

TELEX SERVICE

203

Commissioning Tests of Stations Equipped with
Units, Telex, Nos. 1, 2, 3, 6 or 10

1. **General.** This Instruction describes the method of testing telex stations, equipped with Units, Telex, Nos. 1, 2, 3, 6 or 10, prior and subsequent to installation at customers' premises.

2. **Mains voltage precautions.** The telex units are designed for use on a mains supply of 200-250V a.c. The procedures described in the following paragraphs do not entail operations on points at mains potential while the supply is switched on. Nevertheless, incorrect or careless behaviour could result in an electric shock.

THE MAINS SUPPLY MUST BE DISCONNECTED WHEN TRANSFORMER PRIMARY OR SECONDARY TAPPING CHANGES ARE NECESSARY TO ADJUST THE POWER-PACK. WHENEVER IT IS NECESSARY TO DISCONNECT THE MAINS SUPPLY THE THREE-PIN PLUG MUST BE REMOVED FROM THE WALL SOCKET.

3. **Adjustment of rectifiers.** Where rectifiers are used to supply teleprinter motors, they should be checked and adjusted as described in POWER, Machines & Switchboards, F 1035 or F 1041 as appropriate.

4. **Test equipment requirements.** The following items are required for testing the telex units:-

(a) Tester No. 114C - neon test probe for fault locating (see General, T 1006).

(b) A test cord made-up from two Plugs No. 112 and a Cord, Instrument, No. 1/20F. (Only required if a Tester No. 114C is not available.)

(c) Meter, Multi-range, No. 3 or No. 12, for adjustment of the power equipment, and the private-metering circuit.

(d) Two Potentiometers No. 32A, 2.2k ohms and 100 ohms, for adjusting the private-metering circuit on the Unit, Telex, No. 3.

(e) Standard load resistors for checking and adjusting the telex unit power-pack output. The load resistors should be made-up locally into a small unit comprising the following:-

(i) *Units, Telex, Nos. 1, 2 and 3.* A potentiometer of four Coils, Resistor, No. 9, 800 ohms, connected in series, with the centre-point connected to one side of a Coil, Resistor, No. 9, 500 ohms. Flexible leads terminating on crocodile clips should be wired to the outer and centre points of the potentiometer and to the free end of the 500-ohm resistor.

(ii) *Units, Telex, Nos. 6 and 10.*

50V supply. A resistance of 210 ohms, comprising a Resistor, Coil, No. 9, 110 ohms, connected in series with a Resistor, Coil, No. 9, 100 ohms.

80V supply. A resistance of 1775 ohms, comprising a Resistor, Coil, No. 9, 1600 ohms, connected in series with a Resistor, Coil, No. 9, 175 ohms.

Flexible leads terminating on crocodile clips should be wired to the outer points of the 210-ohm and 1775-ohm load resistors.

5. **Diagrams.** The following diagrams refer:-

TG/TGW 5325	Unit,	Telex	No.	1
TG/TGW 5314	"	"	No.	2
TG/TGW 5326	"	"	No.	3
TG/TGW 5544	"	"	No.	6
TG/TGW 5715	"	"	No.	10

PRE-INSTALLATION TESTS (TO BE PERFORMED AT THE ASSEMBLY CENTRE)

6. **Pre-assembly check of telex station equipment.** This should be carried out in accordance with A 3105.

7. **Adjustment of the telex unit power-pack.** Utilizing the load resistors described in par. 4, adjust the telex unit power-pack as follows:-

(a) *Units, Telex, Nos. 1, 2 and 3.* Remove the bulb resistors RLP1 and RLP2 and connect the outer leads of the 4 x 800-ohm potentiometer across capacitors C6 and C7 ($\pm 80V$ supplies). Connect the potentiometer centre point to the strap between C6 and C7 and connect the lead on the free end of the 500-ohm resistor to the 50V common on resistors R4, R6 and R7. Care should be taken in making this connexion as the 80V common is adjacent to the resistors.

(b) *Units, Telex, Nos. 6 and 10.* Remove the bulb resistors RLP1 and RLP2 and connect the 1775-ohm load resistor across capacitor C5 ($+80V$ supply). Connect the 210-ohm resistor between BFB4 and BFB5 ($-50V$ supply).

(c) Check that the input tappings on the mains transformer and on the Power-Unit No. 45A, where provided, are set at the declared mains voltage.

(d) Connect the mains supply and measure the a.c. mains input voltage to transformer T1 and the 50V and 80V d.c. outputs across the load resistors. [The $-80V$ supply cannot be measured at this stage on the Units, Telex, Nos. 6 and 10, see sub-par. (e)]. If the measured a.c. input voltage is equal to the declared voltage, adjust the secondary tappings of transformer T1 to the nearest tapping to give $80 \pm 1V$ and $50 \pm 1V$ on Units, Telex, Nos. 1, 2 and 3, and $85 \pm 1V$ and $50 \pm 1V$ on Units, Telex, Nos. 6 and 10.

When the voltage of the mains supply differs from the declared voltage, allow 2V at each 80V output for every 5V difference between measured and declared mains voltages. At the 50V output, allow 1V for each 4V difference.

NOTE:- Disconnect the mains supply (see par. 2) when it is necessary to change transformer trappings.

If the correct output voltages cannot be obtained with the secondary tappings of transformer T1 at their maximum setting, change the telex unit and return the faulty unit to the maintenance centre for a detailed check of components.

(e) *Units, Telex, Nos. 6 and 10.* With the mains input supply disconnected, disconnect the 1775-ohm load resistor from the +80V supply and connect it across capacitor C6 (-80V supply). Using the procedure given in sub-par. (d), adjust the transformer secondary winding to give $-85 \pm 1V$ across the 1775-ohm load resistor.

(f) When testing is completed, disconnect the mains supply, remove the load resistor and replace the bulb resistors.

8. Pre-installation testing. The tests described in Tables 1 - 5 and, where the equipment includes a tape-transmitter, Tables 6 - 9, should be carried out on machine and signalling-unit assemblies, with the mains supply connected, before they are installed in customers' premises. If, however, a station-line connexion to a telex exchange is available at the assembly centre, the assemblies may be tested instead as described in Table 10, testing operations (5) - (8), (10) and (11).

The polarities expected in the various tests should normally be observed on a Tester No. 114C connected as specified. As an alternative, a test cord (see par. 4) may be connected between LKA 1 and LKA 4 to earth the S wire. The potentials are then indicated by the glowing of the positive or negative bulb resistor in the telex unit.

On Units, Telex, Nos. 1, 2 and 3, raising the cover renders the key buttons inoperative, but the designations are written on the unit base plate, and the keys can be operated by pressing on the spring-set operating plungers.

TABLE 1. CHECK OF CONTINUITY OF DIAL AND CLEAR KEY CIRCUITS

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB and connect the test probe to LKA 1	Positive potential indicated on the test probe
(2) Operate the CLEAR key	Positive potential still indicated
(3) Release the CLEAR key	-
(4) Press the DIAL key	Negative potential indicated on the test probe
(5) Dial 0	Test probe flashes to the dial pulses
(6) Release the DIAL key	Positive potential indicated on the test probe
(7) Remove the test probe and replace links LKA and LKB	-

TABLE 2. CHECK OF TELEPRINTER 'ON-SPEED' RELAY

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB and connect the test probe to LKA 1	Positive potential indicated on the test probe
(2) Insert U-link between LKB 2 and LKB 4	Teleprinter motor starts and the CALL lamp glows. The potential indication on the test probe changes from positive to negative within one second of inserting U-link
(3) Withdraw U-link and repeat testing operation (2) to check results	As for testing operation (2)
(4) Remove test probe and restore U-links to normal	-

TABLE 3. CHECK OF INCOMING-CALL ALARM AND J BELL FACILITY

Testing operation	Result if circuit is in order
(1) Operate the INCOMING CALL ALARM switch (at rear of the unit)	-
(2) Remove U-links LKA and LKB and insert link between LKB 2 and LKB 4	Teleprinter motor starts. CALL lamp glows. Alarm buzzer operates
(3) Operate the RESET key	Alarm buzzer ceases. Teleprinter motor still runs and CALL lamp remains glowing
(4) Restore the INCOMING CALL ALARM switch	-
(5) Connect the test probe to LKA 1 and operate the keyboard	The test probe flashes as the signals are transmitted
(6) Operate the teleprinter J-BELL key	The alarm buzzer operates and the lamp glows
(7) Operate the RESET key. Remove the U-link between LKB 2 and LKB 4	Alarms cease
(8) Replace U-links LKA and LKB	-

TABLE 4. CHECK OF SIGNALLING PATH

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB. Insert link between LKA 1 and LKA 3	-
(2) Operate and hold the DIAL key	The CALL lamp glows. The teleprinter motor starts. Relays DC and PD operate
(3) Release the DIAL key	Relay CM operates. Relay PD releases. The teleprinter operates in-local
(4) Operate the LOCAL key	The alarm lamp glows and the buzzer operates, but printing in-local is still possible.
(5) Operate the RESET key	The alarms cease. The LOCAL key resets (mechanically coupled to RESET key)
(6) Remove the U-link between LKA 1 and LKA 3	Relays CM and DC release. The CALL lamp darkens. The teleprinter motor stops
(7) Replace links LKA and LKB	-

TABLE 5. CHECK OF LOCAL FACILITY

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB and connect the test probe to LKA 1	Positive potential indicated on the test probe
(2) Operate the LOCAL key	The CALL lamp glows. The teleprinter motor starts. The teleprinter works in-local. Positive potential still indicated on the test probe
(3) Simulate an incoming call by inserting a U-link between LKB 2 and LKB 4	The alarm lamp glows, the buzzer operates and the local record is cut. The test probe still indicates positive potential
(4) Operate the RESET key	The alarms cease. The LOCAL key resets. Printing in-local is possible. Negative potential is indicated on the test probe as the RESET key operates

TABLE 5 (Contd.)

Testing operation	Result if circuit is in order
(5) Remove the link between LKB 2 and LKB 4. Operate the LOCAL key and reinsert the link between LKB 2 and LKB 4. Trip the answer-back unit by hand	The above condition is repeated until the answer-back unit moves off-normal, the test probe indication then changes to negative potential
(6) Operate the RESET key	The alarms cease
(7) Remove the link between LKB 2 and LKB 4. Replace the links LKA and LKB	-

TABLE 6. CHECK OF LOCAL FACILITY WITH TAPE TRANSMITTER

Testing operation	Result if circuit is in order
(1) Remove the U-links LKA and LKB	-
(2) Operate the LOCAL key. Insert a prepared tape in the tape transmitter and operate the AUTO START key	The teleprinter motor (and with Units, Telex, Nos. 2 and 3 the automatic-transmitter motor) starts. A local copy of the transmission is printed on the teleprinter; the keyboard is inoperative
(3) Simulate an incoming call by inserting a U-link between LKB 2 and LKB 4	The alarm lamp glows and the buzzer operates. The tape transmission stops:- (a) Units, Telex, Nos. 2 and 3 The automatic-transmitter motor stops. (b) Units, Telex, Nos. 6 and 10 The teleprinter TM magnet and AL contacts operate. (The reperforator magnet, RM, also operates to stop reperforation if the reperforating attachment is in use)
(4) Operate the RESET key and also the tape transmitter STOP key (Units, Telex, Nos. 6 and 10 only)	The alarms cease. The teleprinter keyboard operates in-local
(5) Remove the link between LKB 2 and LKB 4	The CALL lamp darkens

TABLE 6 (Contd.)

Testing operation	Result if circuit is in order
(6) Operate the LOCAL key. Insert a prepared tape in the tape transmitter and operate the AUTO START key	As for testing operation (2)
(7) Operate the AUTO STOP key	Tape transmission ceases and with Units, Telex, Nos. 2 and 3 the automatic-transmitter motor stops. Keyboard operation in-local is possible.
(8) Operate the RESET key	The teleprinter motor stops
(9) Replace links LKA and LKB	-

TABLE 7. CHECK OF INTERRUPT ALARM

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB	-
(2) Insert link between LKA 1 and LKA 3	-
(3) Operate the DIAL key until the CALL lamp glows	The teleprinter motor starts
(4) Insert a prepared tape into the tape transmitter and operate the AUTO START key	A printed copy of the tape message is received on the teleprinter. The alarm lamp and buzzer respond to the spacing elements of the transmitted signals
(5) Operate the AUTO STOP key and remove the link from LKA 1 and LKA 3	Tape transmission stops. The teleprinter motor stops and the CALL lamp darkens
(6) Replace links LKA and LKB	-

TABLE 8. CHECK OF 'TAPE-OUT' CONTACTS AND FORCED RELEASE OF TAPE TRANSMITTER

Testing operation	Result if circuit is in order
(1) Remove U-links LKA and LKB and insert link between LKB 2 and LKB 4	The CALL lamp glows and the teleprinter motor starts
(2) Insert a prepared tape in the tape transmitter and operate the AUTO START key	A local copy of the tape message is printed on the teleprinter. The teleprinter keyboard is inoperative

TABLE 8 (Contd.)

Testing operation	Result if circuit is in order
<p>(3) <i>Units, Telex, Nos. 2 and 3 only:</i></p> <p>(a) Operate the automatic-transmitter tight-tape lever</p> <p>(b) Operate the RESET key</p> <p>(c) Restore the tight-tape lever and operate the AUTO START key</p>	<p>The alarm lamp glows and the buzzer operates. The automatic-transmitter motor stops; the teleprinter keyboard works in-local</p> <p>The alarms cease</p> <p>Tape transmission is resumed</p>
<p>(4) Allow the tape to run out or lift the tape guide to operate the 'tape-out' contacts</p>	<p>The alarm lamp glows and the buzzer operates and, with Units, Telex, Nos. 2 and 3, the automatic-transmitter motor stops. The teleprinter works in-local</p>
<p>(5) Operate the RESET key and, on Teleprinters No. 15, the tape transmitter STOP key</p>	<p>The alarms cease</p>
<p>(6) Repeat testing operation (2)</p>	<p>As for testing operation (2)</p>
<p>(7) Simulate a 'clear-down' by removing the link from LKB 2 and LKB 4 while the message is being sent</p>	<p>The alarm lamp glows and the buzzer operates. The teleprinter and automatic transmitter (Units, Telex, Nos. 2 and 3) motors stop and the CALL lamp darkens</p>
<p>(8) Operate the RESET key and, on Teleprinters No. 15, the tape-transmitter STOP key. Replace links LKA and LKB</p>	<p>The alarms cease</p>

TABLE 9. CHECK OF TAPE-TRANSMITTER START KEY ALARM

(UNITS, TELEX, NOS. 6 and 10 ONLY)

Testing operation	Result if circuit is in order
<p>(1) Remove U-links LKA and LKB and operate the tape transmitter START key</p>	<p>The teleprinter motor starts. The alarm lamp glows and the buzzer operates. The teleprinter TM magnet is energized and operates the AL contacts, which release relay MS and so switch off the teleprinter motor</p>
<p>(2) Operate the tape transmitter STOP key. Replace links LKA and LKB</p>	<p>The alarms cease</p>

TESTS BETWEEN EXCHANGE TEST POSITIONS AND TELEX STATIONS

9. **Installation tests.** The tests to be made on the customer's line by the exchange engineering test positions are given in pars. 10 and 11. The tests to be made in conjunction with the installation officer at the customer's premises are given in Table 10 and pars. 12 and 13, the tests described in testing positions (5) - (8), (10) and (11) of Table 10 being excluded if previously made at the Assembly Centre (see par. 8).

Before any of the tests are made it is essential that the installation officer checks the power wiring to the unit. As the protective fuses in the telex unit are inserted in one leg only it is imperative that the fuses should be in the live side of the a.c. input. To check this, remove fuses FS1 and FS2 and, with the power switched on, measure the a.c. voltage between earth and the black lead to the primary of the mains transformer T1. If the full a.c. voltage is present across these points the a.c. input should be reversed.

10. **Insulation, line and signalling-earth resistance.** These resistances should be measured in accordance with A 3105. The transmission and signalling limits are scheduled in General, A 3010.

11. **Panel, Telegraph, No. 103A timing check.** This timing check, using a Tester TG 5162, is required when the station line includes m.c.v.f. circuits.

(a) *Panel, Telegraph, No. 103A (Dgm. TG/TGW 5241).* The panel at the customer's m.c.v.f. terminal should be set up as follows:-

- (i) Loop the customer's side of the relay unit under test (tags 5 to 1 or tags 17 to 13).
- (ii) Insulate the spring CTA 5 with an Insulator, Contact, No. 1.
- (iii) Connect -80V to the travelling spring of spring-set CTA 1 (spring CTA 4).

It is essential that the Panel, Telegraph, No. 103A is restored to normal after the completion of testing.

(b) At the telex exchange test desk the Tester TG 5162 should be set to measure the first positive pulse. The send wire should be connected to -80V and the receive wire connected to the Tester TG 5162.

The polarity of the 80V on the send wire should then be reversed (i.e. changed from -80 to +80V) and the duration of the positive pulse returned by the CT relay in the Panel, Telegraph, No. 103A measured on the Tester TG 5162. The pulse duration should be within the limits of 325 to 475 ms; if not, correct the timing of the CT relay by varying the value of the capacitor C1 and also, if necessary, adjusting relay CT if this is outside the limits given in TELEPHONES, Automatic, B 5144.

TABLE 10

Operation at the telex test desk	Operation at the customer's station
<p>(1) <i>Teleprinter 'on-speed' relay</i></p> <p>Check the timing of the customer's 'on-speed' relay in accordance with General, T 1018</p>	-
<p>(2) <i>Transmitter distortion</i></p> <p>Establish connexion</p> <p>Measure distortion over a minimum period of 20 seconds. Maximum or minimum distortion not to exceed the values given in General, T 5052</p>	<p>Transmit on run-out and mixed signals from teleprinter and tape transmitter when fitted</p>
<p>(3) <i>Receiver margin</i></p> <p>Establish connexion</p> <p>Transmit distorted test message</p>	<p>Check that the maximum distorted test message that the teleprinter receives without error is in accordance with the values given in General, T 5052</p>
<p>(4) <i>Speed error (governed motors only)</i></p> <p>Establish connexion</p> <p>Check that the speed error does not exceed 0.5%</p>	<p>Transmit a 'plugged' character from the teleprinter and then the automatic transmitter if fitted. Adjust the motor governor as required</p>
<p>(5) <i>Dial speed and ratio</i></p> <p>Establish connexion via the test final or the engineering control board</p> <p>Check the dial speed and ratio and inform the installation officer of the results</p>	<p>When call established, operate the CLEAR key until the CALL lamp darkens then operate the DIAL key until the CALL lamp glows. Dial 000909</p> <p>If the dial is outside the speed limits, adjust it in accordance with TELEPHONES, Auto., B 5125. If difficulty is experienced in adjusting the dial, or, if the pulse ratio is outside permissible limits, change the dial</p>

TABLE 10 (Contd.)

Operation at the telex test desk	Operation at the customer's station
<p>(6) <i>Outgoing calls</i></p> <p>Check bothway transmission, J-bell alarms and then clear the connexion</p>	<p>Operate the DIAL key until the CALL lamp glows. Dial the telex test desk number</p> <p>Check bothway transmission and J-bell alarms</p>
<p>(7) <i>Incoming calls</i></p> <p>Call the customer's station</p>	<p>Confirm that the incoming call alarm operates and then clear the connexion</p>
<p>(8) <i>Local facility</i></p> <p>Call the customer's station. Check that the answer-back is returned within 2.4 to 4.8 seconds after completion of dialling</p>	<p>Operate the LOCAL key. The green lamp should glow and the teleprinter operate in-local</p> <p>Check that the incoming call alarm operates and stops the local record until the answer-back is tripped by receipt of WRU</p> <p>Restore the LOCAL key and alarms by operating the RESET key and then clear the connexion</p>
<p>(9) <i>'Out-of-service' condition</i></p> <p>Call the customer's station and check that the service signal 'ABS' is received followed by the clear down of the connexion</p>	<p>Disconnect the telex station power to provide an 'out-of-service' condition</p>

TABLE 10 (Contd.)

Operation at the telex test desk	Operation at the customer's station
<p>(10) <i>Tape transmission facilities</i></p> <p>Check that the received message is correct</p> <p>Tap the teleprinter space bar</p> <p>Clear the connexion during the tape message reception</p>	<p>Operate the DIAL key until the CALL lamp glows</p> <p>Dial the telex test desk number. Insert a prepared tape (preferably from the teleprinter reperforator attachment) into the tape transmitter and operate the tape transmitter START key</p> <p>Check that the local record copy is correct</p> <p>Confirm that the interrupt alarm momentarily operates but does not stop the tape transmission</p> <p>Operate the tape transmitter STOP key and check that the tape transmission is stopped and keyboard transmission is possible</p> <p>Resume tape transmission and check that at the end of tape transmission ('tape out') the tape transmitter stops and operates the alarm</p> <p>Operate the alarm RESET key (and on Teleprinters No. 15, the TAPE OFF key) to restore the alarm. Check that keyboard transmission is possible</p> <p>Resume tape transmission</p> <p>Check that when the connexion clears down, the alarm is operated and that this is restored by operating the alarm RESET key (and the TAPE OFF key on Teleprinters No. 15)</p>

TABLE 10 (Contd.)

Operation at the telex test desk	Operation at the customer's station
<p>(11) <i>Tape transmission local facility</i></p> <p>Call the customer's station during the customer's local tape transmission</p>	<p>With the LOCAL key operated, check that the correct local record is obtained with tape-transmitter operation</p> <p>The tape transmission should stop and operate the alarms. Operation will then be as given in (8)</p> <p>Restore the LOCAL key and the alarms by operating the RESET key (and the TAPE OFF key on Teleprinters No. 15). Clear the connexion</p>

12. Adjustment of the private-metering circuit. (Unit, Telex, No. 3 only).

The frequency response of the line filter and the gain of the amplifying valve are both adjustable to allow for the effects of line characteristics. The frequency response of the line filter is adjusted by applying continuous meter tone at the exchange and varying the filter tuning until maximum response is obtained. The gain of the amplifying valve is then adjusted by varying its grid-bias voltage and confirming that the equipment responds to trains of meter pulses transmitted by a tester in the exchange. The procedure for adjusting the private metering equipment is as follows:-

(a) Call the test desk and ask for co-operation. The test desk will maintain correct signalling conditions to the line and arrange for the connexion of a Tester TG 5486 to the exchange equipment. A continuous 450 Hz tone will be applied to the line at normal level.

(b) With the two Potentiometers No. 32A, 2.2k chms and 100 ohms, set to maximum resistance, connect them in series across terminals SC 2 and SC 20 of the Unit, Telex, No. 3.

(c) Set the Meter, Multi-range, No. 12 (or equivalent) to a scale suitable for measuring a maximum of 16V and connect it across relay A (terminal SC 17 and +80V).

(d) Connect the adjustable tapping to the -2V terminal (R16 - R20 in the Unit, Telex, No. 3), i.e. at the junction of R16 and R17.

(e) Adjust the variable capacitor C11 to its minimum value, and ensure that the other capacitors of the C11 - C14 combination are not connected in circuit. The voltmeter across relay A should indicate about 16V, but may read up to 25V in some cases. Relay A should be operated by the 450 Hz tone.

(f) Find the combination of capacitors which, on the particular line under test, will give the maximum response at 450 Hz at terminals 4 and 5 of transformer T4. Proceed as follows:-

(i) Gradually reduce the resistance in the Potentiometers No. 32A until the indicated voltage drops sharply (relay A releases).

(ii) Gradually increase the capacitance of the C11 - C14 combination (see Note) until the voltage returns to its original value (relay A reoperates).

(iii) Reduce the potentiometer resistance again until a further sharp decrease in voltage is observed, and then add capacitance until the voltage regains its former value.

(iv) Repeat this process until the voltage cannot be restored by any further increase to the total capacitance so far included in circuit.

The circuit is now tuned to maximum sensitivity, and any temporary straps should be wired-in permanently.

When the line conditions are such that no voltage, or a very low voltage, is developed across relay A when 450 Hz is connected at the exchange, capacitance must be introduced until a voltage appears across relay A: tests (i) - (iv) are then followed.

NOTE:- Capacitance should be added by utilizing combinations of capacitors C11 - C14 in parallel in the following order:-

- 1 C11 only
- 2 C11 + C14
- 3 C11 + C13
- 4 C11 + C13 + C14
- 5 C11 + C12
- 6 C11 + C12 + C14
- 7 C11 + C12 + C13
- 8 C11 + C12 + C13 + C14

The whole of the capacitance range of each combination used should be made available by adjusting C11 initially to its minimum capacitance in each instance and by changing the combination only after the full capacitance of C11 has been utilized.

(g) Disconnect the Potentiometers No. 32A from terminals SC 2 and SC 20. Alter the grid-bias voltage by -2V steps by moving the tapping on the grid-bias potentiometer (R16 - R20) until the indicated voltage across relay A shows a reduction in value. Restore the tapping to the previous connexion. Request the test desk to reduce the level of the 450 Hz tone by 4 dB. There should not be any significant change in the voltage across relay A. If such a change does occur reduce the grid-bias voltage in 2V steps until the voltage across relay A is restored to its original value.

(h) Advise the test desk that the customer's private-meter is now ready for functional test (see par. 13). The continuous tone will be removed from the line.

13. Functional test of private-meters (Units, Telex, No.3 only). The installation officer should call the test desk and ask for a private-meter functional test. The test desk will maintain correct signalling conditions to line and arrange for the connexion of a Tester TG 5486 to the exchange equipment. The tester sends three pulse trains: first, 10 pulses of 100 ms duration, to which the meters should not respond; then 10 pulses of 180 ms duration, to which the meters should respond; and finally 10 pulses of 180 ms duration at 4 dB below the normal level, to which the meters should respond. While these pulse trains are being sent, signals should be transmitted from the station teleprinter to simulate normal working conditions. Finally, the DIAL key should be operated to check that the trip meter restores and the CLEAR key should be operated to restore the station to normal.

References:- A 3105
(NP3.4.3) General, A 3010, T 1006, T 1018, T 5052
POWER, Machines & Switchboards, F 1035, F 1041
TELEPHONES, Automatic, B 5125, B 5144

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