COLD CATHODE TUBES
USING TEST SET SD-25808-01 (J24754A)
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers the conditions under which the electrical requirements of cold cathode tubes shall be applied, using the cold cathode tube test set SD-25808-01.

Caution: Before handling any tubes marked with a purple-red, three-bladed, propeller-shaped symbol on the tube envelope, take precautions which are specified in Section 024-700-801 covering method of handling specially marked cold cathode electron tubes containing radium bromide.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Reference shall be made to Section 024-722-101 for interpretation of marking showing the date of manufacture of tubes.

1.04 Terminal numbering on tubes having soldering terminals is as follows:

(a) Tubes having tubular soldering terminals

Electrode	Terminal No.
Anode	1
Starter anode	2
Starter anode through resistance	3
Cathode	4

(b) Tubes having flat-type soldering terminals

Electrode	Terminal No. 3 Element	Terminal No. 2 Element
Anode	2	5
Starter Anode	4	-
Starter anode through resistance	5	-
Cathode	7	2

2. APPARATUS

2.01 One cold cathode test set J24754A (SD-25808-01).

2.02 One P3K cord, 6 feet long, equipped with two No. 310 plugs (3P15A cord).

2.03 One P3D cord, 6 feet long, equipped with two No. 309 plugs (3P3A cord).

2.04 Pratt and Lambert "Dulux" black enamel 83-005 or 93-005.

2.05 Dulux olive green enamel RP88033.

Tubes Wired in Circuit

2.06 One W2W cord, 6 feet long, equipped with one No. 310 plug, one No. 360B tool, one No. 360C tool (2W17A cord), and two KS-6278 connecting clips.

Tubes Having Lead-in Wires - Not in Circuit

2.07 One 893 cord, 6 feet long, equipped with two No. 360A tools, one KS-6278 connecting clip, and one No. 364 spade terminal.

Tubes Equipped with Soldering Terminals - Not in Circuit

2.08 One W2W cord, 6 feet long, equipped with one No. 310 plug, one No. 360B tool, one No. 360C tool (2W17A cord), and two KS-6278 connecting clips.

2.09 One 893 cord, 6 feet long, equipped with two No. 360A tools, one KS-6278 connecting clip, and one No. 364 spade terminal.

3. PREPARATION

All Tube Tests

3.01 Using a P3K cord, connect the 48-volt jack of the test set to a 48-volt battery supply jack.

3.02 Using a P3D cord, connect the 130-volt jack of the test set to a +130-volt battery supply jack.

Socket-mounted Tubes

3.03 Connect the tube to be tested to the V1, V2, VR1, or VR2 socket of the test set as specified in Tables A and B.

TABLE A

2-ELEMENT TUBES						
		IONIZE VOLTAGE TEST PROCEDURE 5.05		ANODE DROP TEST PROCEDURE, 5.07		
TUBE	WIRING CONNECTIONS	MIN	MAX	MIN	MAX	CURRENT (ma)
413A and B	(a),(d)	180	255	55	75	30

3-ELEMENT TUBES										
		STARTER GAP VOLTAGE					ANODE GAP VOLTAGE			
		IONIZE TEST PROCEDURE 5.01		DROP TEST PROCEDURE 5.02 [See Note (e)]			FORWARD VOLTAGE TEST PROCEDURE 5.03	DROP TEST PROCEDURE 5.04		
TUBE	TEST SET SOCKET OR WIRING CONNECTIONS	MIN	MAX	MIN	MAX	CURRENT (ma)	MAX	MIN	MAX	CURRENT (ma)
313C	V2	62	89	52	74	20	185(f)	68	90	20
313CA	V2	66	78	52	74	20	200	68	88	20
313CB	V2	62	89	52	74	20	170	71	81	20
313CC	V2	66	78	52	74	20	150	68	88	20
313CD	V2	64	78	52	74	20	—	—	—	—
333A	(a),(c)	62	89	52	74	20	150	68	90	20
346B and C	(a),(d)	65	89	52	74	20	225	72	90	20
353A	(a),(d)	62	89	52	74	20	150	68	90	20
359A	(a),(b)	67	89	52	74	10	165	66	90	10
372A	(a),(c)	62	89	52	74	20	150	68	90	20
376B and C	V1	67	85	52	74	20	275	60	80	30
395A	(a),(b)	71	84	52	74	10	140	68	85	10
405A	(a),(b)	67	89	52	74	10	165	66	90	10
426A	(a),(b)	65	85	53	72	3	180	63	75	10
430A and B	V2	65	85	52	74	20	185	68	85	20

Notes

(a) Tube wired in circuit — Preparation as in 3.04 and 3.05.
(b) Tube out of circuit — Preparation as in 3.06.
(c) Tube out of circuit — Preparation as in 3.07.
(d) Tube out of circuit — Preparation as in 3.08.
(e) Not applicable to tubes wired in circuit.
(f) For tubes manufactured prior to the fourth quarter of 1948, the maximum anode gap forward voltage is 150 volts.

TABLE B

2-ELEMENT TUBES

Tube	Test Set Socket	Ionize Voltage Min	Ionize Voltage Max	Ionize Voltage Test Procedure	Anode Drop Potential Test Procedure, 5.07 Min at 5ma	Max at 30ma	Regulation Volts
0A-2(VR-150)	VR2	-	185	5.05	140	168	6.0
0A-3(VR-75)	VR1	-	105	5.06	68	83	4.5
0B-2(VR-105)	VR2	-	133	5.06	101	114	4.0
0C-3(VR-105)	VR1	-	133	5.06	103	113	2.5
0D-3(VR-150)	VR1	-	185	5.05	142	163	4.5
5651	VR2	-	115	5.06	82(a)	92(b)	3.0

Notes

(a) Voltage drop at 1.5ma.

(b) Voltage drop at 3.5ma.

Tubes Wired in Circuit

3.04 Insert the No. 310 plug of the W2W cord in the TST jack of the test set. If anode potential is not permanently connected to the tube under test, connect the No. 364 spade terminal on the 893 cord to the A binding post of the test set. Then with the associated circuit removed from service, connect the KS-6278 connecting clips, inserted in the 360-type tools, to the tube terminals in accordance with the test clip data in the circuit requirements table.

3.05 Where test clip data is not given in the circuit requirements table, analyze the circuit in order that the proper connections may be made. In such cases, insulate contacts at the nearest electrical points to the starter anode and the cathode of the tube to be tested, then connect the KS-6278 connecting clip associated with the No. 360C tool (white) to the starter anode (through control resistance where used), and connect the KS-6278 connecting clip associated with the No. 360B tool (black) to the cathode of the tube to be tested. If anode potential is not permanently connected to the tube under test, insulate contacts at the nearest electrical point to the anode, and connect the KS-6278 connecting clip associated with the No. 360A tool (red) to the anode. For 2-element tubes disregard above connecting information pertaining to the starter anode.

Tubes Having Lead-in Wires - Not in Circuit

3.06 Connect the wires or terminals of the tube to the binding posts of the test set as follows:

Yellow wire (cathode) to the K binding post

Black wire (main anode) to the A binding post

Red wire (starter anode) to the SA binding post

3.07 Connect the wires or terminals of the tube to the binding posts of the test set as follows:

Yellow wire (cathode) to the K binding post

Black wire (main anode) to the A binding post

Terminal 2 (starter anode) to the SA binding post by means of the 893 cord with the No. 364 spade terminal on the cord connected to the binding post of the test set and the KS-6278 connecting clip to the terminal of the tube

Tubes Having Soldering Terminals - Not in Circuit (See 1.04)

3.08 Insert the No. 310 plug of the W2W cord into the TST jack of the test circuit. Connect the No. 364 spade terminal on the 893 cord to the A binding post of the test set. Connect the KS-6278 connecting clips, inserted into the 360-type tools on these cords, to the tube terminals in the following manner:

No. 360A tool (red) to main anode

No. 360B tool (black) to cathode

No. 360C tool (white) to starter anode (not applicable for 2-element tubes)

4. REQUIREMENTS

4.01 Cold cathode tubes shall meet the electrical requirements specified in the circuit requirements table. Where the requirements are not given in the circuit requirements table, the values given in Tables A and B shall apply. The tables also refer to the test set socket to be used and the paragraph covering the test set preparation and test procedure for the various tubes.

4.02 Where the cold cathode tube is provided with a black or olive-drab opaque lacquer coating on the outside of the glass envelope, no glow shall be visible through the lacquer coating when the tube is in the ionized condition except that caused by defects in the coating. Where the cold cathode tube is provided with a red translucent lacquer coating on the outside of the glass envelope, glow shall be visible through the lacquer coating when the tube is in the ionized condition, regardless of the presence or absence of defects in the coating. The following maximum defects in the coating are allowed:

(a) Thinness or absence of lacquer coating at the juncture between the base and glass envelope extending not more than 1/32 inch from the base.

(b) For black or olive-drab lacquered tubes, a total area of all other defects not exceeding approximately 0.008 square inch. This is, for example, approximately equal to a single defect 1/16 inch by 1/8 inch or two defects 0.005 inch by 3/4 inch each. For red translucent lacquered tubes, a total area of all other defects not exceeding approximately 0.001 square inch. This is, for example, approximately equal to a single defect 1/32 inch by 1/32 inch or 0.005 inch by 1/4 inch.

The check of lacquered tubes shall be made under conditions of low intensity room illumination. For corrective action see 6.01.

Note: Tubes with defects that approach the maximum stated above shall be located in equipment where they will not be exposed to direct sunlight.

5. TESTING PROCEDURES

5.01 Procedure for Checking Starter Gap Ionization Voltage - 3-element Tubes

(1) With the REV (reverse) and VR (voltage regulation) keys at the NORM (normal) positions and the VM (voltmeter) key at the 0-100 position, turn the SG V (starter gap voltage) potentiometer to the MIN position. Turn the ADJ I (adjust current) potentiometer to approximately a midposition.

(2) Operate the SG (starter gap) key to the ION (ionize) position.

(3) Turn the SG V potentiometer slowly toward the MAX position until a reading is obtained on the milliammeter, indicating that the tube has ionized.

(4) Operate the RLS (release) key and note the voltmeter reading. Release the RLS key.

(5) Turn the SG V potentiometer to the MIN position. Momentarily operate the RLS key and observe that no reading is obtained on the milliammeter.

(6) Repeat (3), (4), and (5) two or three times, then average all voltmeter readings except the first to determine the starter gap ionization voltage of the tube.

(7) Restore the SG key to normal and the VM key to the 0-200 position.

5.02 Procedure for Checking Starter Gap Voltage Drop - 3-element Tubes (Not to Be Used for Tubes Wired in Circuit Unless the Tube is Used to Trip Ringing)

(1) With the REV and VR keys at the NORM positions and the VM key at the 0-200 position, operate the SG key to the DROP position.

(2) Turn the SG V potentiometer to the MAX position. Observe that a reading is obtained on the milliammeter, indicating that the tube has ionized.

(3) Turn the ADJ I potentiometer in either direction until a reading is obtained on the milliammeter corresponding to the specified starter gap current value for the tube under test. If sufficient current cannot be obtained by this means, turn the ADJ I potentiometer to the MIN position, hold the M key operated to the INC I (increase current) position, and turn the ADJ I potentiometer until the specified current is obtained, then note whether the voltmeter reading is within the specified limits. Operate the VM key to the 0-100 position if it is desired to obtain a closer voltmeter reading.

(4) Restore the VM key to the 0-200 position and the SG key to the normal position. Turn the SG V and the INC I potentiometers to the MIN positions.

5.03 Procedure for Checking Anode Gap Forward Voltage - 3-element Tubes

(1) Allow approximately 2 minutes to elapse after checking the starter gap voltage drop and before checking the anode gap forward voltage. With the REV and VR keys at the NORM positions and the VM key at the 0-200 position, turn the AG V potentiometer to the MIN position.

(2) Operate the AG key to the ION position.

(3) Turn the AG V potentiometer until a reading on the voltmeter is obtained corresponding to the specified anode gap forward voltage for the tube under test or the greatest voltage obtainable if the specified voltage is greater than that obtainable on the test set. Observe that no steady reading is obtained on the milliammeter, indicating that the tube has not ionized. Care should be taken that the hand or body is no closer than 2 inches to the tube under test to avoid false forward voltage readings.

Note: This procedure does not provide an absolute test for tubes having specified forward voltages of over 183 volts.

(4) Restore the AG key to the normal position and turn the AG V potentiometer to the MIN position.

5.04 Procedure for Checking Anode Gap Voltage Drop - 3-element Tubes

(1) With the REV and VR keys at the NORM positions and the VM key at the 0-200 position, turn the ADJ I potentiometer to approximately a midposition.

(2) Operate the AG key to the DROP position.

(3) Turn the AG V potentiometer to the MAX position.

(4) Momentarily operate the M key to the BK DN (breakdown) position. Observe that a reading is obtained on the milliammeter indicating that the tube has ionized.

(5) Turn the ADJ I potentiometer until a reading is obtained on the milliammeter corresponding to the specified anode gap current value for the tube under test. If sufficient current cannot be obtained by this means, turn the ADJ I to the MIN position, hold the M key operated to the INC I position, and turn the ADJ I potentiometer until the specified current is obtained, then note whether the voltmeter reading is within the specified limits. Operate the VM key to the 0-100 position to obtain a closer voltmeter reading.

(6) Restore the VM key to the 0-200 position and the AG key to the normal position. Turn the AG V and SG V potentiometers to the MIN positions.

5.05 Procedure for Checking Ionization Voltage of 2-element Tubes Having Ionization Voltages Above 135 Volts

(1) With the REV and VR keys at the NORM positions and the VM keys at the 0-200 position, turn the AG V potentiometer to the MIN position and turn the ADJ I potentiometer to approximately a midposition.

(2) Operate the AG key to the ION position.

(3) Turn the AG V potentiometer slowly until a reading is obtained on the milliammeter indicating that the tube has ionized. If the tube does not ionize at the MAX position of the AG V potentiometer, momentarily operate the M key to the BR DN position. Care should be taken that the hand or body is no closer than 2 inches to the tube under test to avoid false forward voltage readings.

(4) Operate the RLS key and note the voltmeter reading. Release the RLS key.

(5) Turn the AG V potentiometer to the MIN position, then momentarily operate the RLS key. Observe that no reading is obtained on the milliammeter indicating that the tube has deionized. Care should be taken that the hand or body is no closer than 2 inches to the tube under test to avoid false forward voltage readings.

(6) Repeat (3), (4), and (5) two or three times, then average all voltmeter readings except the first to obtain the ionization voltage of the tube.

Note: When it is necessary to operate the BK DN key to cause the tube to ionize, add 2 volts to the voltmeter readings obtained in order to determine the ionization voltage.

(7) Restore the AG key to the normal position.

5.06 Procedure for Checking Ionization Voltage of 2-element Tubes Having Ionization Voltages Less Than 135 Volts

(1) With the REV key at the NORM position and the VM key at the 0-200 position, operate the VR key to the OPR position and turn the ADJ I potentiometer to approximately a midposition.

(2) Turn the AG V and SG V potentiometers each to the MIN positions.

(3) Operate the AG key to the ION position.

(4) Turn the SG V potentiometer slowly until a milliammeter reading is obtained, indicating that the tube has ionized. If the tube has not ionized with the SG V potentiometer at the MAX position, turn the AG V potentiometer slowly until the tube ionizes.

(5) Operate the RLS key and note the voltmeter reading. Release the RLS key.

(6) Turn the SG V potentiometer to the MIN position, then momentarily operate the RLS key. Observe that no reading is obtained on the milliammeter.

(7) Repeat (4), (5), and (6) two or three times, then average all voltmeter readings except the first, to obtain the ionization voltage of the tube.

(8) Restore the VR and AG keys to the normal positions and turn the AG V potentiometer to the MIN position.

5.07 Procedure for Checking Anode Voltage Drop - 2-element Tubes

(1) With the REV and VR keys at the NORM positions and the VM key at the 0-200 position, turn the ADJ I and AG V potentiometers each to the MIN positions. Turn the ADJ I potentiometer to approximately a midposition.

(2) Operate the AG key to the DROP position.

(3) If a reading is obtained on the milliammeter, the indication is that the tube has ionized. If not, turn the AG V potentiometer toward the MAX position until the tube ionizes. If the tube still has not ionized, momentarily operate the BK DN key. Observe that the tube has ionized.

(4) Turn the ADJ I potentiometer until a reading of 5 milliamperes (1.5 milliamperes for No. 5651 tube) is obtained, turning the AG V potentiometer toward the MAX position if necessary. Observe that the anode drop potential as indicated by the voltmeter reading is not less than the specified minimum value for the tube under test.

Note: If the tube under test is not a voltage regulator tube, as in the case of the No. 413A tube, the anode drop voltage is measured at only one specified current. In this case, adjust the controls to the specified current and note that the voltmeter reading is within the specified limits. Then proceed as in (7), omitting (5) and (6).

(5) Turn the ADJ I potentiometer until a reading of 30 milliamperes (3.5 for the No. 5651 tube) is obtained. If sufficient current cannot be obtained by this means, turn the ADJ I potentiometer to the MIN position, hold the M key operated to the INC I position, and turn the ADJ I potentiometer until 30 milliamperes is obtained. If sufficient current still cannot be obtained, turn the AG V potentiometer toward the MAX position. Observe that the anode drop potential is not more than the specified maximum value for the tube under test.

(6) Compare the voltmeter readings obtained in (4) and (5) and note that the difference is within the specified voltage regulation limits.

(7) Restore the AG key to the normal position, and turn the ADJ I and AG V potentiometers to the MIN positions.

6. CORRECTIVE ACTION

6.01 If defects in the lacquer coating exceed the area specified in 4.02 these defects shall be retouched as follows:

(a) On black opaque or red translucent finished tubes, defects shall be retouched with Pratt and Lambert "Dulux" black enamel 83-005 or 93-005.

(b) On olive-drab finished tubes defects shall be retouched with Dulux olive green enamel RP88033 or the black enamels specified in (a).