

CHAPTER 4

FIFTH ECHELON FINAL TESTING

24. Purpose of Final Testing

The tests outlined in this chapter are designed to measure the performance capability of a repaired equipment. Equipment that meets the minimum standards stated in the tests will furnish satisfactory operation, equivalent to that of new equipment.

25. Test Equipment Required for Final Testing

In addition to the test equipment listed in paragraph 14, the following items are required for final testing:

Item	Quantity
Variable Transformer CN-16/U.....	1
Resistor, 3,000 ohms, $\pm 1\%$, 1 watt.....	1
Resistor, 450,000 ohms, $\pm 1\%$, 1 watt.....	1
Resistor, 550,000 ohms, $\pm 1\%$, 1 watt.....	1

26. Test Facilities

All tests should be conducted under the following conditions:

- a. Test should be made at room temperature.
- b. The equipment should be ON at least 20 minutes before tests are made.
- c. Input voltage should be 115 volts ± 10 percent, 60 cycles, single phase.
- d. Voltmeter, Meter ME-30A/U should be calibrated to an accuracy of ± 0.5 percent error, for making ac voltage measurements.
- e. Multimeter AN/URM-105 should be calibrated to an accuracy of 1 percent error, for making dc voltage measurements.

27. Modification Work Orders

The performance standards listed in the tests (par. 28-39) assume that the modification work orders listed below have been performed. A listing of current modification work orders will be found in DA Pam 310-4.

MWO No.	Date	Priority	Echelon	Location of MWO marking	Remarks
MWO 11-6625-316-45/1	28 December 1959	Urgent	4	Near the nomenclature plate on the front panel.	None.
MWO 11-6625-316-45/2	13 May 1960	Normal	4	Near the nomenclature plate on the front panel.	Equipment modified per MWO SIG 11-2661-1, 28 September 1955, need not be remodified. Test Sets TV-2/U and TV-2A/U previously modified in accordance with MWO 11-266-1, 25 February 1958, need not be remodified.

28. Bias Voltage Test (A, fig. 21)

- a. Set the GRID switch to position 5.
- b. Set the BIAS and PLATE fine control fully clockwise.

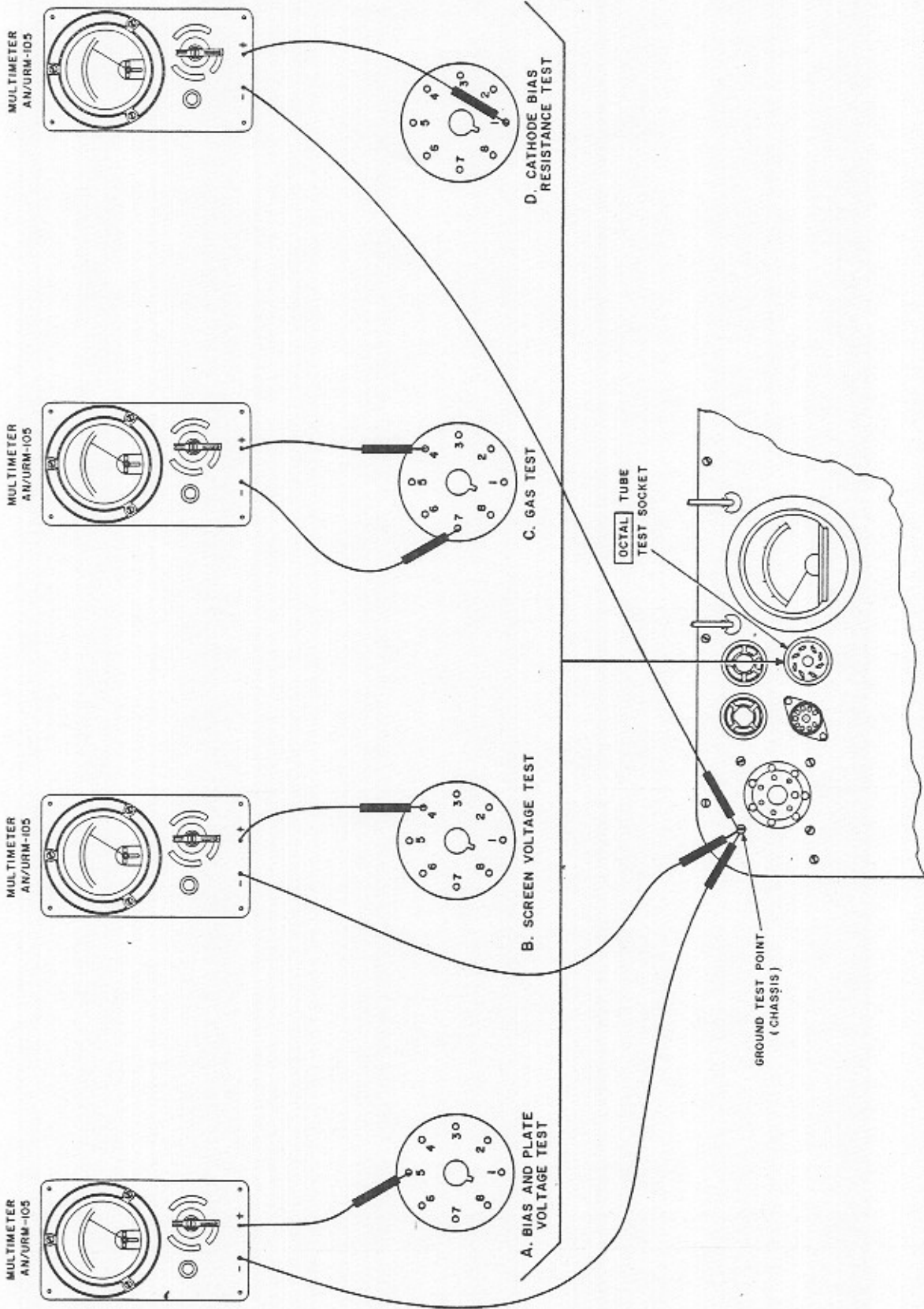
- c. Set the GM-SIGNAL RANGE switch to position A and all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).

d. Connect the Multimeter AN/URM-105 between pin 5 of the OCTAL tube test socket and a ground test point (mounting screw) on the tube tester.

e. Set the ON-OFF switch to the ON position.

f. The GRID BIAS VOLTS meter reads full scale on ranges 50, 10, and 5.

g. The voltage measured on the AN/URM-105 will be equal to the voltage indicated on the GRID BIAS VOLTS meter on all ranges ± 2.5 percent error.



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TEST SET,
ELECTRON TUBE TV-21M1/U

Figure 21. Voltage, gas and resistance tests.

29. Plate Voltage Test

(A, fig. 21)

- a. Set the PLATE switch to position 5.
- b. Depress the PRESS TO TEST P4 switch to its locked position.
- c. Set the GM-SIGNAL RANGE switch to position A and all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).
- d. Connect the AN/URM-105 between pin 5 of the OCTAL tube test socket and a ground test point (mounting screw) on the tube tester.
- e. Set the ON-OFF switch to the ON position.
- f. Adjust the PLATE fine control, and set the PLATE-SCREEN RANGE switch to read its corresponding voltage on the PLATE meter as follows:

PLATE-SCREEN RANGE switch position	Voltage
G	250
H	250
J	250
K	125
L	125
M	125
N	90
P	60
Q	62.5
R	35 ac
S	20 ac

g. The voltages measured on the AN/URM-105 will be equal to the voltages indicated on the PLATE meter ± 2.5 percent error at each dc point, and ± 5 percent error at each ac point.

30. Screen Voltage Test

(B, fig. 21)

- a. Set the SCREEN switch to position 4.
- b. Depress the PRESS TO TEST P4 switch to its locked position.
- c. Set the PLATE fine control in position as indicated in paragraph 29f, the GM-SIGNAL RANGE switch to position A, and all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).
- d. Connect the AN/URM-105 between pin 4 of the OCTAL tube test socket and a ground test

point (mounting screw) on the tube tester chassis.

- e. Set the ON-OFF switch to the ON position.
- f. Adjust the SCREEN fine control, and set the PLATE-SCREEN RANGE switch to read its corresponding voltage on the SCREEN VOLTS meter as follows:

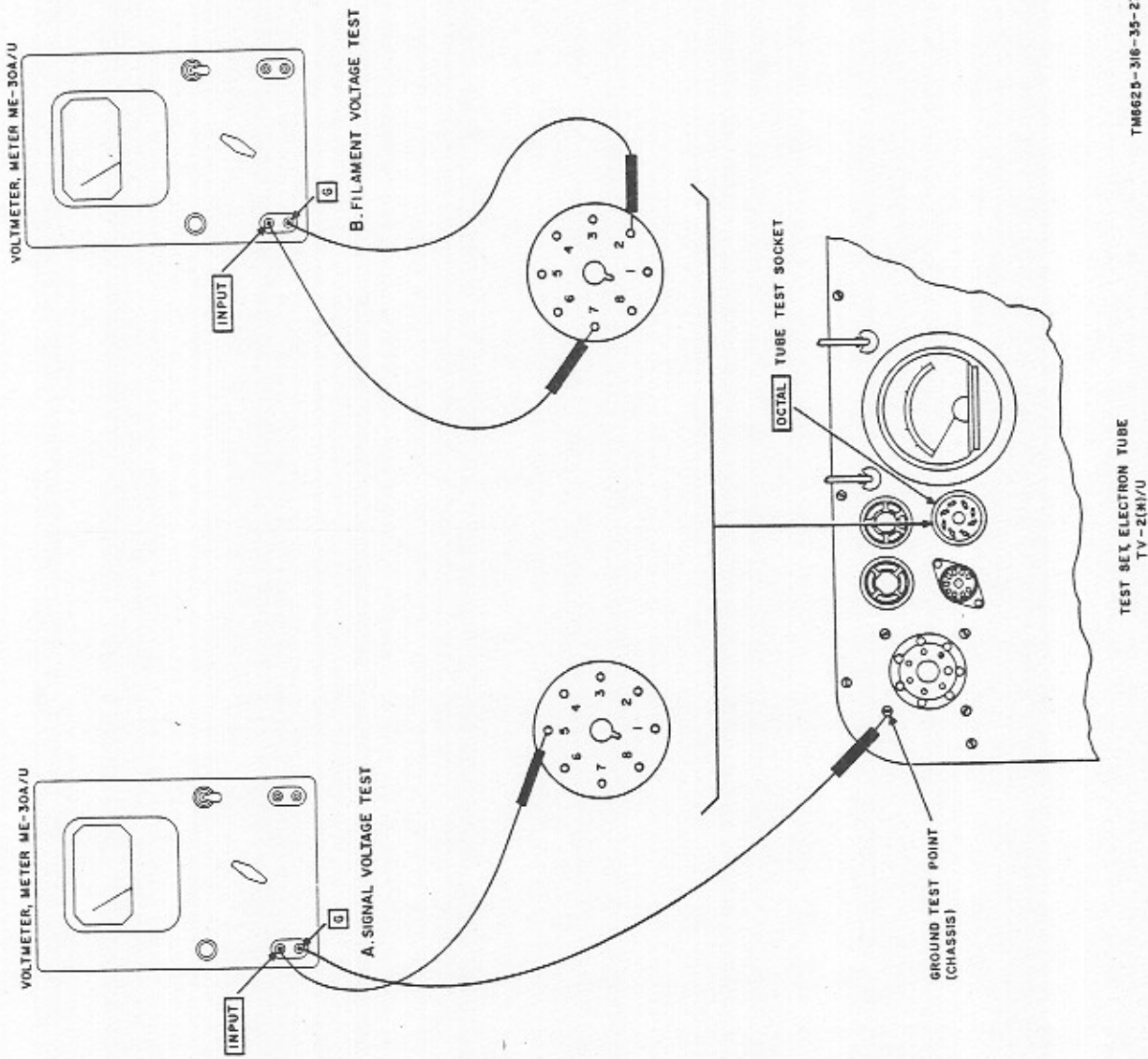
PLATE-SCREEN RANGE switch position	Voltage
G	225
H	180
J	135
K	180
L	135
M	90
N	90
P	45

g. The voltages measured on the AN/URM-105 will be equal to the voltages indicated on the SCREEN VOLTS meter ± 5 volts error at each point.

31. Signal Voltage Test

(A, fig. 22)

- a. Set the PLATE-SCREEN RANGE switch to position S.
- b. Set the GM-SIGNAL RANGE switch to position A.
- c. Set the PLATE fine control fully clockwise.
- d. Set all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).
- e. Set the ON-OFF switch to the ON position.
- f. Adjust the SIGNAL-V.R. fine control so that the SIGNAL meter indicator deflects to the redline.
- g. Set the BIAS RANGE switch to position 10.
- h. Set the GRID switch to position 5.
- i. Adjust the BIAS fine control so that the GRID BIAS VOLTS meter indicates 5 volts.
- j. Set the ON-OFF switch to the OFF position.
- k. Connect the ME-30A/U between pin 5 of the OCTAL tube test socket and a ground test point (mounting screw) on the tube tester.
- i. Set the ON-OFF switch to the ON position.
- m. Set the GM-SIGNAL RANGE switch to position A, B, C, D, or E to read .25, .25, .25, .5, or 2.5 volts ac, respectively. The ME-30A/U indicates ± 5 percent error at each point.



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TEST SET, ELECTRON TUBE
TV-21K1/U

Figure 22. Signal and filament voltage tests.

32. Filament Voltage Test

(B, fig. 22)

- a. Set the FIL— switch to position 7.
- b. Set the FIL+ switch to position 2.
- c. Set the GM-SIGNAL RANGE switch to position A and all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).
- d. Connect the ME-30A/U between pins 2 and 7 of the OCTAL tube test socket.
- e. Set the ON-OFF switch to the ON position.
- f. Set the FILAMENT RANGE switch to each of its 19 voltage positions, and adjust the FILAMENT fine control for the exact corresponding voltage on the FILAMENT VOLTS meter.
- g. The voltages measured on the ME-30A/U will be equal to the voltages indicated on the FILAMENT VOLTS meter ± 6 percent error at each point.

33. Gas Test

(C, fig. 21)

Caution: Be sure that the power switch is in the OFF position before performing the gas test.

- a. Set the GRID switch to position 4.
- b. Set the CATHODE switch to position 7.
- c. Set the FUNCTION switch to position VR.
- d. Set the GM-SIGNAL RANGE switch to position A and all other switches and controls to their neutral or OFF position (vertical position for switches, extreme counterclockwise position for controls).
- e. Connect the AN/URM-105 between pins 4 and 7 of the OCTAL tube test socket.
- f. The AN/URM-105 indicates a resistance of 180,000 ohms ± 10 percent error when the PRESS TO TEST P6 switch is depressed.

34. Leakage Test

- a. Set the tube tester up according to the tube test data roll chart, to test tube 6V6.
- b. Insert the 6V6 tube and perform the inter-element leakage (LK) test.
- c. Remove the 6V6 tube and insert a 450,000-ohm resistor between pins 4 and 8 of the OCTAL tube test socket.
- d. Set the SHORT TEST switch to position Y.
- e. Set the ON-OFF switch to the ON position.
- f. The PLATE meter indicates to the right of the 0.5-megohm point.

- g. Set the ON-OFF switch to the OFF position.
- h. Remove the 450,000-ohm resistor and insert a 550,000-ohm resistor in its place.
- i. Set the ON-OFF switch to the ON position.
- j. The PLATE meter indicates to the left of the 0.5-megohm point.

35. Short Test

- a. Set the tube tester up according to the tube test data roll chart, to test tube 6V6.
- b. Insert a 3,000-ohm resistor between pins 3 and 7 of the OCTAL tube test socket.
- c. Set the ON-OFF switch to the ON position.
- d. The FIL. CONT. SHORT lamp glows continuously when the SHORT TEST switch is set to positions V, W, and Z.
- e. Set the ON-OFF switch to the OFF position.
- f. Remove the 3,000-ohm resistor and insert it between pins 4 and 8 of the OCTAL tube test socket.
- g. Set the ON-OFF switch to the ON position.
- h. The FIL. CONT. SHORT lamp glows continuously when the SHORT TEST switch is set to positions Y and Z.
- i. Set the ON-OFF switch to the OFF position.
- j. Remove the 3,000-ohm resistor and insert it between pins 5 and 8 of the OCTAL tube test socket.
- k. Set the ON-OFF switch to the ON position.
- l. The FIL. CONT. SHORT lamp glows continuously when the SHORT TEST switch is set to positions X and Z.

36. Cathode Bias Resistance Test

(D, fig. 21)

Caution: Be sure that the power switch is in the OFF position before performing the cathode bias resistance test.

- a. Set the CATHODE switch to position 1.
- b. Connect the AN/URM-105 between pin 1 of the OCTAL tube test socket and a ground test point (mounting screw) on the tube tester chassis.
- c. The resistance reading of the AN/URM-105 is 47, 94, 141, 188, or 288 ohms when the BIAS RANGE switch is set to position A, B, C, D, or E, respectively, ± 10 percent error at each point.

37. Filament Continuity Test

- a. Check a IL4 tube known to have a closed filament.

b. The FIL. CONT. SHORT lamp glows when checking for filament continuity.

c. Check a IL4 tube known to have an open filament.

d. The FIL. CONT. SHORT lamp does not glow when checking for filament continuity.

38. Shunt Control Test

(fig. 23)

a. Set the PLATE switch to position 5.

b. Set the SUPPRESSOR switch to position 8.

c. Set the PLATE-SCREEN RANGE switch to position S.

d. Set the GM-SIGNAL RANGE switch to position E.

e. Set the SHUNT fine control to position 10.

f. Set the PLATE fine control fully clockwise.

g. Set all other switches and controls to their neutral or OFF positions (vertical position for switches, extreme counterclockwise position for controls).

h. Connect the test cords of the TS-682A/GSM-1 to the COMMON and 5MA jacks on the test meter.

i. Connect the test cord from the COMMON jack, on the test meter, to pin 8, of the OCTAL tube test socket, on the tube tester.

j. Connect the test cord from the 5MA jack, on the test meter, to pin 5, of the OCTAL tube test socket, on the tube tester.

k. Set the ON-OFF switch to the ON position.

l. With the PRESS TO TEST P2 switch depressed, adjust the DIRECT CURRENT COARSE CONTROL and the DIRECT CURRENT FINE CONTROL, on the test meter until the PERCENT QUALITY meter, on the tube tester indicates full scale.

m. The TS-682A/GSM-1 indicates 4.92 milliamperes dc ± 5 percent error.

n. Set the ON-OFF switch to the OFF position.

o. Remove the test cord on the 5MA jack, and connect it to the 1MA jack, on the TS-682A/GSM-1.

p. Set the SHUNT fine control to position 90.

q. Set the ON-OFF switch to the ON position.

r. With the PRESS TO TEST P2 switch depressed, adjust the DIRECT CURRENT COARSE CONTROL and the DIRECT CURRENT FINE CONTROL, on the TS-682A/GSM-1 until the PERCENT QUALITY meter, on the tube tester indicates full scale.

s. The TS-682A/GSM-1 indicates 0.605-milliamperes dc ± 5 percent error.

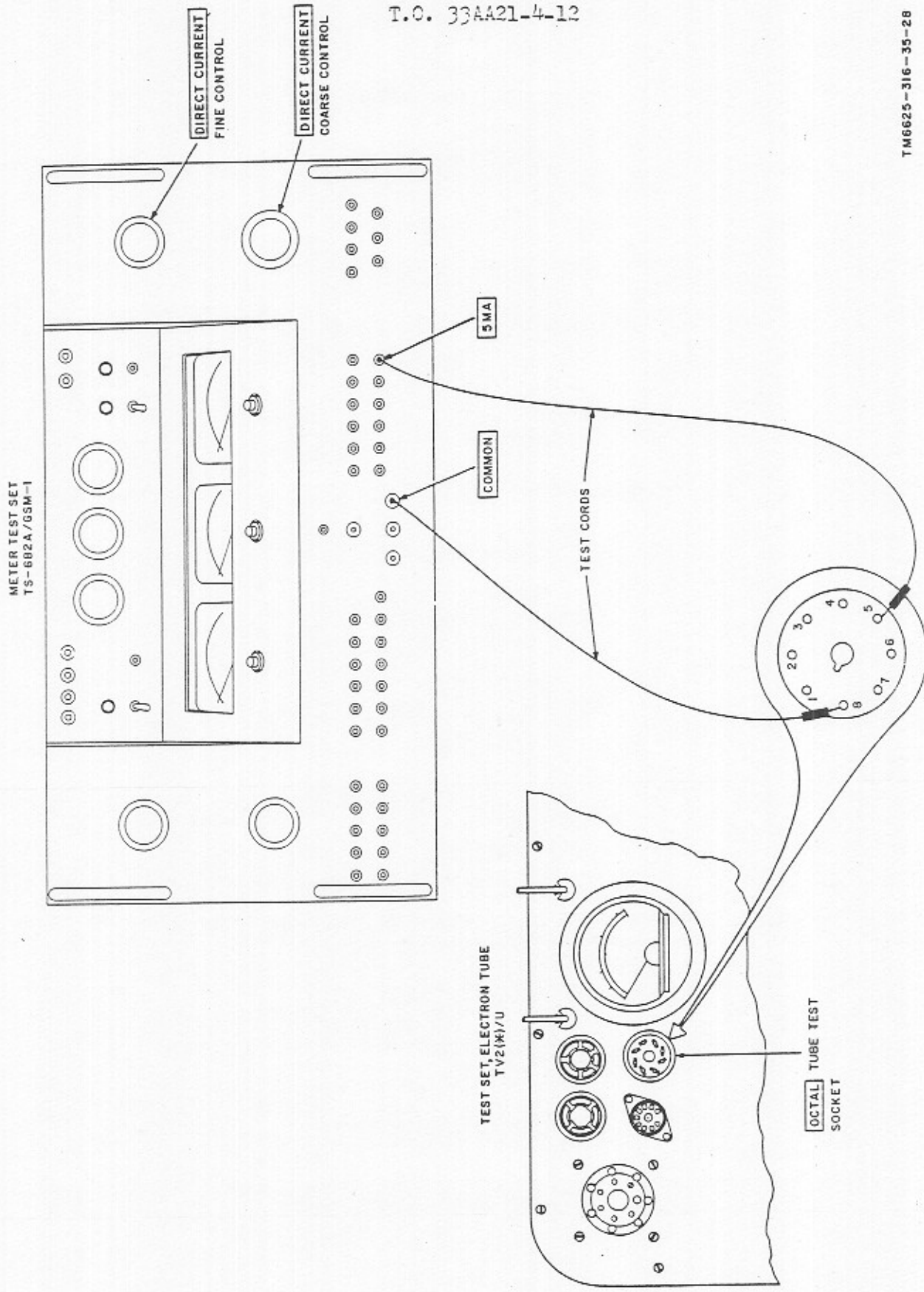


Figure 23. Shunt control test.

39. Final Performance Test

a. Use the TV-2(*)/U and Test Set, Electron Tube AN/USM-31 to measure and record the mutual conductance of each tube listed in e below.

b. Use the FILAMENT, PLATE, SCREEN, and BIAS voltages derived from the TV-2(*)/U tube test data roll chart, for their corresponding setting on the AN/USM-31.

c. Calculate and record the mutual conductance by multiplying the rated mutual conductance listed in e below, times the percent quality value indicated for each tube on the PERCENT QUALITY meter of the TV-2(*)/U.

d. The calculated mutual conductance of each tube measured on the TV-2(*)/U will be equal to the mutual conductance measured on the

TRANSCONDUCTANCE meter on the AN/USM-31, ± 10 percent error.

e. Tubes and rated mutual conductance for the tubes to be checked are as follows:

Tube type	Rated mutual conductance
3E29	8,500 micromhos
6A6	3,100 micromhos
6AT6	1,200 micromhos
6V6	4,100 micromhos
7C7	1,300 micromhos
12AU7	3,100 micromhos
36	900 micromhos
41	2,200 micromhos
45	2,100 micromhos
955	2,200 micromhos
5840	5,000 micromhos
5873	2,900 micromhos

Figure 24. MIL-STD resistor color code markings.
(Located in back of manual)

Figure 25. MIL-STD capacitor color code markings.
(Located in back of manual)

Figure 26. Test Set, Electron Tube TV-2(*)/U, schematic diagram.
(Located in back of manual)

Figure 27. Test Set, Electron Tube TV-2(*)/U, chassis and resistor mounting board wiring diagram.
(Located in back of manual)

Figure 28. Test Set, Electron Tube TV-2(*)/U, control and instrument panel, wiring diagram.
(Located in back of manual)

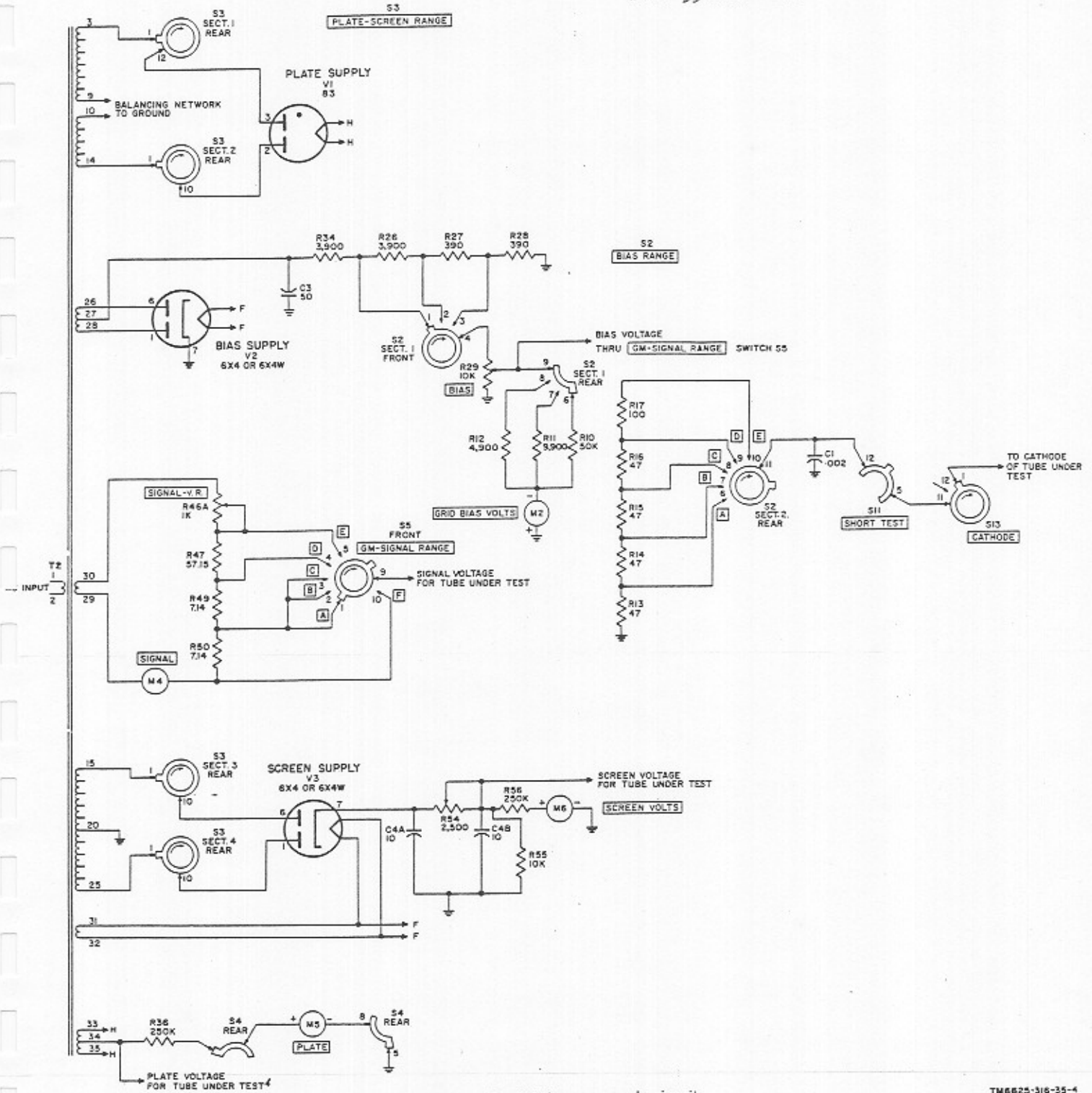


Figure 4. Simplified power supply circuit.

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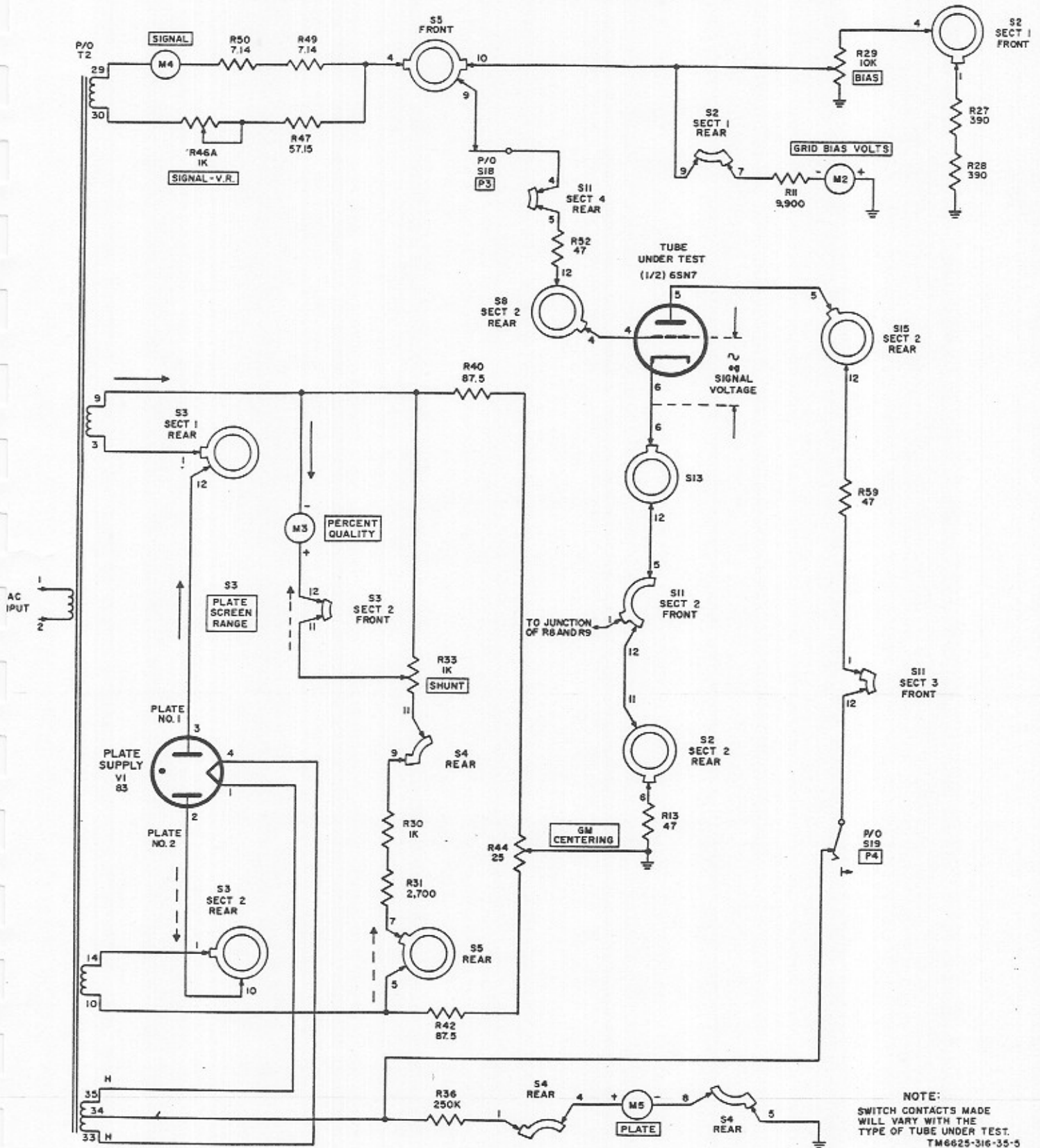


Figure 5. Transconductance measurement circuit of Test Set, Electron Tube TV-2(*)/U.