PICTUREPHONE® PAIR SUITABILITY TESTING PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section describes the testing procedures for determining the suitability of cable pairs for PICTUREPHONE® loop or local trunk service. The Engineering and Implementation Methods System (Section 915-890-310) coordinates this section with PICTUREPHONE® Cable Trouble Location (Section 634-405-301) and Assignment Procedures for PICTUREPHONE® Service (Section 680-539-010).

1.02 This section is issued to:

- Add illustration
- Revise illustrations
- Delete an illustration.

1.03 Pair suitability tests are divided into dc and ac tests as shown in Table A. The dc tests may be performed and completed on an entire loop before any ac tests are attempted. Perform ac tests as necessary and ***ONLY*** after completion of dc tests and in the order listed.

TABLE A

TYPE	TEST	TEST SET	OBJECTIVE
DC 1-man	Foreign EMF	96A	< 6 V
	Insulation Resistance		> 1 MΩ between conductors > 0.5 MΩ either conductor to ground
AC 2-man	Metallic Noise Longitudinal Noise Noise Balance	3A NMS (3kc flat)	< 43 dBrn < 43 dBrn > 40 dB
	Equalization	F58635 PE(2) 150 K CETS(2) HPCO7-3550B	within ±0.05 dB at 1, 23, 70, 200, 500, 900 kHz
	Equalized Transmission Deviations, 500-900 kHz, Loop Back		< 1.1 dB

1.04 The dc tests are usually made from the Central Office Main Distributing Frame while the ac tests are usually made from both the central office and customer location. If intermediate equalizers are required, the tests are performed on one equalizer section at a time.

1.05 The Outside Plant Engineer originates the PICTUREPHONE® Pair Suitability Record (Form E-6097) which authorizes pair suitability testing. The craftsman doing the testing inserts the results of these tests on the reverse side of this form. If trouble location is required, the craftsman will fill out Part 1 of Form E-6098 (Suitability Test Results Summary) and forward it with Form E-6097 to the local trouble locating force.

2. APPARATUS

(a) At central office end of the cable:

(1) One J1C150K Cable Equalizer Test Set (CETS) (Fig. 1)

(2) One F58635 Portable Equalizer (PE) (Fig. 2)

(3) One Hewlett-Packard C07-3550B Transmission Test Set (Fig. 3)

(4) Test Cords for test sets (Fig. 4)

(5) One 1013A, or equivalent, Handset

(6) One 96A Test Set (Fig. 5) equipped with W3AG Cord (Fig. 6)

(7) One J94003A Noise Measuring Set (Fig. 7), one 3P17A Test Cord (Fig. 8), and one headset.

(8) One 76C Test Set (Fig. 9).

(b) At customer end of cable:

(1) One J1C150K Cable Equalizer Test Set (CETS)

(2) One F58627 Portable Equalizer (PE) equipped with two F58627 and one F58628 Test Cords

(3) One 1013A, or equivalent, Handset.

Note: The CETS and PE use Mallory 303791 batteries. Battery life is 120 hours minimum at room temperature.

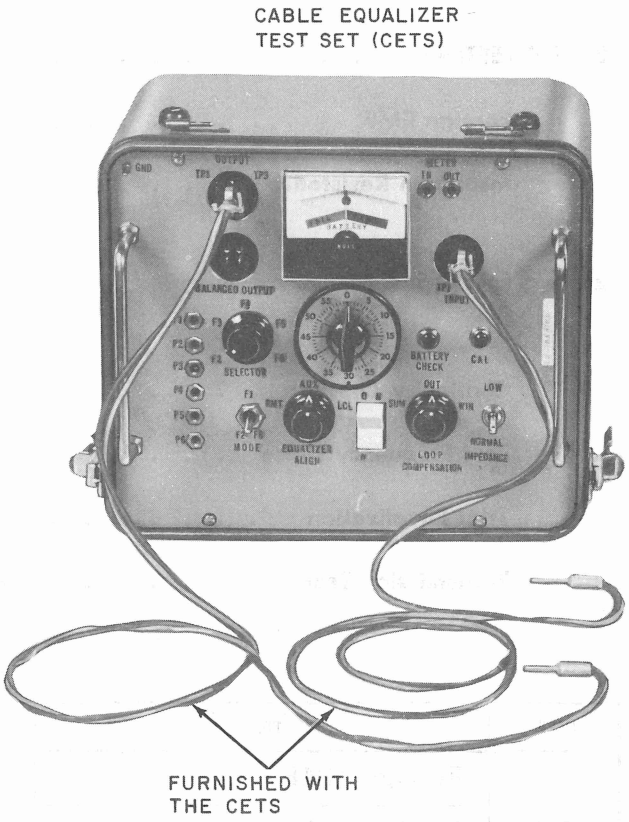

Fig. 1—Cable Equalizer Test Set

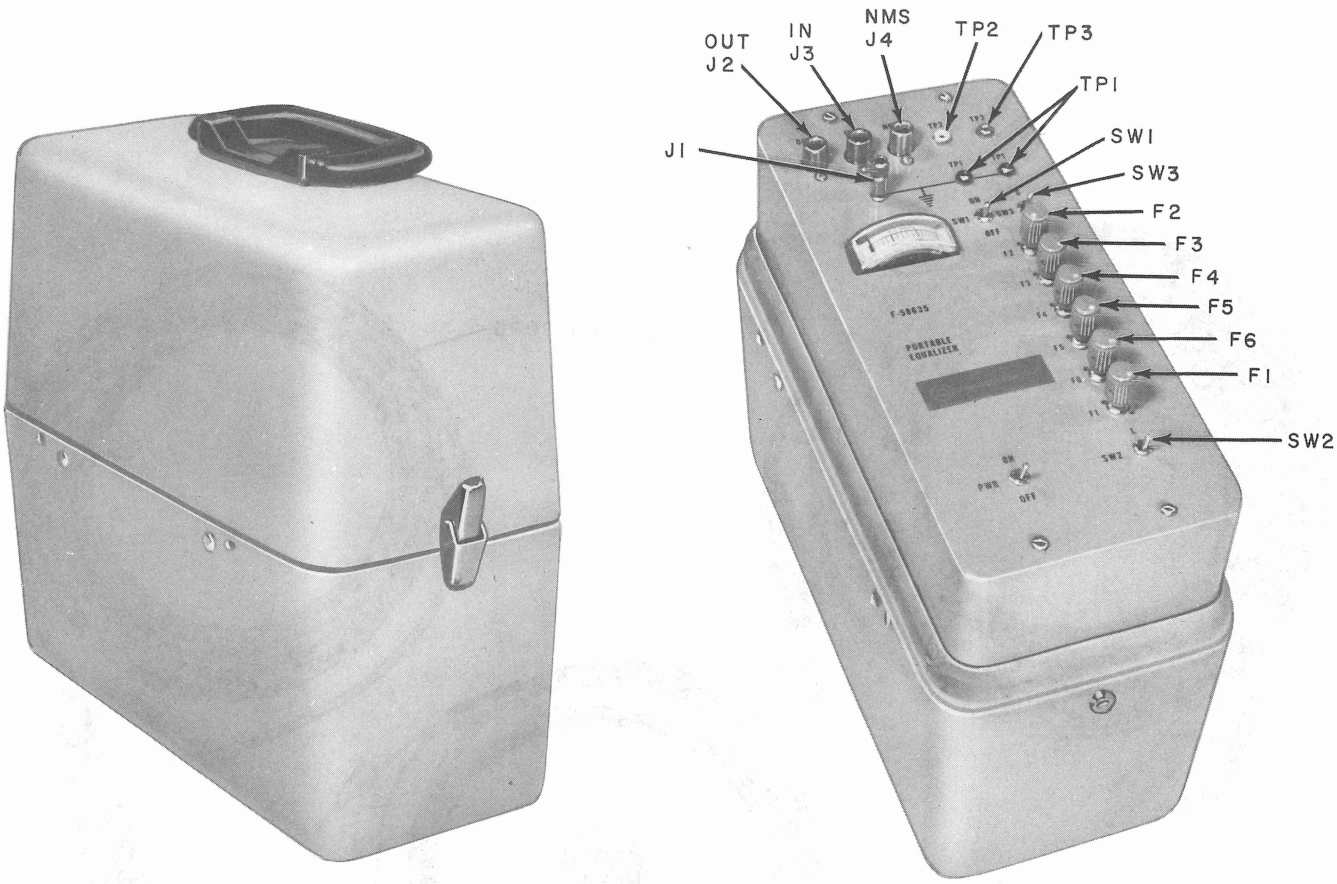

Fig. 2—Portable Equalizer

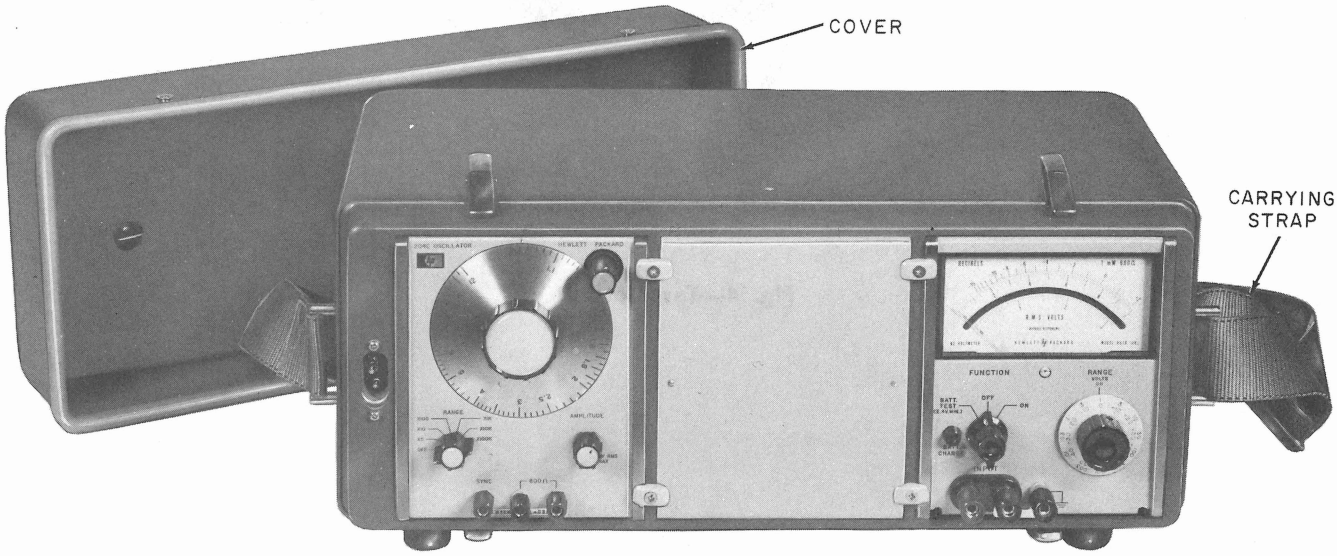

Fig. 3—HP C07-3550B Test Set

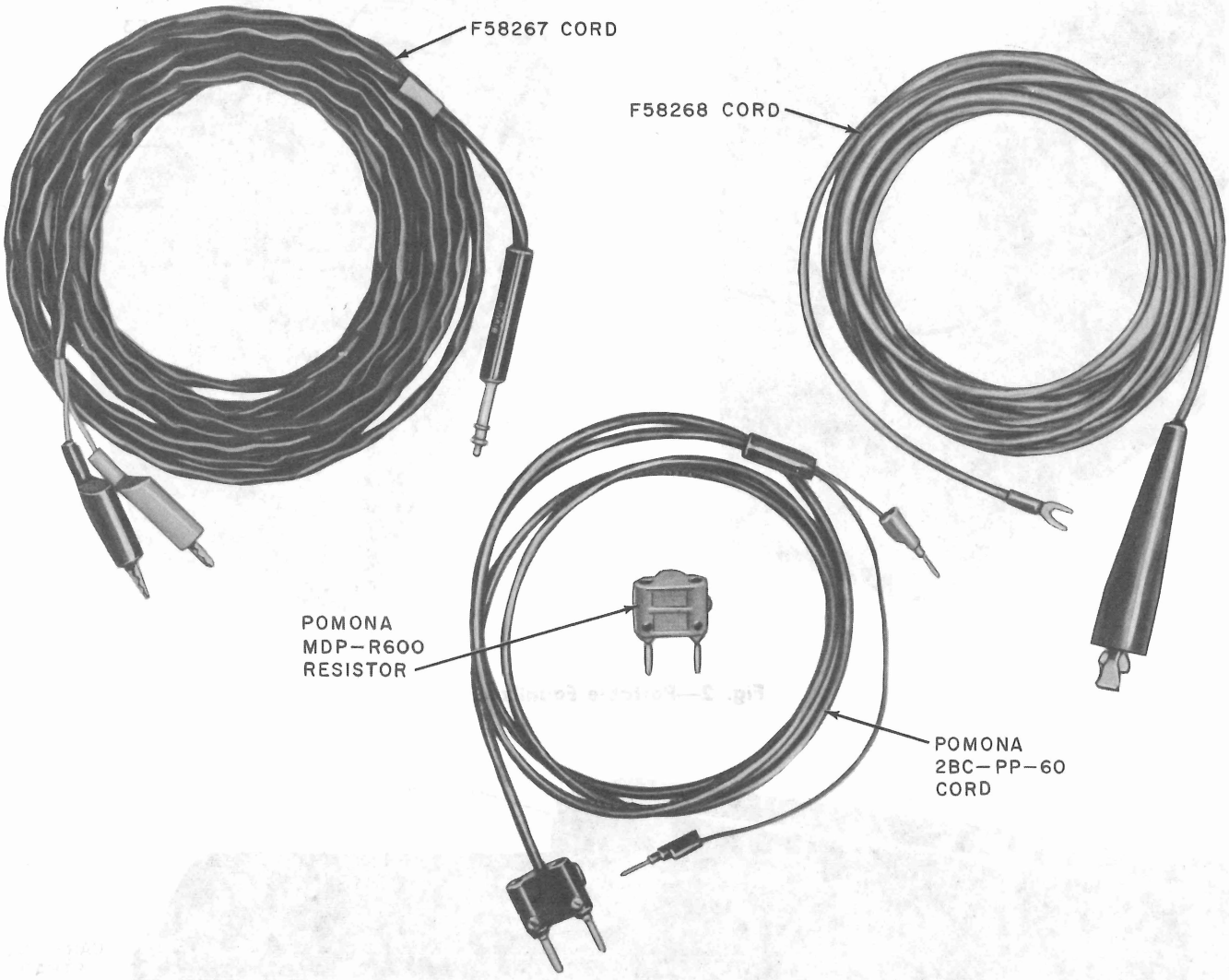

Fig. 4—Test Cords

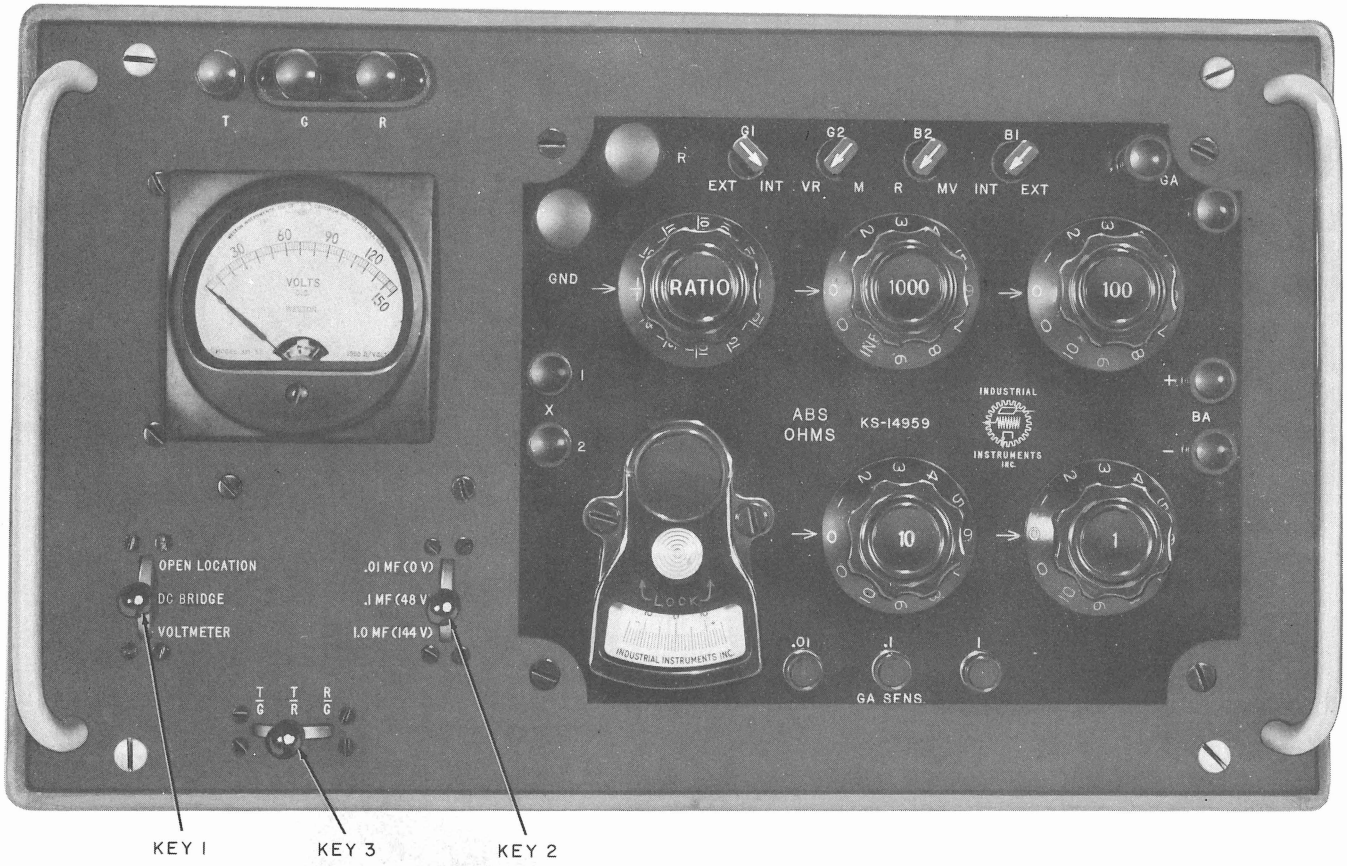

Fig. 5—96A Test Set

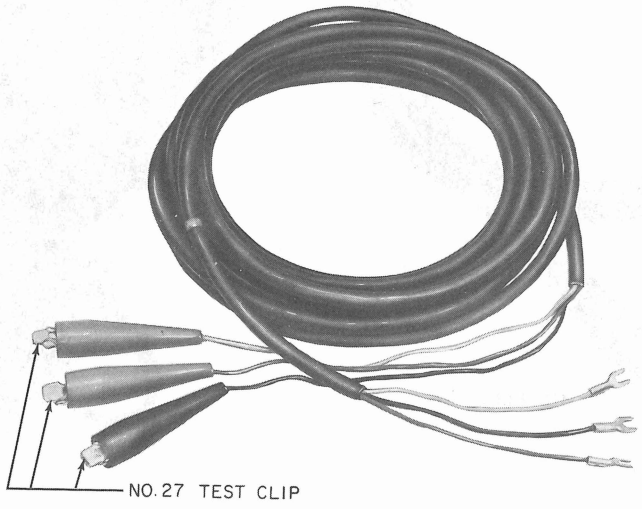

Fig. 6—W3AG Cord

Fig. 7—3A Noise Measuring Set Cover Removed

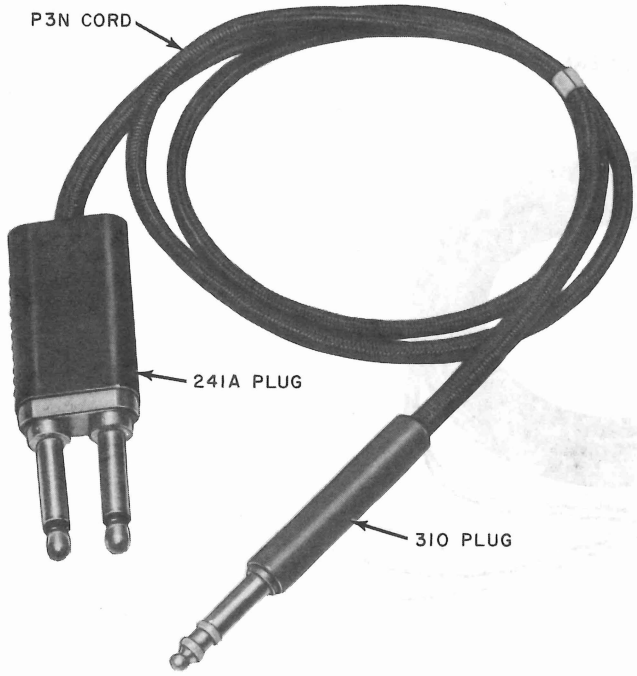

Fig. 8—3P17A Cord

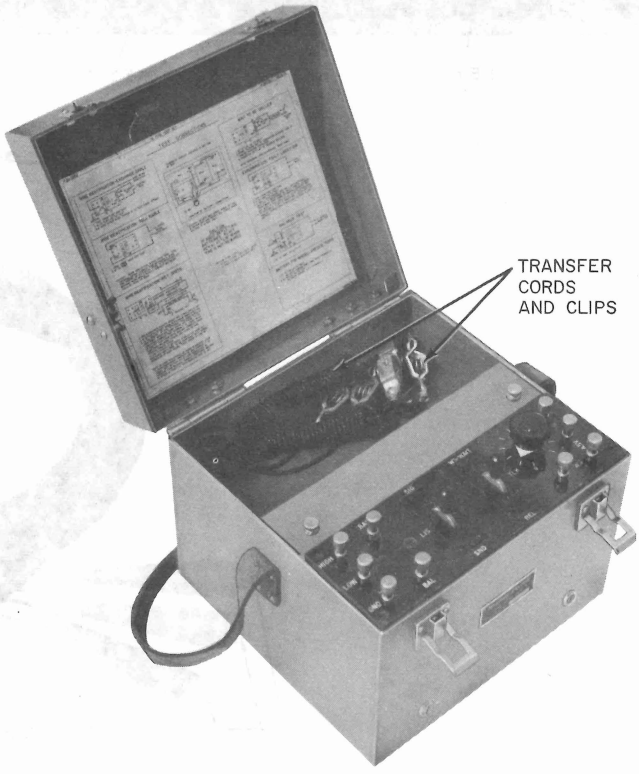

Fig. 9—76 Type Test Set

3. DC TESTING

3.01 Preliminary

(a) At central office visually inspect pairs to be tested for cross-connect jumpers at main frame. If jumpers are present, refer to Test Center in accordance with local procedures and do not continue until clearance is obtained.

(b) Remove steel pins, heat coils (or equivalent) from test pairs at central office vertical main frame.

(c) At the customer test location, clear the test pairs of all jumpers going beyond test point.

3.02 Connect the tip and ring sides of the pair to be tested and central office ground to the T, R, and G binding posts, respectively, of the 96A Test Set with W3AG Cord (Fig. 10).

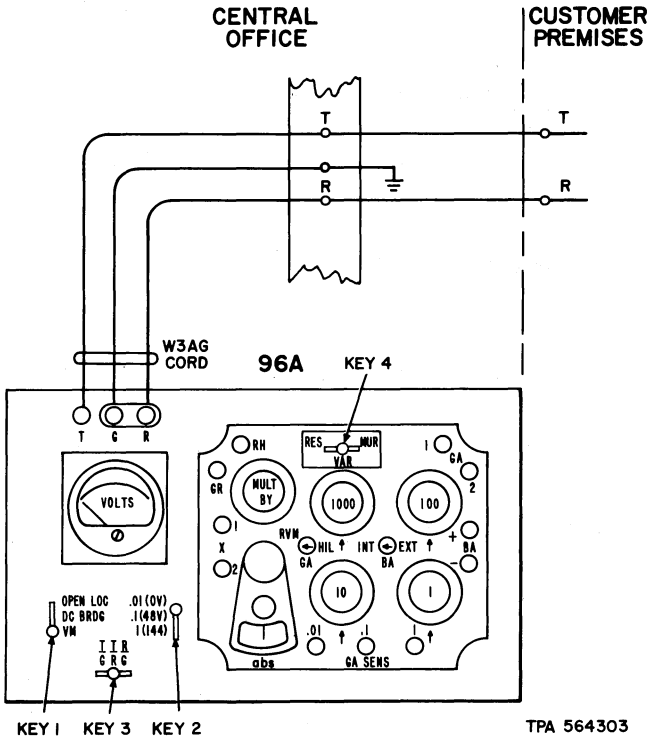

Fig. 10—Foreign EMF and Insulation Resistance Test

Foreign EMF

3.03 Measure Foreign EMF as follows:

(a) Set Key 2 to .01MF(OV).

(b) ***Set Key 3 to T/R.***

(c) Operate Key 1 to VOLTMETER.

(d) Read voltage indicated on meter and record on Form E-6097B.

(e) ***Set Key 3 to T/G.***

(f) Operate Key 1 to VOLTMETER.

(g) Read voltage indicated on meter and record on Form E-6097B.

(h) ***Set Key 3 to R/G.***

(i) Operate Key 1 to VOLTMETER.

(j) Read voltage indicated on meter and record on Form E-6097B.

3.04 If any reading listed above is greater than 6 volts, discontinue tests on the pair and move on to the next pair.

Insulation Resistance

3.05 Test the Battery of the 96A Test Set as follows:

(a) Place a short across the T and R binding posts or terminals.

(b) Set Key 2 to 1.0MF(144V).

(c) ***Set Key 3 to T/R.***

(d) Operate Key 1 to VOLTMETER.

(e) Read voltage indicated on meter. If less than 130 volts, replace battery before continuing and repeat steps (a) through (e).

(f) Remove short across the T and R binding posts.

3.06 Measure the insulation resistance of a pair as follows:

(a) Set Key 2 to 1.0MF(144V).

(b) ***Set Key 3 to T/R.***

(c) Operate Key 1 to VOLTMETER.

(d) Read voltage indicated on meter and record on Form E-6097B.

(e) ***Set Key to T/G.***

(f) Operate Key 1 to VOLTMETER.

(g) Read voltage indicated on meter and record on Form E-6097B.

(h) ***Set Key 3 to R/G.***

(i) Operate Key 1 to VOLTMETER.

(j) Read voltage indicated on meter and record on Form E-6097B.

3.07 Do not continue tests with a pair unless all three voltages are equal or less than limits in Table B.

TABLE B

VOLTAGE	VOLTS MAX.
T/R	17
T/G	30
R/G	30

4. AC TESTING

Continuity Check

4.01 Establish a talk circuit between central office and customer location as described in Section 634-040-502 (talking circuit with 76-type Test Set) and identify all pairs to be tested per Section 634-200-501 (76C Test Set).

4.02 If an audible tone is heard, record a check (✓) on Form E-6097B. If a tone is not heard, record a cross (x) and discontinue tests on the pair.

Low Frequency Noise

4.03 Calibrate 3A NMS as follows:

(a) With the FUNCTION switch at OFF, adjust the meter needle to the base line at the left end of the scale with the meter screw.

(b) Orient and plug in the weighting network for 3 kc FLAT.

(c) Turn FUNCTION switch to BAT to check battery voltage. Replace the battery if the meter indicates below the shaded area.

Note: For the description and operation of the 3A NMS, see Section 103-611-100.

(d) Turn the DBRN switch to 85.

(e) Turn the FUNCTION switch to CAL. Adjust the CAL screw for a meter indication on the red line.

(f) Set the DAMP NORM switch to NORM.

4.04 At customer end using F-58635 Portable Equalizer (PE) (Fig. 11):

(a) Connect ground to J1, using F-58628 Test Cord.

(b) Connect test pair to J3 using F-58627 Test Cord.

4.05 At central office end using PE:

(a) Connect ground to J1, using F-58628 Test Cord.

(b) Connect test pair to J3 using F-58627 Test Cord.

(c) Connect from the IN jack of the 3A NMS to J4 on PE using 3P17A Test Cord (Fig. 8).

4.06 Make Noise to Ground Measurement (3 kHz FLAT) using 3A NMS as follows:

(a) Set DBRN switch to 85.

(b) Set FUNCTION switch of 3A NMS to NG.

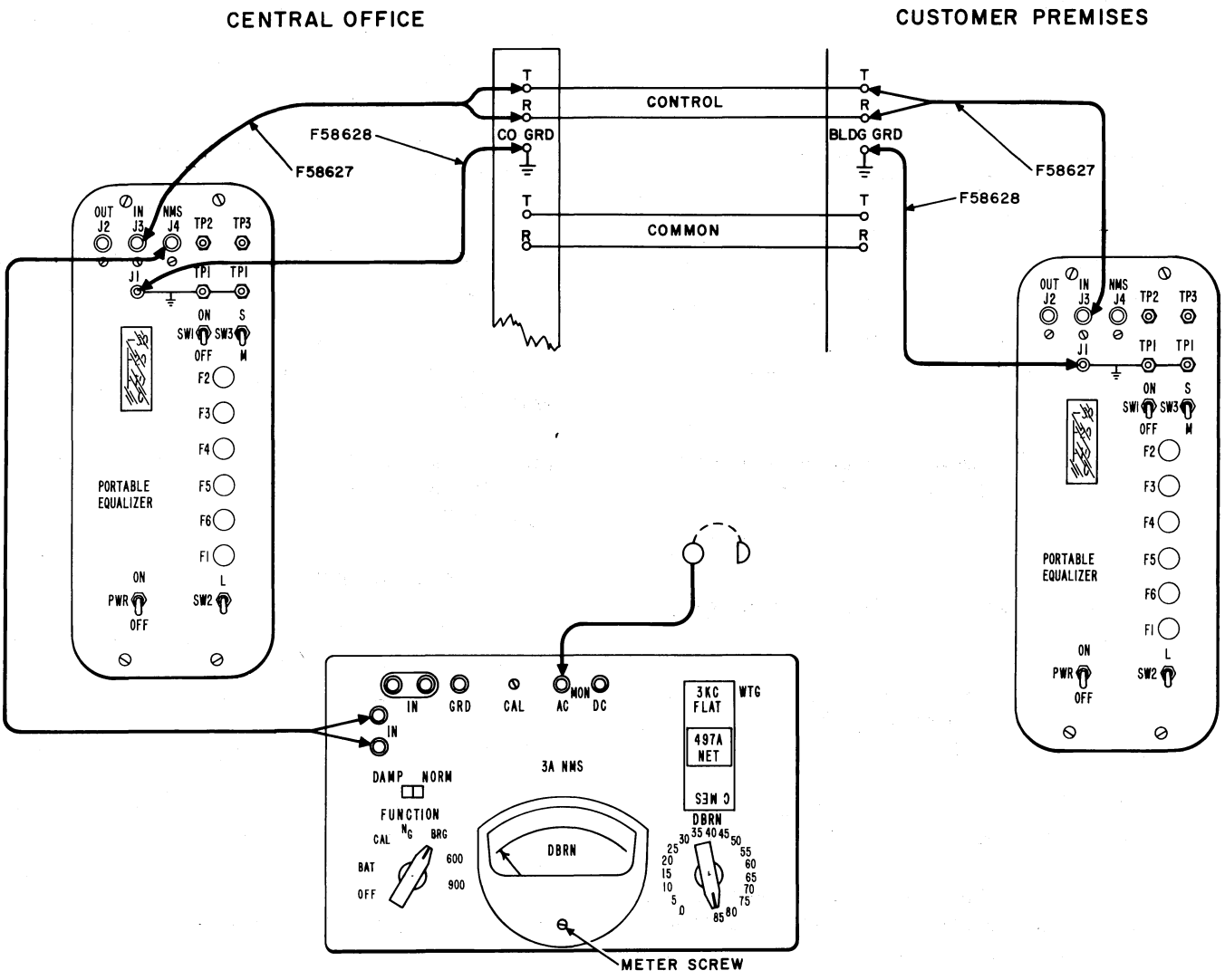

Fig. 11—Low Frequency Noise Test

(c) Adjust DBRN switch to obtain a reading between +3 and +8 on the meter scale.

(d) Record sum of setting of DBRN switch plus average meter on Form E-6097B.

(e) Listen to the noise on the pair with the monitoring headset. Record the appropriate symbol from Table C in the space provided on Form E-60967B.

TABLE C

Hissing	HS	Data	D
Frying	F	Static	S
Crosstalk	C	Tone	T
Hum	H	Singing	SG
Teletype	TTY	Other	O

4.07 Make Noise-Metallic Measurement (3 kHz FLAT) using 3A NMS as follows:

(a) Set FUNCTION switch to BRIDGING N_M.

(b) Plug Headset in AC MON jack of the 3A NMS.

(c) Slowly decrease the setting of the DBRN switch until the average indication of the meter is between +3 and +8.

(d) Record sum of setting of DBRN switch plus average meter reading on Form E-6097B.

Note: If reading above +3 on meter cannot be obtained, record 0 on data Form E-6097 and continue test.

(e) During the measurements, listen to the noise on the pair with the monitoring headset. Record the appropriate symbol from Table C in the space provided on Form E-6097B.

4.08 Discontinue tests on a pair if the measurements of either N_G or N_M exceed 43 dBrn or N_M is greater than N_G.

Trial Equalization

4.09 Connect an F-58635 Portable Equalizer (PE) and a J1C150 K Cable Equalizer Test Set (CETS) at both locations as follows (Fig. 12):

(a) CONTROL pair to J2 of PE at the CO end and J3 of PE at the customer end using F-58627 Test Cord.

(b) COMMON pair to J3 of PE at the CO end and J2 of PE at the customer end using F-58627 Test Cord.

Note: The CONTROL pair is used to transmit from the CO end to the customer end. The COMMON pair is used in the reverse direction.

(c) Connect J1 or PE to ground using F-58628 Test Cords.

(d) Connect CETS INPUTS TP1 and TP2 to TP1 and TP2 on the PE's using cord provided with CETS.

(e) Connect CETS OUTPUTS TP1 and TP3 to TP1 and TP3 on the PE's using cord provided with CETS.

4.10 Prepare the CETS as follows:

(a) Turn on POWER switch and set TIMER for one hour. (Allow 3-minute warmup period.)

(b) Turn EQUALIZER ALIGN switch to AUX.

(c) Press BATT CHECK button and observe meter reading to verify condition of test set batteries. Replace if necessary.

(d) Set IMPEDANCE switch on NORMAL.

(e) Set MODE switch on F2-F6.

(f) Set SELECTOR knob on F6.

(g) Press CAL button and adjust P6 for a NULL reading on the meter.

Note: A null is indicated when needle is in the GREEN AREA of the meter dial.

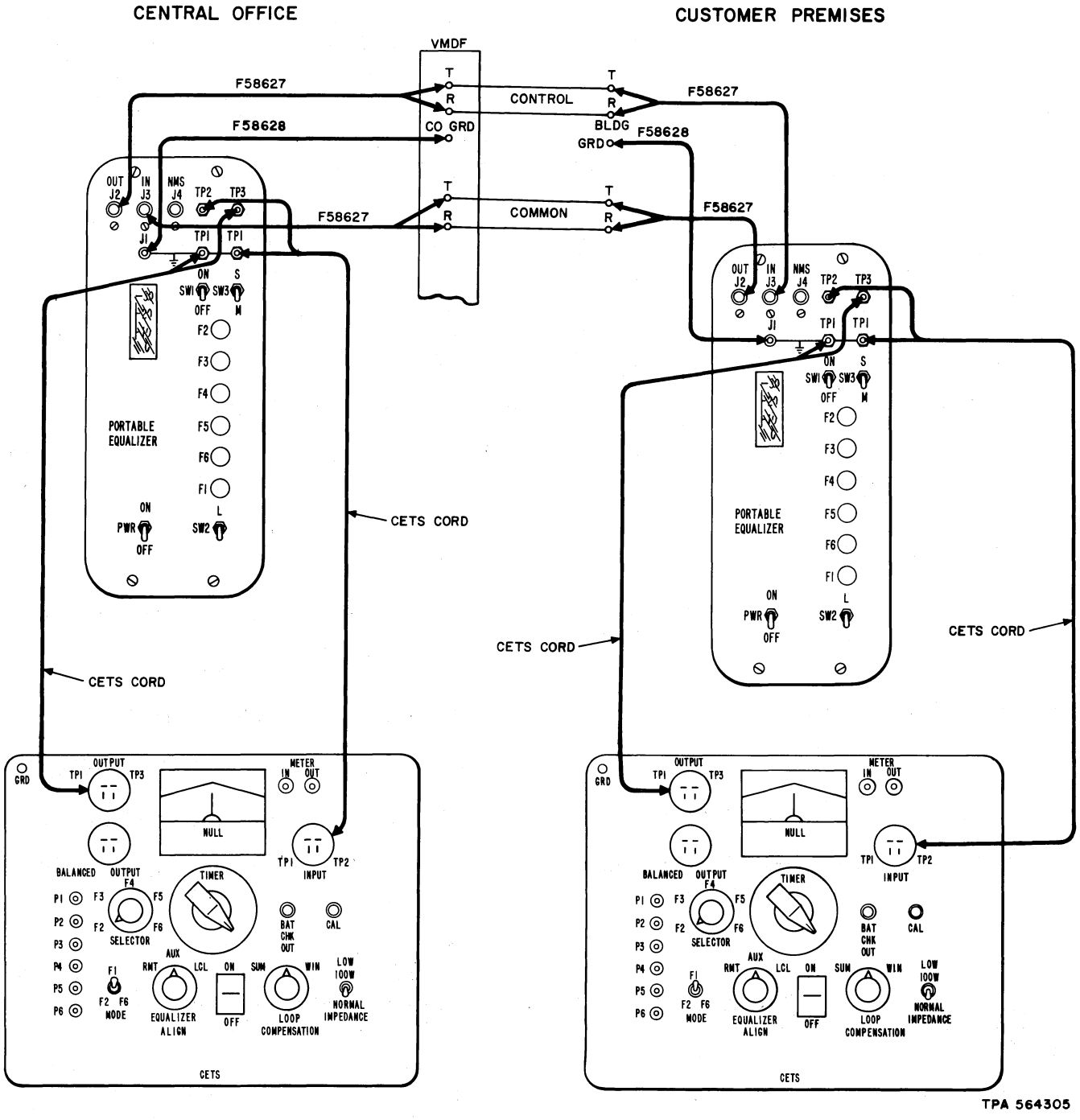

Fig. 12—Trial Equalization

(h) Set MODE switch on F1.

(i) Press CAL button and adjust P1 for a null reading on meter.

(j) Set MODE switch on F2-F6.

(k) Turn SELECTOR knob to F2 position.

(l) Press CAL button and adjust P2 for a null reading on meter.

(m) Repeat steps (k) and (l) for SELECTOR switch positions F3, F4, and F5 adjusting P3, P4, and P5, respectively.

(n) Repeat steps (e) through (m) until all 6 positions give a null reading without any adjustment.

(o) Steps (a) through (n) are performed daily. Steps (a) through (g) are performed each time the set is used.

(p) Set MODE switch to F1.

Note: For the description and operation of the J1C150K (CETS) Test Set, see Section 103-930-100.

4.11 One kHz Equalization.

(a) Prepare both PE as follows:

(1) Place switch SW1 in down position.

(2) Set switches SW2 and SW3 according to length and gauge per Table D.

TABLE D

SWITCH	POSITIONS	PAIR LENGTH (IN KILOFEET)		
SW2	SW3	22 GAUGE	24 GAUGE	26 GAUGE
Down	Up	0-2.7	0-2.2	0-1.8
Down	Down	2.7-5.4	2.2-4.4	1.8-3.6
Up	Down	5.4-9.0	4.4-7.0	3.6-6.0

(3) Turn F1 through F6 fully counterclockwise.

(4) Turn on POWER switch.

(5) Check the battery. If meter reading is below 18 volts, replace battery.

(b) Adjust F1 on each PE for a null reading (in the GREEN AREA) on the corresponding CETS. Record the F1 meter reading as (G) on Form E-6097B. If a null cannot be obtained on both CETS METERS, record L (left of GREEN AREA) or R (right of GREEN AREA) on Form E-6097B and discontinue test on these pairs.

Note 1: The reading for the Control pair is made at the customer end but is recorded on the data sheet at the central office end.

Note 2: The reading for the Common pair is made and recorded at the central office end.

4.12 Broadband Equalization.

(a) Set EQUALIZER ALIGN switch of CETS at customer end to REMOTE.

(b) Set EQUALIZER ALIGN switch of CETS at CO end to LOCAL.

(c) Equalizer Common pair at CO end as follows:

(1) Set MODE switch of CETS to F1.

(2) Adjust F1 or PE for meter null.

(3) Set MODE switch of CETS to F2-F6.

(4) Set SELECTOR switch of CETS to F6.

(5) Adjust F6 of PE for a null or as close to a null as possible.

(6) Repeat steps (1) and (5) for the other SELECTOR positions and corresponding equalizer controls in descending numerical order, ie, F5, F4, F3, F2.

Note 1: Due to the interaction between equalizer controls, several repetitions of steps (1) through (6) are usually required.

Note 2: If the meter is off-scale, turn on the ac voltmeter of HP3550B Test Set, and using a Pomona 2BC-PP-60 Test Cord connect voltmeter set to TP1 and TP2 on PE. Adjust controls on PE for -15 ± 1dBm on ac voltmeter and then reconnect CETS.

(7) The pair is considered to be successfully equalized when the CETS meter reading is in the green as the CETS is cycled from F1 through F6. No adjustments shall be made during this check.

(8) If, after several repetitions, it becomes impossible to bring the meter any closer to a null at F2, the cable length switches of the PE should be changed. If the meter reads to the right of null, set for the next shorter loop length [see 4.11(a)]; if the meter reads to the left, set for the next longer loop length. Then try equalizing again; steps (1) through (7).

(9) When all meter readings are as close to the green as possible, record the results on Form E-6097B.

(10) When COMMON PAIR has been equalized, set EQUALIZER ALIGN switch to REMOTE.

(d) Equalize Control pair at customer end as follows:

(1) Set EQUALIZER ALIGN switch to LOCAL.

(2) Set SW2 and SW3 on PE to the final setting used at the CO end.

(3) Equalizer per 4.12(1) through (8).

(4) Turn off and unplug both CETS. ***DO NOT DISTURB THE PE ADJUSTMENTS UNTIL A TRANSMISSION TEST IS PERFORMED.***

Transmission Test

4.13 At customer end set SW1 switch to up position on PE. See Fig. 13.

4.14 At the C O end do the following:

(a) Operate voltmeter function switch of the HP3550B to BAT TEST. Meter should read 2.4 volts (minimum). If voltage is below 2.4 volts, recharge battery (see H.P. Instruction Manual).

(b) Turn on the oscillator and voltmeter. Allow 3-minute warmup.

(c) Using two Pomona 2BC-PP-60 Test Cords, connect the HP3550B Transmission Test Set to TP1, TP2, TP3, of the PE plug in the Pomona MDP-R600 Resistor at the oscillator terminals.

(d) Set oscillator to 500 kHz (RANGE to X100K, dial to 5).

(e) Adjust the oscillator AMPLITUDE control for a 0 dB voltmeter reading with the voltmeter RANGE selector on −10 dB.

(f) Adjust F2 and F3 on the PE or the oscillator AMPLITUDE for ±0.1 dB at dial settings of both 5 and 9.

(g) Slowly turn the oscillator dial between 5 and 9.

(h) Record the maximum positive and negative deviations from the 0 dB setting and the frequencies (dial setting) at which they occur.

Note: If the maximum deviation exceeds ±1.1 dB, the pairs do not meet requirements.

Repeat 4.11 through 4.14 on other pairs (2 pairs at a time).

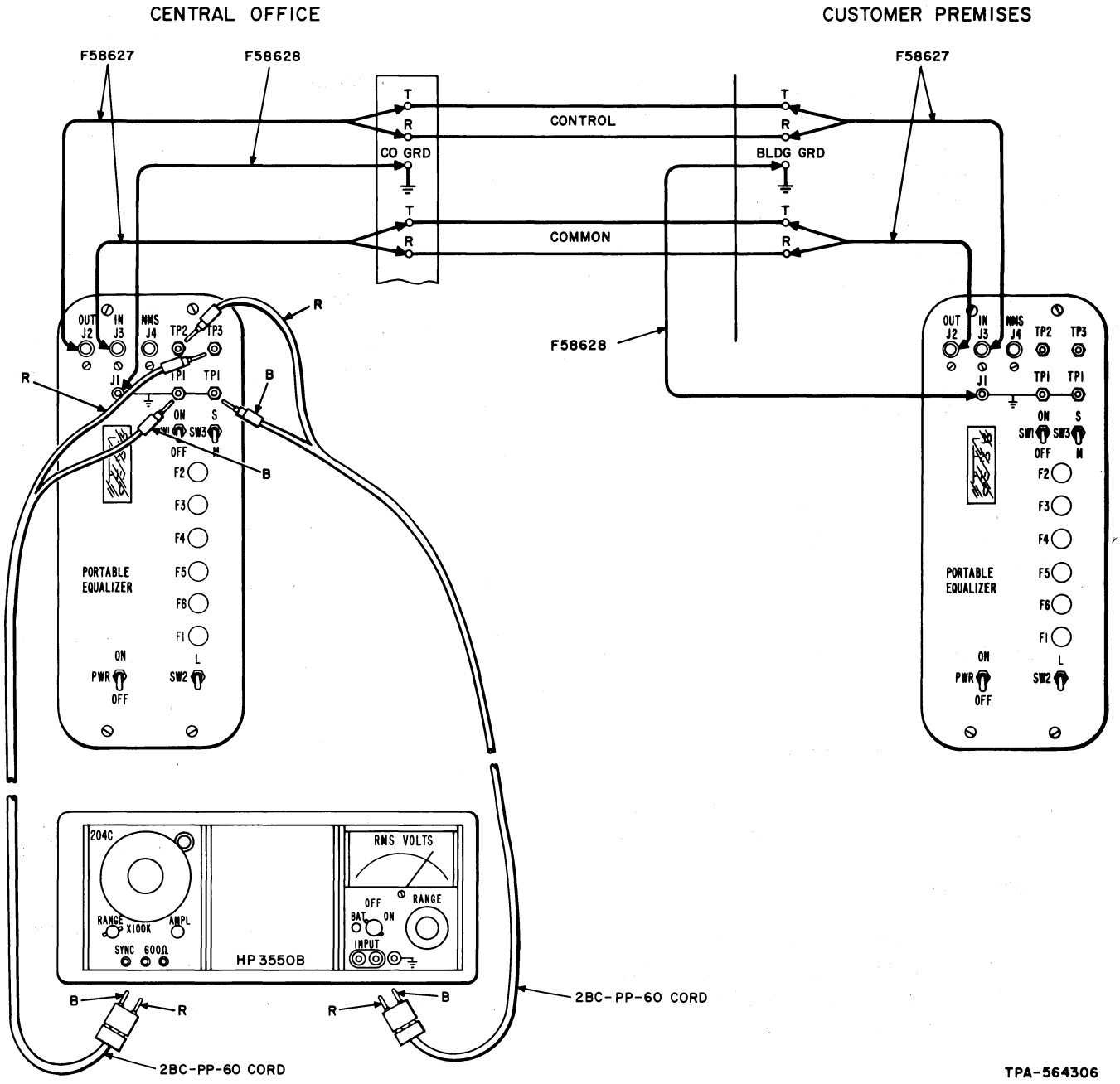

Fig. 13—Transmission Test

PICTUREPHONE PAIR
SUITABILITY RECORD

Form E-6097A
Serial No._____
Issue No._____

Wire Center:_____ Route:_____
From:_____ To:_____
Comments:_____

Cable Complements — Audio Cable_____ Pairs_____
— Control Cable_____ Pairs_____
— Common Cable_____ Pairs_____

Cable Make-Up Details

Control (Direction 2 — CO to Customer)

Common (Direction 1 — Customer to CO)

Special Testing Instructions

(*a*) Number of Consecutive pairs Per Complement to be Tested_____
(*b*) AC Testing Required? YES_____ NO_____
(*c*) DC Fault Locating Required? YES_____ NO_____
(*d*) Test Criteria: DC_____%; AC_____% of those that passed DC tests.

Prepared By:_____ Date:_____
Work Order (Testing):_____

Intermediate Cable Equalizer Apparatus Case Details

Pairs Terminated — Control Cable_____ Pairs_____
— Common Cable_____ Pairs_____
— Order Wire Cable_____ Pairs_____

Prepared By:_____ Date:_____
Work Order (Apparatus Case Installation):_____

Assigning Instructions

— Place Permanent Sticker (E-6036)
— Remove Temporary Sticker (E-4675)

EXHIBIT 1

PICTUREPHONE® PAIR SUITABILITY TESTS RESULTS

BSP 634-405-501

E-6097B

September 9, 1970

Central Office: _____ Date: _____

Customer Location: _____ Tests Made By: _____

CABLE NUMBER																			
PAIR NUMBER																			
EQUALIZE CONTROL SUBSCRIBER END. EQUALIZE COMMON CENTRAL OFFICE.	REQUIREMENT	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON	CONTROL	COMMON
FEMF (Volts) (d) T/R	6 max																		
(g) T/G	6 max																		
(j) R/G	6 max																		
Insulation (d) T/R	17 max																		
Resistance (g) T/G	30 max																		
(Volts) (i) R/G	30 max																		
Continuity																			
Low Freq Noise (d) N_G	43 max																		
(dBrn) (d) N_M	43 or N_G max																		
Character																			
1KHz (b) F1 Equalization	G																		
Broadband F1	G																		
Equalization F2	G																		
F3	G																		
L = Meter Left of Green F4	G																		
G = Meter in Green F5	G																		
R = Meter Right of Green F6	G																		
Loop Transmission (dB)																			
Oscillator Dial Setting	5-9																		
Maximum Positive Dev.	1.1 max																		
Oscillator Dial Setting	5-9																		
Maximum Negative Dev.	1.1 max																		

EXHIBIT 2

Form E-6098
Serial No._____
Issue No._____
Page_____ of _____.

PART I

Suitability Test Results Summary

Place the corresponding code number in the proper box for each pair tested. (Code: 1-5 are failure codes)

1. FEMF
2. Insulation Resistance
3. Pair Balance
4. Equalization
5. Transmission
6. Pair O. K.

CABLE																			
PAIR																			
CODE																			

TROUBLE LOCATION RESULTS

Part II — DC Troubles (Codes 1 & 2)

CABLE	PAIR	CODE	LENGTH TO TROUBLE	CLEARED?	COMMENTS

EXHIBIT 3