

R E S T R I C T E D

ELECTRICAL AND MECHANICAL
ENGINEERING REGULATIONS
(By Command of the Army Council)

TELECOMMUNICATIONS
Y 814

TESTERS, VALVE, AVO

TECHNICAL HANDBOOK - FIELD AND BASE REPAIRS

Errata

Note: These Pages 0 and 01, Issue 1, will be filed immediately in front of Page 1, Issue 1, dated 20 Feb 58.

1. The following amendments will be made to the regulation.
2. Page 1, SUBJECT INDEX; TESTER, VALVE, AVO, NO 3; SPECIFICATION TESTS.
 - (a) Initial setting up, under Paras.
Delete: '21-22'
Insert: '21'
 - (b) Measurement of heater voltage, under Paras.
Delete: '23'
Insert: '22'

Issue 1, 1 Nov 60

Distribution - Class 1330. Code No 6

Page 0

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ELECTRICAL AND MECHANICAL
ENGINEERING REGULATIONS

- (c) Measurement of anode voltage, under Paras.
Delete: '24'
Insert: '23'
- (d) Measurement of screen voltage, under Paras.
Delete: '25'
Insert: '24'
- (e) Measurement of grid voltage, and under Paras.
Delete: 'Measurement of grid voltage', '26-27'
Insert: 'Ia calibration', '25'
- (f) Ia calibration, and under Paras.
Delete: 'Ia calibration', '28'
Insert: 'Measurement of grid voltage', '26-28'

3. Page 11, para 37.

Delete all detail.

Insert: 'Measure the local mains supply and adjust the coarse and fine settings on the voltage selector panel to correspond to this voltage.'

TE/8b/860

Page 01

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Errata

Note: These Pages 02 and 03 will be filed immediately in front of Page 1, Issue 1, dated 20 Feb 58.

4. The following amendments will be made to the regulation.

5. Page 9, para 30

Beneath line 2

Insert: Instrument, testing, electronic, multi-range, No 1 ZD 00167

6. Page 13, para 43

Sub-para (b)

Delete: Connect the valve voltmeter across R5

Insert: Connect the electronic test meter across R5

Sub-para (c)

Delete: 51 - 54mV; 102 - 108mV; 252 - 268mV

Insert: 50 - 55mV; 100 - 110mV; 250 - 270mV

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Page 02

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R E S T R I C T E D

ELECTRICAL AND MECHANICAL
ENGINEERING REGULATIONS

7. Page 14, para 44

Sub-para (c)

Delete: Connect the valve voltmeter

Insert: Connect the electronic test meter

Sub-para (e)

Delete: 102 - 108mV

Insert: 100 - 110mV

Sub-para (g)

Delete: valve voltmeter

Insert: electronic test meter

HQ/TGR

TESTERS, VALVE, AVO

TECHNICAL HANDBOOK - FIELD AND BASE REPAIRS

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INTRODUCTION

1. This regulation deals with the Testers, valve, Avo, Nos 1, 3 and CT 160 and details field and base repair work. It should be used in conjunction with Tels Y 812, Parts 1 and 2, to which reference should be made for technical description, circuits and layout diagrams.

TESTER, VALVE, AVO, NO 1

Permissive repairs

2. All repairs, replacements and adjustments detailed for this instrument may be carried out in field workshops unless otherwise stated.

Instruments used in repair

3. Instrument, testing, Avometer, universal, 50-range, Mk 2 ZD 00021.

DISMANTLING, REPAIR AND ASSEMBLYRemoval of main unit from case

4. (a) Remove the eight No 6 B.A. screws, two in each side of the case, and the two No 4 B.A. screws holding the 9-pin socket to the left-hand side of the case.
- (b) Lift the panel, with components attached, clear of case.

Removal of the meter

5. (a) Unsolder the two leads connecting the movement to a tag panel.
- (b) Remove the two No 2 B.A. screws, one on either side of the magnet.
- (c) Lift the movement up and back, taking care that the meter scale clears the wiring.
- (d) To replace, reverse the above procedure.

Repair of meter

6. General details of meter repair will be found in Inst Z 414, and will only be carried out in base workshops. The internal resistance of the meter is 27Ω and the current at full scale deflection is $600\mu\text{A}$.

Removal of sub-unit from case

7. (a) With the unit face downwards remove the four screws which hold the case.
- (b) Lift the case clear of the unit.

SPECIFICATION TESTSMeasurement of heater voltages

8. (a) Set the ROLLER SELECTOR switch as follows:-
- 036 500 210
- (b) Insert the prods of the Avometer in pins 2 and 7 of the International octal base.
- (c) Set the NORMAL/ \div by 7 switch to NORMAL.
- (d) Rotate the HEATER VOLTS switch through the full range of values.
- (e) Compare the readings obtained with those shown in Table 1.

HEATER switch SB	Permissible limits	Avometer range
1.4 *	1.4 - 1.65) 10V a.c.
2.0	2.0 - 2.3	
2.5	2.5 - 2.8	
4.0	4.1 - 4.5	
5.0	5.2 - 5.6	
6.0	6.2 - 6.8	
7.5	7.9 - 8.5	
10	10.3 - 11.0) 100V a.c.
13	13.5 - 14.5	
16	16.5 - 17.5	
20	21.0 - 22.5	
26	27.0 - 29.5	
30	31.0 - 34.0	
35	37.0 - 40.0	
40	42.0 - 45.0)

* HEATER switch SB set to 10V and ÷ BY 7 switch SH set to ÷ BY 7 position

Table 1 - Heater voltage T.V.A. No 1

Measurement of anode voltages

9. (a) With the ROLLER SELECTOR switch set as in para 8 (a), insert the prods of the Avometer in pins 3 and 8 on the International octal base.
- (b) Rotate the ANODE VOLTS control through the full range of values.
- (c) Compare the readings obtained with those shown in Table 2.

ANODE VOLTS switch setting	Permissible limits	Avometer range
D	11.4 - 12.6) 100V a.c.
REC	28.5 - 31.5	
80	106.5 - 117.5	
100	133 - 147) 400V a.c.
125	166 - 183	
150	199.5 - 220.5	
200	266 - 294	
250	332.5 - 367.5	

Table 2 - Anode voltages T.V.A. No 1

Measurement of screen voltages

10. (a) With the ROLLER SELECTOR switch set as in para 8 (a), insert the prods of the Avometer in pins 4 and 8 of the International octal base.

- (b) Rotate the SCREEN VOLTS control through the full range of values.
- (c) Compare the readings obtained with those shown in Table 3.

SCREEN VOLTS switch setting	Permissible limits	Avometer range
60	57 - 63) 100V a.c.
75	71 - 79	
90	85.5 - 94.5	
100	95 - 105	
Pen LF) 142.5 - 157.5) 400V a.c.
150)	
200	190 - 210	
250	237.5 - 262.5	

Table 3 - Screen voltages T.V.A. No 1

TESTER, VALVE, AVO, NO 3

Permissive repairs

11. All repairs, replacements and adjustments detailed for this instrument may be carried out in field workshops unless otherwise stated.

Instruments used in testing

12. Instrument, testing, Avometer, universal, 50-range, Mk 2 ZD 00021
 Voltmeter, valve, No 3 ZD 00121

DISMANTLING REPAIR AND ASSEMBLY

Removal of the case (Mks I and II)

- 13. (a) With the instrument standing normally remove the two bolts in each lifting handle, using a wrench setscrew (5/32 in.).
- (b) Lift the case clear of the instrument.

Removal of valve holder panel (Mks I and II)

- 14. (a) With the case removed, unscrew the four bolts, two on either side frame.
- (b) Unsolder the ten-way tag panel at the rear of the instrument.
- (c) Lift off the valve holder panel.

Note: If it is desired to reach some component on the under side of the panel, remove the two front bolts only and loosen the two rear ones. The panel can then be raised like a lid.

Access to rear of front panel

15. Mk I. (a) Remove the four nuts and bolts, two on either side, which hold the front panel to the main frame.
- (b) The panel can now be drawn forward sufficiently to enable most component changes to be made.
16. Mk II. (a) Loosen the two grub screws in each of the collars at the base of the handles.
- (b) Unscrew the collars and the handles will be removed with them.
- (c) Unscrew the brass retaining studs now exposed.
- (d) The panel can now be drawn forward sufficiently to allow the replacement of most components.

Note: In both Mk I and II it is necessary to unsolder several leads at the rear of the panel before attempting to replace a banked switch.

Removal of transformers

17. Mk I. (a) Remove the base of the instrument by unscrewing the four bolts, one in each rubber foot.
- (b) Unsolder the connections to the transformer being replaced.
- (c) Remove the small paxolin panel mounted on top of the transformer (T1 only).
- (d) Remove the four screws holding the paxolin strip to the runners which support the transformers.
- (e) Remove the four bolts which hold the transformer to the runners.
- (f) To reassemble, reverse the above procedure.
18. Mk II. (a) Unsolder the mains input lead from the transformer and then remove the base of the instrument by unscrewing the six bolts, three in each runner, which hold it to the frame.
- (b) Unsolder the connections to the transformer being replaced.
- (c) Remove the paxolin panel by unscrewing the four No 6 B.A. bolts which hold it to the transformer.
- (d) Remove the four No 4 B.A. bolts holding the transformer to the runner.
- (e) To reassemble, reverse the above procedure.

Removal of the meter (Mks I and II)

19. (a) Remove control knobs.

Note: These Pages 7-10, Issue 2, supersede Pages 7-10, Issue 1, dated 20 Feb 58. The paragraphs marked ● are additional or have been amended.

- (b) Remove the front panel from the frame as detailed in para 15 or 16.
- (c) Remove the screws which hold the engraved metal panel to the front panel.
- (d) Remove the paxolin panel at the rear of the meter.
- (e) Remove the screws holding the meter in position.
- (f) To replace the meter reverse the above procedure.

Repair of the meter (Mk I and II)

20. General details of meter repair will be found in Inst Z 414, and will only be carried out in base workshops. The internal resistance of the meter is 100Ω and the current at full scale deflection is 460μA.

SPECIFICATION TESTS

Initial setting up

- 21. Measure the local mains supply and set LK1 and SB (SET ~) to correspond to this voltage. Connect the instrument to the mains supply and switch on.

Measurement of heater voltages

- 22. (a) Set the ROLLER SELECTOR switch as follows:-

036 500 214

- (b) Insert the prods of the Avometer in pins 2 and 7 on the International octal base.
- (c) Set CIRCUIT SELECTOR to TEST.
- (d) Rotate the HEATER VOLTS switches through the full range of values.
- (e) Compare the readings obtained with those shown in Table 4.

Table 4 - Heater voltages T.V.A. No 3

Setting of HEATER VOLTS switches	Permissible limits	Avometer range
1.1	1.0 - 1.2	} 10V a.c.
1.4	1.4 - 1.65	
2.0	2.0 - 2.3	
2.5	2.5 - 2.85	
3.0	3.0 - 3.3	
4.0	4.0 - 4.3	
5.0	5.0 - 5.35	
6.0	6.3 - 6.7	
7.5	7.5 - 7.85	

Table 4 - (cont)

Setting of HEATER VOLTS switches	Permissible limits	Avometer range
10.0	10.0 - 10.5	100V a.c.
16.0	16.0 - 16.75	
60.0	60.0 - 63.5	
70.0	70.0 - 74.5	
80.0	80.0 - 85.0	
90.0	90.0 - 95.5	
100.0	100.0 - 106.0	400V a.c.
110.0	110.0 - 117.0	

Measurement of anode voltages

23. (a) With the ROLLER SELECTOR switch set as in para 22(a), insert the prods of the Avometer in pins 3 and 8 on the International octal base.
- (b) Rotate the ANODE VOLTS control switch through the full range of values.
- (c) Compare the readings obtained with those shown in Table 5.

Table 5 - Anode and screen voltages T.V.A. No 3

ANODE VOLTS switch SE	SCREEN VOLTS switch SF	Permissible limits	Avometer range
20	20	21 - 23	100V a.c.
-	30	31.5 - 34.5	
40	40	42 - 47	
50	50	53 - 58	
60	60	63 - 70	
75	75	78 - 87	
90	90	94 - 104	400V a.c.
100	100	105 - 115	
125	125	130 - 145	
150	150	155 - 175	
175	175	180 - 205	
200	200	210 - 230	
225	225	235 - 255	1000V a.c.
250	250	260 - 290	
-	275	285 - 315	
300	300	310 - 350	
350	-	365 - 405	
400	-	420 - 460	

Measurement of screen voltage

24. (a) With the ROLLER SELECTOR switch as in para 22(a), connect the Avometer between the anode of V1 and pin 8 on the International octal base.
- (b) Rotate the SCREEN VOLTS control switch through the full range of values.
- (c) Compare the readings obtained with those shown in Table 5.

Ia calibration

25. (a) Open link LK2 on the panel at the rear of the instrument and connect the Avometer in circuit set to the 100mA d.c. range.
- (b) Using a CV1075 (KT66) or a similar valve capable of passing 100mA, set up the tester controls so that the panel meter indicates that the valve is passing 100mA. (In the case of the CV1075, it is necessary to decrease the bias from the figure given in Table 6 of Tels Y 811 to achieve this).
- (c) With the panel meter indicating 100mA, the external meter should read between 47.5 and 52.5mA. If this is not the case, adjust RV7(S).

Measurement of grid voltage

- 26. Set the CIRCUIT SELECTOR switch to TEST. With the ROLLER SELECTOR switch as in para 22(a), connect the valve voltmeter between pins 8 and 9 of the International octal base. Set switch SE to Vg x 10 and set the NEG GRID VOLTS control fully clockwise. Adjust RV6(VG) to give a reading of 52V d.c. on the valve voltmeter. Set switch SH to Vg x 1 and check that the valve voltmeter reads 5.2V d.c.
27. Check that on pressing the mA/V button there is a 0.52V positive change on the reading as obtained in para 26, ie a decrease of 0.52V. If this is not the case, adjust RV5(GM), until the desired 0.52V change is obtained on pressing the button.
- 28. Set the CIRCUIT SELECTOR switch to CHECK (C) and set the ELECTRODE LEAKAGE switch to ~. Check that the meter pointer lies within the black square denoting zero ohms on the insulation resistance scale.

TESTER, VALVE, AVO, CT 160Permissive repairs

29. All repairs, replacements and adjustments detailed for this instrument may be carried out in field workshops unless otherwise stated.

Instruments used in testing

30. Instrument, testing, Avometer, universal, 50-range, Mk 2 ZD 00021
Voltmeter, valve, No 3 ZD 00121

DISMANTLING, REPAIR AND ASSEMBLYRemoval of units from the case

31. (a) Unscrew the four hexagonal-headed bolts, which form the feet of the unit.
- (b) Remove the eight No 4 BA screws, two in each side of the valve holder panel, securing it in the lid.
- (c) Withdraw the two units from their respective halves of the case.

Removal of the meter

32. (a) Support the meter with the hand and remove the two No 2 BA screws from the paxolin panel directly behind it.
- (b) Withdraw the meter carefully through the front panel until the hexagonal pillars can be unscrewed from the meter, thus releasing the connections to the meter. Do not disturb the locknuts as they will position the meter on replacement.

Repair of the meter

33. General details may be found in Inst Z 414, and will only be carried out in base workshops. The internal resistance of the meter is $3,250\Omega$ and the current at full scale deflection is $30\mu\text{A}$.

Replacement of ILP 2

34. (a) Remove the two No 6 BA nuts and bolts securing the lamp mounting bracket to the paxolin panel behind the meter.
- (b) The lamp can now be withdrawn for unsoldering and replacement.

Removal of transformer T1

35. (a) Unsolder the connections to the transformer.
- (b) Remove the two No 2 BA screws securing the plain metal strip adjacent to the transformer.
- (c) Remove the four No 4 BA nuts and bolts securing the runners to the main frame.
- (d) Supporting the transformer with the hand, remove the four tapped hexagonal pillars holding the transformer to the runners.
- (e) Lift the runners just clear of the transformer studs and withdraw the transformer carefully.
- (f) To replace, reverse the above procedure.

Removal of transformer T2

36. (a) Remove the meter as detailed in para 32.
- (b) Unsolder the connections to the transformer.
- (c) Remove the nut and bolt securing the two cableforms to the centre runner supporting the transformer.
- (d) Remove the two No 4 BA nuts and bolts that hold this runner to the main frame.
- (e) Loosen the four No 4 BA nuts and bolts that hold the paxolin panel to the runners.

- (f) Supporting the transformer with the hand, remove the four threaded hexagonal pillars securing it.
- (g) Carefully lower the transformer until the transformer studs are clear of the runners and slide out the centre runner.
- (h) The transformer can now be carefully removed.
- (j) To replace the transformer, reverse the above procedure.

SPECIFICATION TESTS

Initial setting up

37. Connect the instrument to a known 230 - 250V 50c/s supply and adjust coarse and fine settings on the voltage selector panel, until the meter needle lies within the ~ zone on the scale. If it is not possible to do this para 48 must be carried out before any readings are made or other calibrations carried out.

Measurement of heater voltages

38. Set the CIRCUIT SELECTOR to TEST, and the ELECTRODE SELECTOR to A1 and check the relevant electrode voltages as follows:-

- (a) Connect the Avometer between the H+ and H- sockets on the nine-way terminal board.
- (b) Set the HEATER VOLTAGE range switch to 0.625 - 117V.
- (c) Rotate the HEATER VOLTAGE control switch through the full range of values.
- (d) Compare the readings obtained with those shown in Table 6.
- (e) Set the HEATER VOLTAGE range switch to 1.4 - 80V.
- (f) Repeat sub-paras (c) and (d).

Table 6 - Heater voltage T.V.A. CT 160

HEATER VOLTS RANGE switch (SC) set at:-

0.625 - 117V			1.4 - 80V		
HEATER VOLTS (SC) set at:	Permissible limits	Avometer range	HEATER VOLTS (SC) set at:	Permissible limits	Avometer range
0.625	0.5 - 0.8	10V a.c.	-	-	-
1.25	1.2 - 1.45	10V a.c.	1.4	1.4 - 1.55	10V a.c.
2.0	2.2 - 2.45	10V a.c.	-	-	-
2.5	2.6 - 3.0	10V a.c.	3.0	3.1 - 3.4	10V a.c.
4.0	4.2 - 4.7	10V a.c.	4.5	4.9 - 5.3	10V a.c.
5.0	5.1 - 5.5	10V a.c.	5.7	6.0 - 6.4	10V a.c.
6.3	6.6 - 7.0	10V a.c.	7.5	7.6 - 8.0	10V a.c.
10.0	10.5 - 11.0	100V a.c.	-	-	-

Table 6 - (cont)

HEATER VOLTS RANGE switch (SC) set at:-					
0.625 - 117V			1.4 - 80V		
HEATER VOLTS (SC) set at:	Permissible limits	Avometer range	HEATER VOLTS (SC) set at:	Permissible limits	Avometer range
11.0	11.5 - 12.0	100V a.c.	12.6	12.5 - 13.0	100V a.c.
13.0	13.5 - 14.0	100V a.c.	15.0	15.0 - 15.5	100V a.c.
16.0	16.5 - 17.5	100V a.c.	18.0	18.0 - 19.0	100V a.c.
20.0	20.5 - 21.5	100V a.c.	23.0	23.0 - 24.0	100V a.c.
25.0	26.0 - 27.0	100V a.c.	28.0	29.0 - 30.0	100V a.c.
30.0	31.0 - 32.0	100V a.c.	35.0	36.0 - 37.0	100V a.c.
40.0	42.5 - 43.5	100V a.c.	45.0	47.0 - 48.0	100V a.c.
48.0	50.5 - 52.5	100V a.c.	55.0	58.0 - 59.0	100V a.c.
70.0	73.0 - 76.0	100V a.c.	80.0	83.0 - 89.0	100V a.c.
117.0	123.0 - 130.0	400V a.c.	-	-	-

Measurement of anode voltage

39. (a) Connect the Avometer between A1 and C sockets on the nine-way terminal board.
- (b) Rotate the ANODE VOLTAGE control switch through the full range of values.
- (c) Compare the readings obtained with those shown in Table 7.

ANODE VOLTS switch SD	SCREEN VOLTS switch SE	Permissible limits	Meter range
20	20	21 - 23) 100V a.c.
40	40	42 - 47	
60	60	60 - 70	
75	75	77 - 87	
90	90	94 - 104) 400V a.c.
100	100	105 - 115	
-	125	130 - 145	
150	150	155 - 175	
200	200	210 - 230) 1000V a.c.
250	250	260 - 290	
300	300	310 - 350	
400	-	420 - 460	

Table 7 - Anode and screen voltage T.V.A. CT 160

Measurement of screen voltage

40. (a) Connect a shorting link between pin 2 and pin 5 of V1.
- (b) Connect the Avometer between the S and C sockets on the nine-way terminal board.
- (c) Rotate the SCREEN VOLTAGE control switch through the full range of values.
- (d) Compare the readings obtained with those shown in Table 7.

Checking the NEG GRID VOLTS control

41. (a) Open link LK3 on the component panel (Tels Y 812 Pt 2, Fig 2008).
- (b) Set the panel controls as follows:-
- (i) CIRCUIT SELECTOR to TEST
 - (ii) ELECTRODE SELECTOR to A1
 - (iii) NEG GRID VOLTS to 40
- (c) Connect the valve voltmeter across RV3.
- (d) Adjust RV4 until a voltage reading of 20.8V is obtained.
- (e) Transfer the valve voltmeter leads to G1 and C sockets on the nine-way terminal board.
- (f) Check that at the 13 and 4 marks on the dial of the NEG GRID VOLTS control, readings of between 6.4 and 7.1V and between 2.0 and 2.2V are obtained.
42. If either or both readings are out of tolerance, the dial should be adjusted mechanically to split the error. Proceed as follows:-
- (a) Slacken the three countersunk-headed screws on top of the dial, which will then be free to move within the latitude of the kidney-shaped slots.
 - (b) Adjust the dial, retighten screws and check that the readings at the 13 and 4 marks lie within the limits specified in para 41 (f).
 - (c) Setting the marker to lie within the area marked 0, 5, 15 and 40, readings of between 0; 2.55 - 2.75; 7.4 - 8.2; 19.8 - 21.8V should be obtained respectively.

Checking the SET mA/V control

43. (a) Open link LK3 (Tels Y 812 Pt 2, Fig 2008).
- (b) Connect the valve voltmeter across R5.
- (c) Check that when the dial is advanced to the 10, 5 and 2mA/V positions, readings of 51 - 54mV; 102 - 108mV; 252 - 268mV are obtained.

44. If for any reason the relationship between the dial and the potentiometer has been upset, the following procedure must be adopted:-

- (a) Open link LK3 and ensure that the SET mA/V control is at rest.
- (b) Loosen the locking nuts on the U-shaped stirrup and turn RV2 to the maximum anti-clockwise position (viewing from the front panel) and then adjust the nuts friction tight.
- (c) Connect the valve voltmeter, set to a suitable range, across R5.
- (d) Advance the SET mA/V dial to a reading of 5.
- (e) Rotate the spindle of RV2 further by means of the stirrup, in a clockwise direction until a reading of between 102 - 108mV is obtained.
- (f) If this reading is obtained without further clockwise advancement of the stirrup, then check that the values of R1, R2, R5 lie within their percentage tolerance. If they are within tolerance, then check RV2.
- (g) Tighten the locking nuts on the stirrup, checking that the reading of the valve voltmeter remains steady.
- (h) Check that the readings across R5 at the 2 and 10mA/V positions are as obtained in para 43 (c).
- (j) Check that the dial can now be rotated to the 1mA/V position and that the motion is arrested by the stop screw on the dial and not by the stop at the end of the potentiometer track.

Ia calibration check

45. (a) Open link LK1 on the valve holder panel and insert the Avometer set to the 100mA d.c. range.
- (b) Using a CV 1075 (KT66) or a similar valve capable of passing 100mA, set up the tester controls so that the valve is passing 100mA. (In the case of the CV 1075 it is necessary to decrease the bias from the figure given in Table 6 of Tels Y 811 to achieve this).
- (c) With the ANODE CURRENT control set to 100mA and the panel meter indicating zero, the external meter should read between 47.5 and 52.5mA. If this is not the case check the value of the meter shunt R9.

Checking GAS test circuit

46. (a) Set NEG GRID VOLTS control to 40.
- (b) Connect a resistor of $860k\Omega \pm 5\%$ between G and C sockets on the nine-way terminal board.
- (c) Set CIRCUIT SELECTOR to GAS and ELECTRODE SELECTOR to A1.

Note: This Page 15, Issue 2, supersedes Pages 15 and 16, Issue 1, dated 20 Feb 58.
Para 47 has been amended.

- (d) Check that the panel meter reading is between 59 and 92 μ A.
- (e) If the meter reading is not within tolerance, the NEG GRID VOLTS having been set up as in para 41, check the values of R7 and R8.

Checking and adjustment of safety cut-out

47. Before making any adjustments check that lamp ILP2 is operative (when the instrument is used solely on a 110V a.c. supply, it is preferable to replace ILP2 by a 100V, 15W pygmy lamp). Using insulated tools, adjust the two No 4 BA screws in the paxolin panel. One adjusts the gap setting and the other the spring tension, the action of the two being complementary. Adjust the relay as follows:-

- (a) Check, with the instrument disconnected from the mains, that the gap between the contact screw and relay armature contact is approximately 1/8" when armature is pulled down to pole piece. Adjust contact screw to produce correct distance, then connect to the mains and switch on.
- (b) Set up for U.52 or equivalent rectifier valve but strap diodes in parallel, ie 030808020 roller switch setting. With maximum current range selected on 'Diode and Rectifier', use an insulated screwdriver to tighten spring setting screw (ie decrease spring tension) until the relay chatters.
- (c) Increase tension (ie loosen off screw) until chattering ceases.
- (d) Remove rectifier, set electrode selector to A and anode volts to 100. With a lead, short C - A₁. Relay should break and will also buzz. Increase anode volts to 200 and repeat short check. Relay should break without excessive arcing.
- (e) Set screen volts to 60, allow instrument to warm up and short C - S. Relay should break with a click. Do not leave short on, as when relay is operating the primary current in the transformers is limited by 15W lamp in series with windings. This means that the heaters on the two diode valves in the instrument are almost extinguished. The diode in series with the screen volts supply will become severely damaged if a short circuit exists whilst the heaters are at a low temperature, and will damage the cathode coating.
- (f) If the relay operates successfully except for check (e) a replacement CV140 should be fitted.

Checking the SET ~ indication

48. The above check may only be carried out in base workshops and the method is as follows:-

- (a) Standardize the valve voltmeter at 47 volts d.c.
- (b) With LK3 closed, set the tester controls as follows:-
 - (i) CIRCUIT SELECTOR to SET ~
 - (ii) ELECTRODE SELECTOR to A₁
- (c) With the valve voltmeter connected across RV3 a reading of 47V should be obtained and the panel meter needle should lie within the ~ zone. If the voltage reading is correct but the panel meter needle lies outside the zone, check resistors R3 and R4.