing the relay(s) to operate.

- (c) In the ASR set, a make contact of the motor control relay closes a circuit in parallel with the power switch (normally off), causing the motor to start. In the KSR set, a make contact from one motor control relay turns on the KSR motor, and a make contact of the other motor control relay turns on the LXD motor.
 - (d) The number 8 contact of the TB relay completes the circuit to the busy lamp, causing it to light, thus indicating that the Teletype equipment is connected to the line.
 - (e) The number 6 and 12 contacts of the TB relay connect holding current to the LPR selector magnets and remove them from the local loop.
 - (f) The number 10 contact on the TB relay maintains the continuity of the local loop when the LPR selector magnets have been removed.
 - (g) Contacts number 3 and 5 of the TB relay transfer the telephone line from the telephone set through the repeat coil in the control unit into the 130C1 Subset.
 - (h) The number 2 contact of the TB relay ^{shorts Figs. "F" Contact when online,} ~~brings negative battery through the UGH and UCF stunt box contacts up to a normally open TD start relay contact. (This path will later be used as a holding path for the TD start relay.~~
- (2) After the completion of the sequence of operation listed above the sending station is in condition for transmission. Message transmission is initiated from either the keyboard or the transmitter distributor. When transmitter distributor operation is desired, it is necessary to depress the TD start (gray) button, which completes an operating path for the TD start relay. The TD start relay operates and locks through its make contact and the path described in paragraph 2.b.(1)(h). After the TD start relay operates, its other make contact completes an operating circuit for the TD clutch magnets. The latter now function under control of the form start, horizontal tabulator, tape out and tight tape contacts, and the manual control switch.
- (3) TD Transmission can normally be stopped in one of three ways: These are:
- (a) Reception of UCF by the Typing Unit - The UCF contact in the stunt box opens, breaking the holding path to the TD start relay. The latter releases, opening the circuit to the TD clutch magnets. In this case the line connection is maintained.
(Applies to Local Test position only. When transmitting on line, the upper case "F" contact is shunted by a contact of the "TB" relay.)

- (b) Reception of UCH by the Typing Unit. Operation of the UCH contact in the stunt box opens the holding paths of both the TB and the TD Start relays, causing them to release. Release of the TD start relay stops TD operation. Release of the TB relay turns off the equipment motor(s) and restores the line to telephone operation.
- (c) Depression of the TEL (normally closed) push button. This causes the TB relay to release, which turns off the equipment motor(s) and restores the telephone to the line circuit.

c. Circuit Description - Receiving Station

- (1) The receiving station equipment is normally idle (motor off, telephone on-line). When TTY operation has been agreed to, and the sending station has started transmission of the 1300 cycle tone, the operator depresses the TTY (red) normally open push button. The resulting sequence of operation occurs:
 - (a) The TTY push button contact completes a circuit from positive battery through a 3K ohm dropping resistor, through the TA relay winding, TTY push button, UCH stunt box contact, (normally closed), to negative battery.
 - (b) The TA relay operates and locks through its number one contact, the TEL push button (normally closed), and the UCH stunt box contact.
 - (c) The number four contact of the TA relay completes a circuit to the motor control relay, which operates.
 - (d) A make contact on the motor control relay closes a circuit in parallel with the power switch (normally off) causing the motor to start.
 - (e) The number three and five contacts of the TA relay transfer the telephone line from the telephone set to the repeat coil of the control unit for teletypewriter operation.
- (2) The receiving station equipment is now ready for teletypewriter operation. The receiving only typing unit will operate, under control of the sending station, until UCH is received.
- (3) The receiving equipment responds to UCH in the same manner as the sending equipment, in that the TA relay releases, causing the motor control relay to release, motor to stop, and telephone set to return to the line. The receiving equipment does not respond to UCF. If for some reason it is desired to remove the R.O. set from the line, it is necessary to depress the TEL push button (black). Either the reception of UCH, or the depression of the TEL push button restores the equipment to the idle condition (motor off-telephone on the line). The TEL push button will not be operated under normal circumstances.

d. Off-Line Operation

- (1) Off-line operation of the sending equipment can be obtained by manually operating the power switch. In this case the LPR magnets will be in the local loop, and the ASR operator can prepare tape or hard copy locally. The "K" position of the K-KT-T switch will be used when tape and hard copy are to be prepared. The "T" position of the switch will be used when tape alone is to be prepared. The KT position is not to be used. Since the control relay (TB) is not operated, the telephone line will not be affected during off-line operation.
 - (2) The KSR set can also be used for off-line operation when tape is not required.
- e. The actual transmission of teletypewriter intelligence over the telephone line is accomplished by the 130C1 teletypewriter subscriber set. Marking pulses (current) are converted to an audio tone of approximately 1300 cps, and spacing pulses (no current) to an audio tone of somewhat lower frequency. The intelligence is transmitted as combinations of these frequencies. The receiving equipment reverses the procedure, converting a 1300 cps tone into a marking pulse, and the lower tone into a spacing pulse.

SECTION III

ADJUSTMENTS, SPECIAL REQUIREMENTS AND LUBRICATION

1. Refer to individual unit specifications for adjustments and lubrication.
The teletypewriter apparatus used has no special requirements.

SECTION IV

MANUFACTURING REQUIREMENTS

1. Refer to individual unit specifications for manufacturing requirements.
No special tests are required.

SECTION V

INSTALLATION & SERVICING INSTRUCTIONS

1. INSTALLATION

- a. Adjustments required during initial installation of a printer set prior to placing the keyboard and typing unit into the cabinet may be found in Specification 6311, "Engineering Specification for Model 28 Complete Set and Accessories," as well as in standard adjusting bulletins.
- b. In addition, the following procedure is to be observed:
 - (1) Connect cable assembly 164131 or 164133 which terminates at the keyboard push buttons, into the 163695 plate assembly in the electrical service unit.
 - (2) Connect busy lamp 160338 to the respective cabinet terminals as indicated on 3752WD, 3753WD and 3754WD.
- c. The following test equipment will be required in addition to the tools normally furnished to the teletypewriter repairman:
 - (1) Sending Station
A KS-14510 L-1 Volt-Ohm-Milliammeter or equivalent.
 - (2) Receiving Station
A KS-14510 L-1 Volt-Ohm-Milliammeter or equivalent.

Since the following electrical measurements will normally be made only in the field, by Bell System teletypewriter repairmen, the instructions contained in this section refer to standard Bell System test equipment. Equivalent instruments may be substituted.
- d. Sending Station (Keyboard Send-Receive (KSR) and Automatic Send Receive (ASR) See 3752WD, 3753WD, 3775WD, and 3776WD)
 - (1) For KSR stations, install the 159373 relay rack set of parts into the lower section of console and fasten in place with screws, lock washers and nuts provided. For ASR stations assemble 160388 relay rack set of parts, and place into console.
 - (a) Install the 163697 relay panel assembly on the relay rack set of parts. Fasten in place with four 76832 screws and speed nuts.
 - (b) Install the 164503 rectifier on the relay rack set of parts. Fasten in place with four 76832 screws and speed nuts.

- (c) Install the 130C1 Teletypewriter Subscriber Subset per J-70127A-1, L-1; 43A1 Carrier Terminal J-70112A-2, L-1 equipped with 1-L2 & LA; 2W Line Coil Unit J-70127B-1, L-1 on the 159373 set of parts. Fasten in place with four 76832 screws.
- (d) Connect station assembly as shown on 3752WD or 3753WD using cables supplied as part of control set of parts.
- (2) Verify that the correct filter has been installed in the 43A1 terminal. A 453E send network is required. NO receive network is required in this terminal.
- (3) Remove vacuum tubes V3 (407A), V4 (408A) V5 (429A) and V6 (429A) if they have been provided.
- (4) Verify that the remaining vacuum tubes are in the correct sockets - V1 (407A), V2 (407A).
- (5) Verify that the "GRD" switch is in the "OFF" position.
- (6) Verify that the "CARR IND" switch is in the "OFF" position.
- (7) Set the "LINE IMP" switch to position "C".
- (8) Verify that all cord connectors are securely connected.
- (9) Connect the power cord to the 115V AC building service appliance outlet and observe that all the tube filaments light on the 43A1 terminal. Allow 10-15 minutes for warm-up of 130C1 Subset.
- (10) Operate the power switch of the LXD (in KSR installations) to the "ON" position and observe that its motor does NOT start.
- (11) Operate the power switch of the KSR (or ASR) to the "ON" position and observe that its motor runs satisfactorily. Shut motor off.
- (12) Momentarily operate the "TTY" push button and observe that the motor(s) run satisfactorily and the busy lamp lights.

NOTE: Leave the unit(s) in this condition for the following tests.

- (13) Connect the KS-14510 meter (300V DC scale) or KS-14234 V.O.M. to the terminal 14 (-) and 28 (+) on the 130C1 Subset. ~~Adjust The 164503 rectifier DC output as required for 130 + 2 volts.~~
is self regulating and is not adjustable.
- (14) Connect the KS-14510 meter (60V AC scale) or KS-14234 V.O.M. to terminals 15 and 29 on the 130C1 Subset. ~~Adjust The 164503 rectifier 20 volts AC control as required for 20V AC.~~
is self regulating and is not adjustable.
- (15) Connect the KS-14510 meter (120 MA scale) or KS-14234 V.O.M. in series with lead on terminal 5 of the 130C1 Subset and verify that the LP DC loop current is ~~0.30~~ amperes. Adjust the "SEND LP" control, located on the 130C1 Subset for ~~0.30~~ amperes, if necessary.

- (16) Verify that the SB control, located on the 130C1 Subset, is in the extreme clockwise position.
- (17) Verify that the receiving bias tolerance margin on the typing unit from both the keyboard and the LAD are within the standard requirements for a local circuit, plus the range scale at the optimum setting.
- (18) Verify that the "Send" switch, located on the 43A1 terminal, is in the "HM" position.
- (19) Verify that the "OSC" switch, located on the 43A1 terminal, is in the "ON" position.
- (20) With the KS-14510 meter connected to Pin Jack test points SA and G, located on the 43A1 terminal, measure the AC voltage and →
[Record this reading on the reference chart.] ←
- (21) Adjust the "send Level" control, located on the 43A1 terminal, for a reading of 1.54 volt using 3V AC scale. *This will give a -8 DB into the cable pair.*
- (22) With the KS-14510 or KS-14234 meter connected to Pin Jack test points MD & C, located on the 43A1 terminal, measure the DC voltage and record on the reference chart.
- (23) Disconnect the KS-14510 meter.
- (24) Momentarily operate the TEL push button. Observe that the motor(s) stop and busy lamp goes out.
- (25) In ASR stations, operate the power switch to the "ON" position. Observe that the motor starts and the busy lamp does NOT light.
- (26) Observe that both tape and hard copy can be made from the keyboard in the "K" position of the K-KT-T switch.
- (27) Observe that tape can be made from the keyboard in the "T" position of the K-KT-T switch.
- (28) The ASR is now ready for off-line service.
- (29) Turn off the motor using the power switch.
- (30) Connect the telephone line to terminals C1 and C2, and the telephone receiver to terminals C3 and C4 of the KSR (or ASR) console. Connect the signal ground lead to the console grounding screw.

- (31) Make standard transmission and bell tests on the telephone set.
 - (32) Insert and align the form in the Typing Unit. Insert tape in the LPR (ASR station).
 - (33) Make a test call to the testing station.
 - (34) Verify test message contents for error at both the sending and receiving stations.
 - (35) This station should now be ready for service.
- e. Receiving Station (Receiving-Only Typing Unit) (See 3754WD and 3775WD)
- (1) Install the 159373 relay rack set of parts into the lower section of the console and fasten in place with screws, lockwashers and nuts provided.
 - (a) Install the 153696 relay panel assembly on the relay rack set of parts. Fasten in place with four 76832 screws and speed nuts.
 - (b) Install the 164503 rectifier on the relay rack set of parts. Fasten in place with four 76832 screws and speed nuts.
 - (c) Install the 130C1 Teletypewriter Subscriber Subset per J-70127A-1, L-1; 43A1 Carrier Terminal J-70112A-2, L-1, equipped with 1-L2 and LA; 2W Line Coil Unit J-70127B-1, L-1 in the 159373 set of parts. Fasten in place with four 76832 screws.
 - (d) Connect station assembly as shown on 3754WD, using cables supplied as part of control set of parts.
 - (2) Verify that the correct filter has been installed in the 43A1 terminal. A 454E receive network is required. NO send network is required in this terminal.
 - (3) Remove vacuum tubes V1 (407A) ^{if it has} and ~~V6 (429A)~~ if they have been provided.
 - (4) Verify that the remaining vacuum tubes are in the correct sockets, V-2 and V-3 (407A), V4 (408A), and V5 (429A).
 - (5) Verify that all cord connectors are securely connected.
 - (6) Verify that the "REC" switch located on 43A1 terminal is in the "H+" position.
 - (7) Verify that the "GRD" switch is in the "OFF" position.
 - (8) Verify that the "CARR IND" switch is in the "OFF" position.

- (9) ~~Set the "LINE IMP" switch to position "C", (Not used)~~
- (10) Connect the power cord to the 115V AC building service appliance outlet and observe that all the tube filaments light in the 43A1 terminal. Allow 10 to 15 minutes for warm up of the 130C1 subset.
- (11) Operate the power switch of the Typing Unit to the "ON" position and observe that the motor runs satisfactorily.
- (12) Operate the power switch of the Typing Unit to the "OFF" position and observe that the motor stops.
- (13) Momentarily operate the "TTY" pushbutton. Observe that the Typing Unit motor runs and the busy lamp lights.

NOTE: The Typing Unit must be left in this condition for the following tests.

- (14) Connect the KS-14510 meter (300 VDC scale) or KS-14234 V.O.M. to terminal 14 (-) and 28 (+) on the 130C1 Subset. ~~Adjust The 164503 rectifier DC output as required for 130 ± 2 volts.~~
is self regulating and not adjustable.
- (15) Connect the KS-14510 meter (60V AC scale) or KS-14234 V.O.M. to terminals 15 and 29 on the 130C1 Subset. ~~Adjust The 164503 rectifier 20 volts AC control as required for 20V AC.~~
is self regulating and not adjustable.
- (16) Connect the KS-14510 meter (120 ma scale) or KS-14234 V.O.M. in series with the lead on terminal #4 of the 130C1 Subset. Adjust the "loop Cur" control, located on the 43A1 terminal, for .030 amperes if necessary. This is a preliminary adjustment. Final adjustment will be completed in paragraph (24), 24
- (17) Connect the KS-14510 meter (300V DC scale) or KS-14234 V.O.M. to Pin Jack test points LP and C, located on the 43A1 terminal, and measure the DC voltage. Adjust the "REC LP" control, located on the 130C1 subset, for ~~55V~~
80V if necessary.
- (18) Verify that the "REC. GAIN" control, located on the 43A1 terminal, is in the extreme clockwise position.
- (19) Momentarily operate the "TEL" push button (black). Verify that the motor stops and the busy lamp goes out.
- (20) Connect the telephone line to terminals C1 and C2 of the teletypewriter cabinet and the ground lead to the grounding screw for the cabinet. Connect the telephone receiver to terminals C3 and C4 of the teletypewriter cabinet, and the ground lead to the grounding screw for the cabinet.

- (21) Make a test call to the testing station and request the testing station attendant to provide a steady marking tone of 1300 cps. Leave the equipment in this condition for the following tests.

NOTE: If a separate telephone is available it may be of some help to establish a separate talking connection to the sending station to facilitate the performance of these tests.

- (22) Recheck the TTY loop current as described in par. ~~(15)~~⁽¹⁶⁾ above and readjust (if necessary) for .030 ampere.
- (23) Recheck the voltage reading between Pin Jack test points LP and C as described in paragraph 1(e)(16) above and readjust (if necessary) for ~~55~~⁶⁰ volts.
- (24) Repeat steps (21) and (22) above until the required readings of ~~55V~~^{60V} and .030 amperes are obtained simultaneously. Enter these readings on the reference chart.
- (25) Request the testing station to again send steady marking tone.
(IF 164C TMS IS TO BE USED, REQUEST TESTING STATION TO SEND "FOX" TEST LINE)
- (26) Connect the KS-14510 meter (60V DC scale) or KS-14234 V.O.M. to Pin Jack test points D & C, located on the 43A1 terminal. The voltage should be approximately 46V D.C. Record this voltage on the reference chart. Adjust "REC BIAS" control to meet this requirement. *(IF 164C TMS IS AVAILABLE, ADJUST FOR BEST SIGNAL WHEN SET ON "PEAK" DISTORTION)*
- (27) Request the testing station attendant to provide a steady spacing tone of 1240 cps. With the KS-14510 meter (60V DC scale) or KS-14234 V.O.M. again connected (WITH THE LEADS REVERSED), since this is a negative voltage) to test points C & D, measure this voltage. This voltage should be approximately 48V DC. Record this reading on the reference chart.
(IF 164C TMS IS USED, DISREGARD THIS PAR.)
- (28) Insert and align the forms in the Typing Unit.
- (29) Request the testing station attendant to transmit a test message and verify that the receiving bias tolerance margin is within standard requirements for a local circuit.
- (30) Examine the message for absence of errors.
- (31) Request the sending station to send a sample test ticket and observe that it is received correctly.
- (32) Replace all covers.
- (33) This station should now be ready for service.

2. SERVICING INSTRUCTIONS

a. General

(1) After initial installation and testing, no routine maintenance shall be necessary other than normal routine teletypewriter machine maintenance. If trouble is reported the repairman shall first make a check to determine whether the trouble is in the machine or the subset.

b. If the Subset is suspected of being in trouble, the following procedure should be followed:

- (1) Verify that the tube filaments are lighted.
- (2) Check the voltages, loop current and level, as described in paragraphs 1-d(13), (14), (15), (20) & (22) for the sending station and 1-e(14), (15), (16), (17), (26), (27) for the receiving station. Compare with the last entry on the routine reference chart. Wide variations in these readings will usually indicate the probable source of trouble.
- (3) Repair of the 43A1 terminal shall be limited to the changing of tubes and the network.
- (4) Failure to find trouble after making local adjustments and tests described above indicates replacement of the 43A1 channel terminal. If the 43A1 terminal proves to be the cause of trouble it shall be returned to the local repair center for repair.
- (5) If any controls, adjustments or component parts of the 130C1 Subset are changed, a new set of reference readings shall be entered on the Routine Chart upon completion of clearing the trouble condition.

RECEIVING STATION
ROUTINE REFERENCE CHART

<u>To Measure</u>	<u>Reference Section V.</u>	KS-14510 Meter Scale <u>Volts</u>	<u>Test Point</u>	<u>Requirement</u>	<u>Initial Install.</u>	<u>Date</u> / / <u>Reading</u>	<u>Date</u> / / <u>Reading</u>	<u>Date</u> / / <u>Reading</u>
130 Volt Power Supply	1e (14)	300V DC	(-14) (+28) 130C1 Subset	130± 2 Volts				
20 Volt Power Supply	1e (15)	60V AC	(15) (29) 130C1 Subset	20 Volts (Approx.)				
Loop Current	1e (16)	120 MA	(4) 130 C1 Subset	.030 A.				
Plate- Cathode Voltage of Rec.Out. Tube	1e (17)	300V DC	LP to C 43A1 Term.	55V 80V				
Discrimi- nator	1e (26)	60V DC	D to C (Mark)	46 Volts				
Rectifier Output	1e (27)	60V DC	D to C (Space)	48 Volts				

SENDING STATION ROUTINE CHART

<u>To Measure</u>	<u>Reference Section V</u>	<u>KS-14510 Meter Scale Volts</u>	<u>Test Point</u>	<u>Requirement</u>	<u>Initial Installation Readings</u>	<u>Subsequent Readings</u>	
						<u>Date</u>	<u>Date</u>
130 Volt Power Supply	1d (13)	300V DC	(-14) (+28) 130C1 Subset	130 ± 2 Volts			
20 Volt Power Supply	1d (14)	60V AC	(15) (29) 130C1 Subset	20 Volts (Approx)			
Loop Current	1d (15)	120 MA	(5) 130 CI Subset	Approx. 30 MA 62.5 MA			
Sending Carrier Level	1d (22)	3V AC	SA to G 43A1 Term.	5V 1.54V			
Send Control Tube Plate	1d (23)	300V DC	MD to C 43A1 Term.	90 to 100 Volts			