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ENGINEER-IN-CHIEF'S TRAINING SCHOOL.

UNIT AUTO. No.5.

RURAL AUTOMATIC EXCHANGE

ROUTINE TESTING.

Diagrams E. 828

E. 901

A.T. 2018

S.M.264/3
Rota 310/33.

MAINTENANCE TESTING USE OF R.A.X.

LINE TEST CASE (Case Test D.9262).

Normally the telephone associated with the test case is an ordinary exchange line, but by means of the keys in the test case may be connected as the testing officers' speaking telephone.

The operations to make the various tests are as follows:-

To test for	Throw
Line side	In and Out Switching normal.
Exchange side	In and Out Switching Key
Ringing sub.	Ringing key and rotate generator
Earth on B line	Voltmeter Key
Earth on A line	"Voltmeter" key &"Reversing" Key
Batt. on B line	"Voltmeter", "Voltmeter Batt.C.O." and "Voltmeter Reversing" Key
Batt. on A line	"Voltmeter","Voltmeter Batt.C.O." "Voltmeter Reversing" and "Reversing" Keys.
Loop resistance	"Voltmeter" & "Reversing" Keys
To supply speaking batt.	Speaking Batt. Key.
Dial speed test	"Speaking Batt" & "Dial Test"Keys
Speak to sub. (via test clip)	"Test Cot.Speaking" Key

Notes:-

(1) Should a call be received on the test exchange line, while the testing officer is speaking on the test circuit, the bell in the test case will ring.

(2) A detector No.2 and tester No.43 (dial speed tester) are not provided at each R.A.X. The lineman will use his own detector, removing it when he leaves the exchange, and the tester No.43 will be obtained on loan, when required for dial speed tests.

Rota 310/33.

ROUTINE TEST OF AUTO. EQUIPMENT (UNIT AUTO No.5).

TO BE CARRIED OUT WITH

TESTER No. 8Z (DIAGRAM E. (901), AND

CASE TEST D.9262 (DIAGRAM K. 828).

GENERAL.

The outgoing side of the Tester 8Z, should be connected to a spare line equipment modified as a coin box circuit, and the line equipment jumpered temporarily to a spare multiple number.

The incoming side of the tester should be similarly connected to another spare equipment and number but without the coin box modification.

In the following tests the outgoing and incoming sides of the tester are referred to as test circuits No.1 and 2 respectively.

In exchanges containing more than one unit it will be necessary to transfer test circuits No.1 and 2, together with their associated jumpers to the second etc. units when certain tests are being made on the connecting links. To facilitate this, cords terminating in test clips may be used in place of jumpers.

During the tests the operating of the common apparatus should be closely observed whenever it is brought into use. The following points should be particularly noted.

(a) Assignment Switches. Note that disengaged Selectors are picked up in sequence, and that the assignment switch relay contacts are free from sparking.

(b) Relay Timing Group. Note that the operation of these relays is regular and that no sparking occurs.

(c) Ringing Vibrator. The adjustments for the vibrator given in the adjustment instructions should be strictly adhered to. The ringing and the ringing tone will be weak in quality unless the adjustment of the vibrator is correct.

(d) Tone Relay. The quality of the tone should be observed. It should be clear, fairly high in pitch, and unvarying. If the pitch changes or has a "rasping" quality the adjustments of the relay should be verified and the contacts cleaned with Tool Instrument No. 185.

TEST 1. REGULAR LOCAL CALL.

Operate the "1200 ohm loop", and "Connect" key, and dial the multiple number of test circuit No. 2. Check that the selector action is smooth, and that there is no excessive sparking. Verify the reception of ringing tone by operating the "listen" key. The bell should ring satisfactorily. Trip the ringing by operating the

"Trip"/

"Trip" key and check that the meter associated with test circuit No. 1 operates once. Operate "1800 ohms Loop" key and note that selector relays DA and DS remain operated. Restore "1800 ohms loop" key, operate the "transmission" key and check reception of tone through the selector by listening in the receiver with the "listen" key operated. Restore all keys and note correct release of the selector.

TEST 2. LOCAL Call. CALLED LINE BUSY.

Operate the Trip key and "connect key". Operate "1200 ohms loop" key and dial the multiple number of No. 2 test circuit. Busy tone should be heard when the listening key is operated. Restore all keys to normal and note that the meter associated with No. 1 test circuit does not operate.

Repeat the test on all connecting links.

JUNCTION TESTS.

Since it is difficult to make tests on the "O" level without interfering with the normal working of the exchange, arrangements should be made for testing the junction circuits as quickly as possible when traffic is at a minimum.

In the following junction tests, tests 3 and 4 refer to R.A.X's having only one junction in each group, and tests 5 and 6 to R.A.X's having more than one junction in each group.

Before tests are commenced the distant operator should be called by means of the telephone associated with the line test case (Dgm. E.828) and informed that junction tests are about to be made and that the junctions will be out-of-order for a short while. During the tests the selectors should be watched for "O" level calls. If these occur the junctions should be reverted to normal and the test suspended temporarily.

TEST 3. JUNCTION Call. OUTLET FREE.

Intercept the junction line on the main frame with the plug of the line test case and operate the "In and Out Switching" and "Test oct. Speaking" keys.

From test circuit No. 1 dial the junction under test with the "1200 ohms loop" key operated.

The bell of the line test case telephone should ring. Trip the ringing by removing the receiver. Operate the "Earthing" key of

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the line test case and verify reception of coin box tone in the receiver of the instrument.

Restore "1200 ohms loop" key of test circuit No. 1, the Earthing key of the line test case, and replace the receiver.

Repeat the test on all connecting links.

TEST 4. JUNCTION CALL. OUTLET BUSY.

With the "In and out Switching" and "Test cct. Speaking" keys operated on the line test case remove the receiver of the line test case telephone. Dial the junction from test circuit No. 1 after operating the "1200 ohms loop" key. Verify reception of busy tone on the receiver of test circuit No. 1 on operating "listen" key. Repeat the test on all connecting links.

TEST 5. JUNCTION CALL. LAST OUTLET FREE.

Strap the P and P1 contacts of the first and intermediate lines in a group by means of a piece of bare wire wrapped around the multiple block tags. Earth this wire. Intercept the last junction in the group on the main frame; and operate "In and Out Switching" and "Test Cct. Speaking" keys on the line test case. Dial the first junction of the group from test circuit No. 1, trip the ringing by removing the line test case receiver and test for coin box tone as in Test 3. Repeat the test on all connecting links.

TEST 6. JUNCTION CALL. ALL OUTLETS BUSY.

The conditions are the same as in Test 5, except that the receiver of the line test case telephone should be removed before dialling. Dial the first line of the group from test circuit No. 1, and verify reception of busy tone as in Test 4.

Repeat the test on all connecting links.

NOTE:- In order to restore the junctions to normal conditions the bare wire strapping and earthing of the P and P1 tags should be removed immediately tests 5 and 6 are completed and the plug removed from the main frame.

TEST 7. FORCED STAR ON ASSIGNMENT SWITCH WHEN CONNECTING LINK FUSE IS BLOWN.

Connect battery to the fuse alarm stud of a connecting link. Operate the "1200 ohms loop" key of test circuit No. 1. A connecting link is seized and, on restoring the "1200 ohms loop" key, the selector receives one vertical impulse. Operate and release the key in order to seize and release the connecting links in a sequence. Note that the connecting link on which the blown fuse is simulated is passed.

Repeat/

Repeat the test on all connecting links.

TEST 8. STEP ON OF ASSIGNMENT SWITCH WHEN A SELECTOR FAILS TO RESTORE TO NORMAL.

Lift a selector shaft to the off normal position and operate "1200 ohms loop" key of test circuit No.1 in a manner similar to that employed in test No.7. Note that the selector which is off normal is passed.

Repeat the test on all connecting links.

TEST 9. FORCED STEP ON LINE FINDER.

Hold the "I" relay of a spare subscribers equipment in the operated position by hand. Note that a line finder is seized, hunts to the back contact of the calling line, stops momentarily then hunts round to the same contact again, stops again and so on.

Repeat the test on all line finders.

NOTE:- It should be observed that the wipers of a line finder stop only once during each half-revolution. If more than one halt is made it is an indication that earth, which is normally on the P1 bank contacts, is missing, and steps should be taken to clear the fault.

TEST 10. METERING CONDITIONS ON CONNECTING LINKS.

Connect test circuit No.2 to a spare multiple number (not on the "0" level) in the first unit. Note the reading of the meter associated with the service telephone remove the receiver and dial the number to which test circuit No.2 is connected. Trip the ringing by operating the Trip key in test circuit No.2 and note that the meter associated with the service telephone registers once.

Repeat the test until all four connecting links in the unit have been tested.

In exchanges with more than one unit the connecting links which are not available to the service telephone should be tested by connecting test circuit No. 1 to a spare subscribers equipment on the unit concerned. The above test should then be carried out by operating the "1200 ohms loop" key in test circuit No.1 and dialling the multiple number of test circuit No. 2.

TEST 11. SUBSCRIBERS CALLING EQUIPMENTS AND METERS.

Connect test circuit 1 to the voltmeter terminals on the line

test/

test case. Operate the "In and Out Switching","Voltmeter" and "Voltmeter Batt. C.O." keys on the line test case.

..... Rural Automatic Exchange Routine Test of Meters on ..... (date)

Subs. No. or Junction	Reading before Test	Reading after Test

The calling equipments and meters should be tested in consecutive order but to avoid interference with engaged circuits and to discover faulty circuits "held" on the "P" relays connect the positive 50v terminal of a "Detector No.2" to earth and tap a wire from the negative terminal of the detector on the negative lines of all the working circuits. A deflection of about 46°(Depending upon the exchange voltage) will be obtained on O.K. lines which are not in use at the time of the test. Any circuits which are faulty should receive attention and any circuits which are engaged normally should be recorded for test later.

Plug into the first disengaged circuit on the main frame. Make a note on the schedule of the circuit number and its meter reading. Then operate the "1200 ohms loop" key of test circuit No. 1. Dial the multiple number of the service telephone with the dial test circuit No.1. When ringing is received remove the telephone receiver and observe that the meter associated with the calling line registers once. To avoid waiting for the time delay switch to free the link, step the line finder, by hand, off the bank contact of the calling line. Observe that the connecting link is released and that the "K" relay of the subscribers equipment releases, leaving only the "P" relay operated. Restore "1200 ohms loop" key of test circuit No.

1 and make a note on the schedule of the final meter reading.

Continue the test until every calling equipment is proved and restore the test case connections to normal. Any faults should be given immediate attention.

The schedule should be forwarded immediately to the Control Centre in order that the District Manager may be advised of the advancement of the meter readings.

Since the calling equipment test is required more frequently than the meter test, the former test may be carried out separately by omitting to dial after the "1200 ohms loop" key of test circuit No. 1 has been operated. The starting of the time delay switch will prove that a connecting link has been seized, and the associated line finder should then be stepped on as indicated above to prove the holding of the "F" relay.

TEST 12. TIME DELAY SWITCH.

Set the time delay switch to the third bank contact and lift the receiver of the line test case telephone. Verify that the connecting link seized is released after an interval of about 15 seconds. Set the time delay switch to the fourth bank contact and repeat the test, verifying that release occurs after an interval of about 30 seconds.

TEST 13. "N.U." TONE.

Operate "1200 ohms loop" key of test circuit No. 1 and dial any spare number. Verify the reception of "N.U." tone by operating the "Listen" key and listening with the receiver.

TEST 14. FAULT TEST CIRCUIT.

Call 99 from the line test case telephone and note reception of inverted ringing tone. Lift (a) a selector shaft off normal, (b) connect battery to the alarm stud of a connecting link fuse, (c) connect battery to a fuse alarm bar, and (d) tap earth on terminal F of the power board (see diagram A.T. 2018). Note that the inverted ringing tone is replaced by "N.U." tone in each case.

TEST 15. INSULATION TEST OF SUBSCRIBERS' LINES.

The lowest permissible insulation resistance is 50,000 ohms. Subscribers' lines having a less resistance should be treated as Rota 310/33.

faults, /

faults, but should not be put out of service unless unworkable. The insulation test should be made on subscribers circuits in consecutive order as follows:-

Verify that the circuits are disengaged as in test No.11.

To make the insulation test insert the test show in the protector of the line to be tested and connect the detector No.2 to the test case on its 50 volt scale.

Operate the "Voltmeter" and "Earthing" keys of the test case and note the deflection on the detector. Throw the "Reversing" key also and again note deflection. When the exchange voltage is 50 an insulation resistance of 50,000 ohms will give a deflection of 4.5. on the 50 volt scale. Should either deflection be above this figure, the line should be given attention.