

HOW TO CHECK TUBES.

1. Plug line cord into 105-125 volt AC 60 cycle outlet, turn ON-OFF switch to ON and allow the checker to warm up for about 30 seconds.
2. Adjust the ZERO ADJ control until the eye just closes.
3. Turn the FIL SEL switch to the position that corresponds with the first number of the tube type, such as 12 for 12AU7, 6 for 6AU6, etc.
4. Plug the tube into the proper socket and note eye operation. Note that the sockets are labeled with only the last three letters and number of the tube type, omitting the filament voltage. This is because the voltage is selected in Step 3. If the eye blanks out, remove the tube immediately as the tube is either shorted or the pin arrangement is not correct for the socket.
5. Let the tube warm up thoroughly. A good tube will not open the eye. A gassy tube or a tube with grid emission will usually cause the eye to open gradually as the tube heats.
6. Check the tube for intermittent shorts by tapping the tube. If the tube is bad, the eye will flash.

It should be noted that the Senco Leakage Checker is not a cathode emission checker. It is assumed, therefore, that the cathode is in an operating condition in the above tests.

HOW TO CHECK CAPACITORS.

1. Operate the checker as in Steps 1 & 2 of the preceding section on "HOW TO CHECK TUBES".
2. Connect the test leads to the checker; to jacks marked ELECT for electrolytic capacitors and to jacks marked OTHER for paper, mica, oil, etc. capacitors.
3. Connect the test leads to the capacitor, observing polarity on electrolytic capacitors, and note eye operation.
4. The eye should flash open and then gradually close, depending on the capacity, as capacitor charges up. If the eye does not flash for capacitors of 100 micromicrofarads or more, the capacitor is open.

CIRCUIT DESCRIPTION.

The Senco Leakage Checker contains a circuit using a high gain DC amplifier and an electric eye tube indicator that will indicate the presence of leakage in tubes and capacitors. Leakage currents as low as 0.5 microamp are indicated quickly and accurately with this checker.

A schematic diagram of the checker is shown in Fig. 1. Primary power is obtained from a 105-125 volt AC 60 cycle line and is controlled by the ON-OFF switch S-1 in the checker. Plate supply power of 150 volts DC is obtained from a simple selenium rectifier circuit on the secondary output of the power transformer. Filament power for the tubes under test and the tubes in the circuit is obtained from the tapped filament winding on T1. Slightly higher filament voltages than those required by the tubes in normal operation are provided to insure that a bad tube will indicate bad.

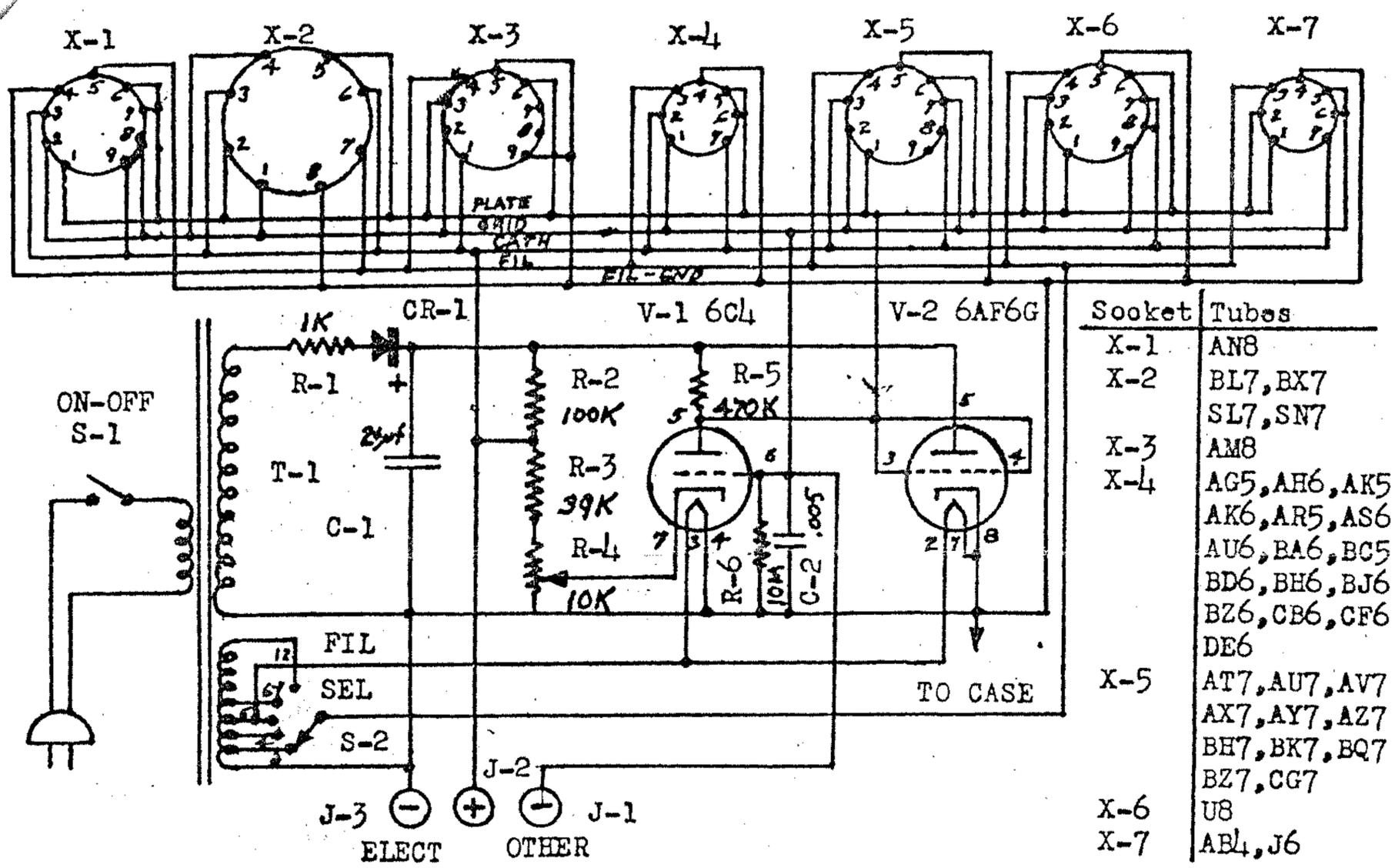


Figure 1.

PARTS LIST

Description	Quantity	Part No.	Description	Quantity	Part No.
Bushing, line cord (2parts)	1	HB101	Resistor, 100,000 ohms	1	R103
Capacitor, disc, 0.005 mfd GMV	1	C102	$\frac{1}{2}$ w(brown,black,yellow)		
Capacitor, filter, 20mfd, 150VDC	1	C101	Resistor, 470,000 ohms	1	R104
Case, including cord bracket	1	M103	$\frac{1}{2}$ w(yellow,violet,yellow)		
Clamp, eye tube, mtg on panel	1	M102	Resistor, 10 megohm $\frac{1}{2}$ w	1	R105
Clip, alligator, red	1	HC101	(brown,black,blue)		
Clip, alligator, black	1	HC102	Socket, octal, laminated	1	X102
Cord, line	1	WC101	Socket, octal, molded	1	X101
Handle, leather	1	HH101	(mtg on panel)		
Hardware			Socket, 7 pin miniature	3	X103
Nut, 6-32x $\frac{1}{4}$	1	HN103	(mtg on panel)		
Nut, 8-32x $\frac{1}{4}$	4	HN101	Socket, 9 pin miniature	4	X104
Nut, control $\frac{1}{2}$	2	HN102	(mtg on panel)		
Screw, 6-32x $\frac{3}{8}$ RH	1	HS101	Switch, rotary, 5 position	1	S101
Screw, 8-32x $\frac{1}{4}$ RH	2	HS103	Switch, slide, SPST	1	S102
Screw, 8-32x $\frac{1}{4}$ BH, phillips	2	HS102	(mtg on panel)		
Screw, sheet metal, 6x $\frac{1}{4}$ RH	2	HS101	Terminal board 7 terminals	1	TB101
Washer, control	2	HW101	including mtg lug		
Jack, tip, black, with	1	HW101	(mtg on panel)		
mtg hardware	4	HW104			
Jack, tip, red with	2	J101	Tip, phone	2	P101
mtg hardware	1	J102	Transformer, power	1	T101
Knob, bar	2	HK101	Tube, 6AF6G	1	V103
Lead, test, black	1	WL103	Tube, 6C4	1	V102
Lead, test, red	1	WL102	Wire		
Panel, including bracket	1	M101	Length bare	1	W111
Potentiometer, carbon,			Length blue	1	W115
10,000 ohm	1	RP101	Length brown	1	W116
Rectifier, selenium, $\frac{10}{25}$ ma	1	CR101	Length green	1	W117
Resistor, 1000 ohms, $\frac{1}{2}$ w	1	R101	Length white	1	W118
(brown, black, red)			Length yellow	1	W119
Resistor, 39,000 ohms $\frac{1}{2}$ w	1	R102			
(orange, white, orange)					

The DC amplifier (V-1) is a 6C4 triode that is directly coupled to the controlling elements of the 6AF6G (V-2) electric eye tube. Conduction of the 6C4 amplifier and consequently its output, is controlled primarily by the ZERO ADJ control R4, which varies the bias on the amplifier, and secondly by grid signals. Since the grid is returned through a high resistance (10 megohm-R6) small currents through the resistor will raise the grid voltage appreciably and will increase the conduction of the amplifier. Thus, the plate voltage of the amplifier will decrease and the shadow in the electric eye tube will open.

A tube under test is effectively placed in parallel with the 6C4 DC amplifier except that its cathode is returned to a high positive voltage (50 volts) holding it to cut-off. If there is leakage between the grid and cathode of this tube, the grid of the DC amplifier will become positive and the eye will open. This same condition exists when there is leakage in a paper, mica, oil, etc. capacitor under test. If a tube has grid emission a current will be drawn through the common 10 megohm grid resistor R6 which will likewise make the grid of the DC amplifier positive and open the eye.

Heater cathode leakage in a tube or leakage in an electrolytic capacitor under test will upset the cathode bleeder circuit of the DC amplifier causing the cathode voltage of the DC amplifier to become less positive. This, of course, will increase the conduction of the amplifier which will open the eye of the 6AF6G.

The tube testing sockets are all wired in parallel. Pentodes are triode connected with the screen grid and plate tied together, and the suppressor grid and cathode tied together. Converter tubes are also connected in this manner.

Capacitor C2 is added to the circuit to prevent hum or pick-up when the test leads are plugged in to the jack marked OTHER. Pick-up usually occurs when the leads are being handled.

SERVICE AND WARRANTY.

The Senco Leakage Checker is simple to service and should not offer any difficulties if the following trouble chart is followed. However, the checker carries a 90 day warranty and the unit will be repaired free of charge if it becomes defective within this period.

TROUBLE CHART

<u>Indication</u>	<u>Check the Following</u>
1. Eye will not open.	1. 6AF6, line cord, ON-OFF switch (S-1), transformer (T-1), R-1, CR-1.
2. Eye lights, but will not open.	2. 6C4, ZERO ADJ control (R-4).
3. Eye lights, but will not close.	3. The cathode line for ground short, R-2, R-3, R-5, ZERO ADJ control (R-4).
4. Abnormal eye indications.	4. Filter condenser (C-1), C-2.
5. Tubes of a particular filament voltage do not light.	5. FIL SEL switch (S-2) transformer (T-1).

OPERATION

The Sencore Leakage Checker was designed for fast and foolproof operation. The Sencore LC3 checker provides three important checks on critical tubes; Filament Continuity, Heater to Cathode Leakage and Control Grid Leakage. These tests are normally made in this sequence.

Operation of only two controls, the FILAMENT switch and the OPERATION switch are required for all tests. Note the spare sockets I (7 pin) or M (9 pin) can be used to preheat the tube before testing. The following procedures should be used to operate the checker.

HOW TO CHECK TUBES

1. Plug line cord into 105-125 volt AC 60 cycle outlet, turn OPERATION switch to FIL CHECK position and let the checker warm up for about 30 seconds.
2. Adjust the zero adjust control until the eye just closes. This control is located on the left side of the checker and is adjusted with a screw driver through a hole in the side of the case. Once set, it does not normally need readjustment.
3. Turn the FILAMENT switch to the position that corresponds with the first number of the tube type, such as 12 for 12AU7, 6 for 6AU6 etc.
4. Turn the data chart until the tube type appears in one of the windows. Note that the first number of the tube type is omitted and only the last two or three letters and number are shown. This is because the filament voltage (first number) has already been selected in step 3 above.
5. Plug the tube into the socket designated on the data chart. The filament check indicator will light if the filament is good.
6. Advance the OPERATION switch to the HEATER CATHODE LEAKAGE position and let the tube warm up thoroughly. If there is heater to cathode leakage of 50,000 ohms or less the eye will open into the bad area. A good tube will not open the eye. Heater Cathode Leakage normally causes Audio Buzz, poor Horizontal or Vertical Sync or one or two black bars across the TV screen.
7. Advance the OPERATION switch to the CONTROL GRID LEAKAGE position. If there is grid leakage of 100 megohms or less, or if there is a grid emission current of 0.5 microamps or more the eye will open into the bad area. A good tube will not open the eye. Control grid leakage normally causes poor sync, poor AGC action, or low audio.
8. Check the tube for intermittent shorts on each leakage test by tapping the tube. If the tube is bad, the eye will flash.

It should be noted that the Sencore Leakage Checker is not a cathode emission checker. It is assumed, therefore, that the cathode is in an operating condition in the above tests.

HOW TO CHECK CAPACITORS

1. Operate the checker as in steps 1 and 2 of the preceding section on "How To Check Tubes".
2. Connect the test leads to the checker and set the OPERATION switch to the ELECT-CAP leakage position for electrolytic capacitors and to the CAPACITOR leakage position for paper, mica, oil etc. capacitors.
3. Connect the test leads to the capacitor, observing polarity on electrolytic capacitors, and note eye operation.
4. The eye should flash open and then gradually close, depending on the capacity, as the capacitor charges up. If the eye does not flash for capacitors of 100 micromicrofarads or more, the capacitor is open. If the eye does not close the capacitor has leakage and should be rejected.

CIRCUIT DESCRIPTION

The Sencore Leakage Checker contains a circuit using a high gain DC amplifier and an electric eye tube indicator that will indicate the presence of leakage in tubes and capacitors. Leakage currents as low as 0.5 microamp are indicated quickly and accurately with this checker.

A schematic diagram of the checker is shown in Fig. 1. Primary power is obtained from a 105-125 volt AC 60 cycle line and is controlled by the OPERATION switch (S-2a) in the checker. Plate supply power of 150 volts DC is obtained from a simple selenium rectifier circuit on the secondary output of the power transformer. Filament power for the tubes under test and the tubes in the circuit is obtained from the tapped filament winding on T1. Slightly higher filament voltages than those required by the tubes in normal operation are provided to insure that a bad tube will indicate bad.

The DC amplifier (V-1) is a 6C4 triode that is directly coupled to the controlling elements of the 6AF6G (V-2) electric eye tube. Conduction of the 6C4 amplifier is initially set with the zero adjust control (R-4) until the shadow in the electric eye tube is just closed. When the control grid of V-1 goes positive, as a result of leakage in a tube or capacitor under test, the plate voltage of V-1 will decrease and the shadow in the electric eye tube will open.

A tube under test is connected so that the filament is returned to ground through a 4700 ohm resistor (R-9), the control grid is returned to ground through a 10 megohm resistor (R-6) and all other elements are at a positive 50 volt potential provided by the bleeder of R-1 and R-2. When the OPERATION switch (S-2) is in the third position, "heater to cathode leakage check and electrolytic capacitor leakage check," the filament lead with the 4700 resistor to ground is connected to the grid

of the 6C4 amplifier. Therefore, any leakage path of 50,000 ohms or less between the cathode (which is at plus 50 volts) and the filament of the tube under test will raise the potential on the 6C4 grid sufficiently to open the electric eye shadow into the bad area. The same condition exists when an electrolytic capacitor is connected between the capacitor test jacks J-1 and J-2.

When the OPERATION switch is in position four; "control grid leakage check and capacitor leakage check", the control grid of the tube under test is connected to the control grid of the 6C4 amplifier and both grids are returned to ground through R-6 a 10 megohm resistor. Therefore, any leakage between the control grid and any other element (except the filament) in the tube under test will raise the potential on the grid of the 6C4 amplifier and the electric eye tube shadow will open. This same condition will exist when there is leakage in a paper, oil, mica etc. capacitor under test. Grid emission in the tube under test will also draw current through R-6 and raise the potential on the 6C4 grid and open the eye.

The value of R-6 was chosen so that control grid leakage and capacitor leakage of 100 megohms or less would open the eye into the bad area. If it is desirable to make the checker less sensitive for individual requirements R-6 can be reduced in value. Sensitivity is approximately 10 times the value of R-6. For example R-6 (10 megohm) times 10 gives us a sensitivity of 100 megohms where the eye just opens into the bad area.

Filament continuity is checked on the second position of the OPERATION switch with the network of R-7, R-8, R-9 and the neon bulb. If the filament in the tube under test is good, there is a complete path from the high side of the transformer secondary to the low side causing the neon bulb to light. The 180K resistor (R-8) is placed across the neon bulb to prevent erratic firing of the neon gas in the bulb.

Capacitor C-2 is added to the circuit to prevent hum or pick-up when the test leads are plugged in for checking capacitors. Pick-up usually occurs when the leads are being handled.

SERVICE AND WARRANTY

The Sencore Leakage Checker is simple to service and should not offer any difficulties if the following trouble chart is followed. However, the checker carries a 90 day warranty and the unit will be repaired free of charge if it becomes defective within this period.

