

SUPREME
Model 550 Radio Tester
DELUXE SERIES

OPERATING DATA

SUPREME INSTRUMENTS CORP.
GREENWOOD, MISSISSIPPI
U. S. A.

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PANEL LAYOUT OF 550 RADIO TESTER

Proper Part Name (used in instructions)	Function	Location on Panel
Meter	Upper window 1 - -10 to + 6 scale used for 5 decibel ranges 1 - 0 to 7 scale 1 - 0 to 35 scale 1 - 0 to 140 scale These three scales used for 6 - D. C. volts ranges 6 - A. C. volts ranges 6 - D. C. mil. ranges 6 - Output ranges 6 - capacity measuring ranges 4 - electrolytic leakage current values 1 - 0-14 amp. range Lower window 1 - 0 to 2,000 ohm scale (5 - resistance measuring ranges)	Center of panel
4-5 and 6 prong sockets	For use when making radio set measurements (connected through analyzing cable)	On left side of panel at top
Small 7 prong, large 7 prong, and 8 prong sockets	For use when making radio set measurements (connected through analyzing cable)	On right side of panel at top
"TOP CAP" pin jacks	To accommodate "TOP CAP" connection to tube in analyzing functions (can be used interchangeably)	Directly under the 5 prong and the large 7 prong sockets

PANEL LAYOUT OF 550 RADIO TESTER

Proper Part Name (used in instructions)	Function	Location on Panel
Double pin jacks numbered 1 to 8 and T.C.	Terminal pin jacks for Radio set analysis measurements	Grouped along bottom edge of panel
"ELECTROSTATIC CAPACITOR LEAKAGE" pin jacks	For use in testing electrostatic capacitors for leakage	On left edge of panel in center
"ELECTROLYTIC CAPACITOR LEAKAGE" pin jacks	For use in testing electrolytic capacitors for leakage	On right edge of panel in center
"TEST PROBES" pin jacks	For use with the "DCMA", "DCV", "ACV", "DB" and "MFDS" circuits	On left side of panel at bottom
"OHMS" pin jacks	For use with the "OHMS" circuit	On right side of panel at bottom
"14 AMP." binding posts	For use with the "14 AMP." circuit. (observe polarity)	At bottom of panel in center
"METER CIRCUIT SELECTOR" switch	For connecting proper functional circuit to meter	To left of "OHM-METER ADJUSTER" POTENTIOMETER
"OHMMETER ADJUSTER" potentiometer	To be used in zero adjusting meter for resistance measurements	To left of meter

PANEL LAYOUT OF 550 RADIO TESTER

Proper Part Name (used in instructions)	Function	Location on Panel
"ELECTROLYTIC VOLTAGE" switch	To select the proper electrolytic voltage when testing electrolytic capacitors for leakage	To right of meter
"RANGE SELECTOR" switch	For connecting meter to proper internal range circuit	To right of "ELECTROLYTIC VOLTAGE" switch
Neon tube	For leakage measurement of electrostatic capacitors	Left center of panel
Rectifier tube (Type 71-A)	Used as a high voltage low current rectifier	Right center of panel
"DB-ACV-MFDS" momentary contact switch	For protecting instrument rectifier	To left of "TEST PROBES" pin jacks
"MEGOHMS-CAPACITOR LEAKAGE" momentary contact switch	For use when making electrolytic leakage, electrostatic leakage, and high resistance measurements	To right of "OHMS" pin jacks

MODEL 550 RADIO TESTER

TABULATION OF METER RANGES

1.	DECIBEL RANGES	SCALE USED	ADD
	-10 to + 6 D. B.	-10 to + 6	0
	0 to + 16 D. B.	-10 to + 6	+10
	+10 to + 26 D. B.	-10 to + 6	+20
	+20 to + 36 D. B.	-10 to + 6	+30
	+30 to + 46 D. B.	-10 to + 6	+40
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2.	D. C. VOLTAGE RANGES	SCALE USED	MULTIPLY BY
	0 to 7 volts	7	Direct
	0 to 35 volts	35	Direct
	0 to 140 volts	140	Direct
	0 to 350 volts	35	10
	0 to 700 volts	7	100
	0 to 1400 volts	140	10
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3.	A. C. VOLTAGE RANGES (SAME FOR OUTPUT)	SCALE USED	MULTIPLY BY
	0 to 7 volts	7	Direct
	0 to 35 volts	35	Direct
	0 to 140 volts	140	Direct
	0 to 350 volts	35	10
	0 to 700 volts	7	100
	0 to 1400 volts	140	10

MODEL 550 RADIO TESTER

TABULATION OF METER RANGES

4.	RESISTANCE RANGES	SCALE USED	MULTIPLY BY
	0 to 2,000 ohms	2,000	Direct
	0 to 20,000 ohms	2,000	10
	0 to 200,000 ohms	2,000	100
	0 to 2,000,000 ohms	2,000	1,000
	0 to 20,000,000 ohms	2,000	10,000
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5.	DIRECT CURRENTS	SCALE USED	MULTIPLY BY
	0 to 7 ma.	7	Direct
	0 to 35 ma.	35	Direct
	0 to 140 ma.	140	Direct
	0 to 350 ma.	35	10
	0 to 700 ma.	7	100
	0 to 1400 ma.	140	10
	0 to 14 amp. (external use only)	140	0.1 (Divide by 10)
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6.	CAPACITY RANGES	SCALE USED	MULTIPLY BY
	.002 to .07 mfd.	7	.01 (divide by 100)
	.01 to .35 mfd.	35	.01 (divide by 100)
	.04 to 1.4 mfd.	140	.01 (divide by 100)
	.1 to 3.5 mfd.	35	.1 (divide by 10)
	.2 to 7.0 mfd.	7	Direct
	.4 to 14.0 mfd.	140	.1 (divide by 10)

! IMPORTANT !

Unless this paragraph is complied with, the Guarantee Policy on your Supreme Instrument is not applicable!

REGISTRATION. The Return Registration Card, which is included with each tester shipment, should be completed with the proper information and mailed immediately after the user's receipt of the tester. It is the purpose of the Return Registration Card (1) to apply the guarantee policy in favor of the owner of the tester, and (2) to assure the user's receipt of any additional data which may be issued with reference to the use of the tester. The issuance of new data may not be necessary; but in case new data be issued, the user is entitled to it and he will receive such new data if his ownership of the tester is registered by means of the Return Registration Card. The guarantee policy is not applicable unless the tester is registered within ten days after its receipt, and the serial number of the tester should be mentioned in all correspondence.

LOCATION OF MODEL NUMBER ON PANEL. The model number of this tester is located on the left side of the panel between the "#1" twin jack and the "DB-ACV-MFDS" switch. MENTION THIS NUMBER IN ALL CORRESPONDENCE.

LOCATION OF SERIAL NUMBER ON PANEL. The serial number of this tester is located on the right side of the panel between the "#8" twin jack and the "MEGOHMS-CAPACITOR-LKG." switch. MENTION THIS NUMBER IN ALL CORRESPONDENCE.

GENERAL. The Model 550 has been designed to provide radio servicemen with the maximum of testing functions of any radio tester and incorporates a new and novel circuit with a simplified range changing mechanism and one basic audio-unit scale reading directly in D. B. (Decibels). It provides for a complete point-to-point analysis for any radio or audio circuit, and is adaptable to changes in tube terminal arrangements. It also provides extended resistor and capacitor measuring ranges and is up to the minute in every respect. The meter employed in this instrument permits easier and more accurate readings than is customary in equipment of this type due to the illuminated double windows and longer scales which are available in the new quadrimeter.

PANEL LAYOUT. By reference to the chart showing the panel layout of this tester, the user may quickly become familiar with the various parts on the panel.

Three parts are given further description as follows:

METER SCALE MARKINGS. The scales on the "METER" show three sets of markings:

- (A) The scale in the lower window is associated with the ohmmeter and megohmmeter circuits and is read directly for the 2,000 ohm (2M) range, multiplied by 10 for the 20,000 ohm (20M) range, by 100 for the 200,000 ohm (200M) range, and by 1,000 for the 2,000,000 ohm (2 meg.) range and by 10,000 for the 20,000,000 ohm (20 meg.) range.

- (B) The lower scale in the upper window is used for all readings of A. C. or D. C. voltage, D. C. current or microfarads. Three sets of index numbers are provided, which at full-scale read 7-35-140. The proper method of reading these scales will be determined by the range used, and simply involves the proper location of a decimal point. In reading A. C. or D. C. voltage or D. C. current, the scale may be multiplied by 10 or 100, etc.
- (C) The upper scale in the upper window is used for reading audio power directly in decibels (D. B.). The basic range is from -10 D. B. through zero D. B. (6 milliwatts in a 500 ohm line) to +6 D. B. By means of the "RANGE SELECTOR" switch a measurable variation may be had from -10 to +46 D. B. See instructions.

"METER SELECTOR" SWITCH. An eight position switch is used as a "type" circuit selector and automatically connects the meter into the circuit used for the various functions which are provided.

"RANGE SELECTOR" SWITCH. A six position switch is used as a "RANGE" selector and connects the desired range of the circuit selected to the output jacks and analysis functions. The "RANGE SELECTOR" switch should always be rotated fully to the left or highest range and then backed down to a range where the needle rests between half and full scale deflection.

D. C. AMPERE CONNECTIONS. (14.0 AMPERE RANGE).

PROCEDURE

- I. Set the "METER CIRCUIT SELECTOR" switch to the "14 Amp." position.
- II. Connect black test plug to "-14 amp." binding post.
- III. Connect red test plug to "+14 amp." binding post.
- IV. Connect test plugs in series with circuit to be tested, observing polarity. If meter needle backs off scale, reverse leads.

NOTE: When applying test leads in series with circuit under test do not use points of plugs for contact, but rather, firmly connect plugs into circuit. This will obviate burned or pitted plugs as this high current will scar plugs unless firm contact is made.

- V. Read meter on 140 scale dividing result by 10; i.e., meter reads 80 divided by 10 equals 8 amperes.
- VI. Disconnect all test leads from panel.

ELECTROLYTIC CAPACITOR LEAKAGE MEASUREMENTS.

PROCEDURE

- I. Test capacitor for short using regular "OHMMETER" procedure before proceeding with balance of this test.
- II. Set "METER CIRCUIT SELECTOR" to the "ELEC." position.
- III. Connect pin plug end of the red alligator test lead to the "+ ELEC-TROLYTIC CAPACITY LEAKAGE" pin jacks.

- IV. Connect pin plug end of the black alligator test lead to the "—ELECTROLYTIC CAPACITY LEAKAGE" pin jack.
- V. Connect red alligator clip to the positive lead of the capacitor to be tested and the black alligator clip to the negative lead of the capacitor to be tested.
- VI. Set electrolytic voltage switch to the closest voltage corresponding to the rated D. C. operating potential of the capacitor to be tested.
- VII. Set "RANGE SELECTOR" to highest range.
- VIII. Close switch marked "MEGOHMS-CAPACITOR LEAKAGE."
- IX. Rotate "RANGE SELECTOR" switch until the meter pointer rests between approximately one half and full scale deflection.
- X. The leakage value is now read directly in mils. on the proper arc of the meter and the results divided by the capacity rating of the capacitor results in the leakage in mils.-per-microfarad; i.e., a good capacitor should not have a leakage of more than 1.0 mil-per-microfarad when tested at the rated working voltage.
- XI. Disconnect all test leads from panel, rotate "ELECTROLYTIC VOLTAGE" switch to "OFF" position and discharge capacitor.
- XII. Rotate "RANGE SELECTOR" to highest range.

CAUTION: Always test capacitor for shorts before making this test.

D. C. MILLIAMMETER CONNECTIONS.

PROCEDURE

- I. Set the "METER CIRCUIT SELECTOR" switch to the "DCMA" position.
- II. Set the "RANGE SELECTOR" switch to the highest range. (Extreme counter-clockwise position).
- III. Connect test leads to pin jacks marked "TEST PROBES" on the lower left side of the panel. (Red lead to "plus" jack and black lead to "minus" jack).
- IV. Connect other ends of test leads in series with circuit to be tested.
- V. Rotate "RANGE SELECTOR" switch to right until correct range is reached at which point meter needle will probably rest between one half and full scale deflection. If needle backs off scale, reverse leads at either end.
- VI. Note range index in proper arc of "RANGE SELECTOR" switch and interpret reading of meter. (See D. C. voltmeter connections #6 for full explanation).
- VII. Remove all test leads from panel and rotate "RANGE SELECTOR" switch to highest range position.

D. C. VOLTMETER CONNECTIONS.

PROCEDURE

- I. Set "METER CIRCUIT SELECTOR" switch to "DCV" position.
- II. Set "RANGE SELECTOR" switch to highest range. (Rotate counter-clockwise fully to the left.)

- III. Connect test leads to pin jacks marked "TEST PROBES" on the lower left side of panel. Observe polarity. Red lead to plus jack, black lead to minus jack.
- IV. Connect other ends of leads across the two points whose potential difference is to be tested; if needle backs off scale reverse test prods.
- V. Rotate "RANGE SELECTOR" switch clockwise (to right) until correct range is reached at which point meter needle probably will rest between one-half and full scale deflection.
- VI. Note range index numeral (in proper arc of "RANGE SELECTOR" switch) which corresponds with full scale deflection of meter, and interpret actual meter reading in these terms; i.e., "RANGE SELECTOR" switch at 350 which corresponds to 350 volts full scale deflection of meter. Needle rests at exactly one-half scale deflection or between 15 and 20 on the 35 scale (17.5). As we wish a reading on the 350 volt scale, all numbers are multiplied by 10 and, therefore, the meter indicates a potential of 175 volts.
- VII. Remove test leads from panel and rotate "RANGE SELECTOR" switch to highest range position.
- VIII. Due to polarity effect of meter backing off scale upon incorrect connection, this procedure may be used for polarity tests.

OHMMETER CONNECTIONS.

PROCEDURE

- I. Set "METER CIRCUIT SELECTOR" switch to the "OHMS" position.
- II. Set "RANGE SELECTOR" switch to the proper range within which lies the value to be tested.
- III. Insert short tip ends of test leads or alligator clip leads in "OHMS" pin jacks.
- IV. Shorting together opposite ends of test leads or alligator clips, adjust meter to zero by rotating "OHMMETER ADJUSTER." Remove short.
- V. Connect free ends to resistor under test. Readings are made directly on meter for 2,000 ohm range. Other readings are obtained by multiplying by 10, 100, etc., as indicated by range; i.e., multiply by 10 for 20M range, by 100 for 200M range, by 1,000 for 2 meg. range and by 10,000 for 20 meg. range.
- VI. Remove all test leads from panel.
- VII. Rotate "RANGE SELECTOR" switch to highest range position.

NOTE A: When making resistance measurements all sources of power should be disconnected from the radio set, amplifier, resistor, etc. under test.

NOTE B: For greatest accuracy readjust meter to "ZERO OHMS" for each different resistance range used. (For operation see paragraph #4).

NOTE C: When measuring the value of an external resistance across which is connected an electrolytic capacitor, connect the test lead which is connected to the "plus" "OHMS" pin jack to the end of the resistance which is connected to the "plus" side of the electrolytic condenser, and the test lead which is connected to the "minus" "OHMS" pin jack to the end of the resistor which is connected to the "minus" side of the electrolytic condenser.

A. C. VOLTMETER CONNECTIONS.

PROCEDURE

- I. Set "METER CIRCUIT SELECTOR" switch to "ACV" position.
- II. Set "RANGE SELECTOR" switch to highest range.
- III. Connect test leads to jacks marked "TEST PROBES" on the left side of panel. (Same pin jacks as D. C. volts.) No polarity need be observed as there is no polarity with A. C.
- IV. Connect other ends of test leads across the two points whose potential difference is to be tested.
- V. Depress momentary contact "DB-ACV-MFDS" switch to read indication on meter. Release switch.
- VI. Rotate "RANGE SELECTOR" switch to right until correct range is reached at which point meter needle will probably rest between one half and full scale deflection. Always release "DB-ACV-MFDS." switch before making any changes. This switch is your protection against burnout of the rectifier.
- VII. Depress "DB-ACV-MFDS." Switch and note position numeral in proper arc of "RANGE SELECTOR" switch and interpret reading of meter. (See D. C. voltmeter connections, paragraph #6, for full explanation.)

VIII. Release "DB-ACV-MFDS." switch.

IX. Remove all test leads from panel and rotate "RANGE SELECTOR" switch to highest range position.

NOTE: The "DB-ACV-MFDS." switch has been incorporated so as to provide all of the protection possible for the rectifier unit. Before the switch is depressed, care should be taken to be absolutely sure that an excessive voltage will not be applied.

OUTPUT METER CONNECTIONS. With the "METER SELECTOR" switch set in the "ACV" position, connections may be made to the "TEST PROBES" pin jacks on the lower left side of panel to permit the meter movement being used as an output meter. Certain precautions are essential when this procedure is attempted, and it is necessary that extreme care be used not to violate the instructions given under this heading. An adequate range on the "RANGE SELECTOR" switch should be selected for the measurement, the "DB-ACV-MFDS." switch button should not be depressed until after the connections are completed, and the switch button should be released before the changing of the "RANGE SELECTOR" switch, or the disconnecting or changing the location of the test leads. It is the purpose of the switch, in its normally-closed position, to shunt damaging surges around the rectifier rather than to allow the instantaneous electrical surges to pass through the rectifier. It is not necessary to interpret output readings in electrical terms, as maxima readings, only, are desired. It is generally found advantageous to keep records of the output readings of various equipments for comparative and reference purposes in future adjustment. A modulated oscillator, when used with the output-measuring functions of this tester provides a satisfactory method for comparative tube testing with operative radios.

This method of tube testing is accomplished by observing the effect on the output meter readings resulting from the replacement of questionable tubes with new tubes. Tubes tested by this method are usually designated as "set tested" tubes. This method of testing is also satisfactory for detecting fading conditions within the radio or tubes, and is being practiced by many leading radio service engineers as a result of the recommendations of some of the leading tube manufacturers. However, the same results may be obtained by using the "DECIBEL" measuring functions as next outlined and if the measurements are taken across a line, the resistance or A. C. impedance of which is known, very accurate measurements may be made. Remember, comparative tube tests pre-suppose a "good" set of tubes to compare with the radio's tubes. This necessitates some type of regular tube tester and a comparative test is not to be considered in any way as a substitute for a regular tube tester.

D. B. (DECIBEL) MEASUREMENTS. Facilities are provided in the Model 550 for a continuous direct measurement of the power level in decibels in a 500 ohm line from -10 D. B. to +46 D. B. with respect to the accepted zero level of 6 milliwatts. This may be used effectively by the projectionist or public address engineer in running output curves and in general audio amplifier work. (Also see "Output Measurements".)

PROCEDURE

- I. Set the "METER CIRCUIT SELECTOR" switch to the "D. B." position.

- II. Set the "RANGE SELECTOR" switch to the furthest left position. (+40 D.B.)
- III. Connect alligator clip leads across line to be tested and insert pin ends of leads in "TEST PROBES" pin jacks on bottom left side of panel.

A pair of 20-foot test leads are available at slight additional cost for the theatre technician who might wish to place his Model 550 radio tester close to his projectors and obviate continued trips back and forth between projectors and source of output voltage under test. (Amplifier)

- IV. Depress "DB-ACV-MFDS." push button and observe output level on D. B. scale of meter. (Minus 10 to plus 6 scale.)
- V. Release "DB-ACV-MFDS." push button, rotate "RANGE SELECTOR" switch to next lowest range. Depress "DB-ACV-MFDS." switch and observe meter readings. Adjust to range which will give greatest swing of meter needle without needle going off scale. ALWAYS RELEASE "DB-ACV-MFDS." button before making any change of controls.
- VI. Interpret meter reading as follows:
 - (A) With "RANGE SELECTOR" switch on "0" position, read D. B. level direct on meter.

(B) With "RANGE SELECTOR" switch on "plus 10," algebraically add "plus 10" to meter reading; i.e., if meter reads -2 D. B., adding +10 results in an actual level reading of +8 D. B.; again, if meter reads +4, adding +10 results in an actual level reading of +14 D. B. Higher ranges are interpreted exactly the same way. Always consider "0" on the meter D. B. scale as the number of D. B.'s indicated by the "RANGE SELECTOR" switch; i.e., with "RANGE SELECTOR" switch set at plus 30, "ZERO" on meter would be plus 30 D. B., etc.

VII. Remove all test leads from panel and disconnect leads from circuit under test.

NOTE: This scale reads direct only on a 500 ohm line, and refers to a zero level of 6 milliwatts in such a line. However, lines of various other impedances are often encountered, and the meter may also be used for ascertaining the level in these lines, by adding or subtracting the number of decibels given by the relation:--

$$DB = 10 \log_{10} \frac{500}{Z}$$

where Z is the impedance of the line under test.

If the Z is more than 500 ohms, the sign of the resultant number of DB's will be negative, indicating a subtraction of that number from the meter reading. If Z is less than 500 ohms, the number of DB's will be positive and should be added to the meter reading.

The foregoing is included for those theatre technicians and P. A. Engineers who wish to compute their own results. An interpolating chart for various lines is included with this operating data.

CAPACITY METER CONNECTIONS.

PROCEDURE FOR CAPACITY MEASUREMENTS OF ALL CAPACITORS

- I. Set "METER CIRCUIT SELECTOR" switch to "MFDS." position.
- II. Set "RANGE SELECTOR" switch to highest capacity range shown on "MFDS." arc.
- III. Connect alligator clip leads to capacitor under test making sure that no external voltage is being applied across capacitor. (Turn radio or amplifier off.)
- IV. Connect tip ends of alligator clip leads to "TEST PROBE" pin jacks on panel.
- V. Connect A. C. cord to convenient A. C. supply.
- VI. Depress "DB-ACV-MFDS." switch and note needle deflection. Release "DB-ACV-MFDS." switch and rotate to next lower range if necessary. Depress switch and note reading. Continue this procedure until range is reached when meter needle deflects furthest to right without going off scale.
NOTE: N E V E R rotate "RANGE" switch with "DB-ACV-MFDS." switch in depressed position. A L W A Y S release "DB-ACV-MFDS." switch before rotating "RANGE SELECTOR" switch. This will obviate damaging the meter rectifier.
- VII. Disconnect A. C. cord from supply.
- VIII. Disconnect all test leads from panel.
- IX. Rotate "RANGE SELECTOR" switch to full counter-clockwise position.

ANALYZING CIRCUITS. This instrument is provided with a 9-wire analyzing cable terminating in a 7-pin analyzing plug which is provided with a center contact for 8-pin tubes and a thumb catch so that adapters may be plugged into position when tubes having other base arrangements are to be tested. This cable is connected to the sockets through twin jacks at the bottom of the panel. A lug attached to a short lead on the analyzing plug forms a connection for the top cap clip on the receiver and a separate pin jack is provided on the radio tester panel so that the connections may be completed to the top cap of the tube. The twin jacks are so designed that it is unnecessary to insert the leads in any particular order when current measurements are required. The circuit is not opened until two leads are inserted. In this way protection has been provided against the surge which may occur when plate or grid circuits are broken, and one of the precautions frequently necessary in using other equipment becomes unnecessary.

To determine the voltage existing between any two elements of a tube, the tube should be removed from the receiver and the analyzing plug inserted in its place. Connections to the top cap should be made if necessary, and the receiver then turned on. After the tubes in the receiver have had time to reach their normal operating temperature, proper voltage readings may be obtained. Rotating the "RANGE SELECTOR" switch to a range which will be adequate for the voltage anticipated and setting the "METER CIRCUIT SELECTOR" in the "ACV" or "DCV" position in accordance with the character of the

voltage, readings may be obtained between any two elements of the tube by inserting the free ends of the test leads in the jacks associated with these elements. If an A. C. voltage is being measured, it will be necessary to depress the "DB-ACV-MFDS." switch in order to obtain a reading. If D. C. voltage is being tested and the meter backs off scale, reverse the leads in the pin jacks associated with the tube elements. If in measuring A. C. voltage, it is found that a lower scale will be adequate the "DB-ACV-MFDS." button should be released before changing the position of a test lead. Close observance of this precaution will result in additional protection for the rectifier unit. The current in any lead other than A. C. heater leads may be read by setting the "METER CIRCUIT SELECTOR" in the "DCMA" position and bringing test leads from the pin jacks on the left hand side of the panel. The free ends of these leads should then be inserted in the twin jacks associated with the circuit in question. If it is found that a lower range than the one originally selected will prove adequate, remove one of the test leads from its twin jack and then shift to the proper range. This procedure will avoid opening the circuit and will prevent the occurrence of unusual surges in the receiver. The numbers below the twin jacks correspond with the numbers radiating from the socket contacts.

PRELIMINARY TESTS. In view of the fact that the plate current of a tube is the result of practically all of the electrical factors involved in the

circuits leading to the tube, a normal plate current value is fairly conclusive evidence that the circuits leading to the tube are performing their normal functions. It is, therefore, usually sufficient, in the preliminary analysis of a radio to measure only the plate current of each tube, in turn, until a tube is encountered in which the plate current is incorrect, when other readings for that tube may be taken in an effort to isolate the defect in the circuit leading to the tube in which the incorrect plate current reading is observed. An abnormally high plate current reading suggests (1) an open grid circuit, (2) a shorted or leaky by-pass capacitor across the grid biasing resistor in the cathode circuit, (3) a leaky coupling capacitor connected to the plate circuit of a preceding tube, or (4) an excessively gaseous tube when resistance-coupled to the preceding stage. A low plate current indication usually suggests (1) a leaky plate by-pass capacitor, or (2) a leaky screen by-pass capacitor. No plate current usually suggests (1) an open grid bias resistor in the cathode (or filament) circuit, (2) a shorted plate by-pass capacitor, (3) a shorted screen grid by-pass capacitor, (4) an open plate circuit, or (5) an open screen grid circuit. There are other possible causes of incorrect plate current values, but those enumerated are the most usual. The use of high resistance coupling circuits in modern radios introduces errors in practically all voltage measurements, because of the multiplier effects of the resistors in the coupling circuits of such radios. Furthermore, potential measurements will vary with different

ranges of ordinary service voltmeters applied to high resistance circuits, so that the voltage readings published by a radio manufacturer may be found quite different by the radioman when analyzing with a voltmeter of the same sensitivity but of a different range from that used by the radio manufacturer. Such differences are much less likely to exist in milliammeter indications, and these factors make it advisable to rely more upon plate current and less upon voltage readings for indications of amplifier circuit conditions. This procedure of preliminary analysis by means of plate current indications, only, saves time and is usually sufficient for all practical servicing purposes. Plate current measurements with this tester are accomplished in the following manner:

- I. Complete all connections to the radio under test with all tubes in the proper sockets for normal operation.
- II. Remove all test lead conductors from tester panel.
- III. With the radio turned "OFF," remove a tube from the radio, place the tube in the proper tester socket, and connect the top terminal of the tube, if any, to the "TOP CAP" pin jack on the tester panel.
- IV. Insert the analyzing plug, with proper adapter attached, into the vacant radio tube socket, complete the radio "TOP CAP" terminal connection, if any, to the lug at the top of the analyzing plug, and turn the radio "ON." As the tubes attain their

normal operating temperature, adjust the volume and tuning controls of the radio for normal response to broadcast signals or to whatever position may be recommended by the radio manufacturer for circuit analysis.

- V. Set the "METER CIRCUIT SELECTOR" to the "DCMA" position, connect a test conductor between the "-TEST PROBE" and the lower #2 twin jack or whichever twin jack corresponds to the plate of the tube, connect another conductor from the "+ TEST PROBE" and insert it in the upper #2 (or "PLATE") twin jack. In any case, if the meter backs off scale, reverse the connections to the "TEST PROBE" pin jacks. Rotate "RANGE SELECTOR" to right until meter needle deflects furthest to right without going off scale. Remember to remove one test lead from the twin jack before each change of range.

The procedure outlined above applied to current measurements in the No. "2" circuit, which is usually a plate circuit. The current in other numbered circuits can be measured by following a similar procedure. It is usually advisable to first observe the plate current reading on the 350-mil. range, after which the "RANGE SELECTOR" may be shifted down to a suitable lower range. The above procedure may be continued from tube to tube until the plate current measurements have been made for all of the tubes in the radio; or until a tube is encountered in which there is an indication of an incorrect plate current value, in which case the radioman

should undertake a more detailed analysis in an effort to isolate the cause of the incorrect plate current condition by the potential and resistance measurements as outlined in these instructions.

TUBE TESTING. So much emphasis has been placed upon the use of the tube checkers designed for testing radio tubes with A. C. power supply that many radiomen do not appreciate the utility of analyzers for testing tubes in the sockets of operative radios. It is quite obvious that if a radio is inoperative it cannot be used to supply power to an analyzer for testing tubes, but in such cases it is more important to repair the radio than to test the tubes. However, when the radio is in proper operating condition the use of an analyzer for testing the tubes in the radio tube sockets provides a method of tube testing which is satisfactory for practical purposes in the detection of weak and/or noisy tubes. It is very often found that, after tubes have been in use for a long period of time, a rattling or raspy noise will be emitted from the loud speaker when the tubes are very lightly thumped or tapped with a rubber mallet or with the handle of a small screw driver, although the tubes may be indicated as satisfactorily operable by the usual meter tests. It is, therefore, advisable to clean the tube pins and gently thump or tap each tube during the regular tests, preferably while the tube is in the analyzer socket and held away from the radio so that any noise observed may be definitely assigned to the tube rather than the vibration of some loose part in the radio chassis. An exception may be observed in the case of detector tubes

which may produce a ringing sound in the loudspeaker when the tube is thumped or tapped. A ringing musical sound may be natural, but a raspy or rattling sound is not generally natural and the experienced radioman soon learns the difference between natural and unnatural sounds accompanying the test procedure. The logical explanation for the benefit of the customer is that tubes with vibratory noises will respond to the loudspeaker vibrations and distort the reception; and that if the noises are caused by loose elements, short circuits may develop which might harm other parts of the radio. Tube testing readings of amplifier tubes are obtained with this tester as a logical step following the measurement of plate current as described in the preceding paragraph, and is accomplished by connecting the self-contained battery in series with the input grid of the tube in which the plate current is being observed. In the types 26 and 27 tubes, the number "3" twin jack corresponds to the input grid, and the following tube testing procedure is recommended:

Insert test leads in the "OHMS" pin jacks and then connect one lead from the "OHMS" pin jack to the lower #3 twin jack (or twin jack connected to the tube's input grid) and the other lead to the upper #3 twin jack (or "INPUT GRID" twin jack). When the second lead is inserted, a change in plate current will be observed.

In the types 24, 35 and similar tubes, the input grid is connected to the "TOP CAP" terminal, and the battery should be connected to the "T. C." twin jacks instead of to the number "3" pin jacks.

Similarly, other terminals may represent the input grids of other types of tubes, and the radioman may determine from commercial tube data charts the functions and terminals of the tube and circuit encountered in service (or refer to our "Tube Base Connection Finder" booklet). If it is desired that the plate current change be made in the reverse direction, the leads to the twin jacks may be reversed. It is the amount of increase or decrease in the plate current which indicates the extent to which the input grid controls the plate current output which corresponds to the amplifying ability of the tube. An amplifier tube in which the plate current remains unchanged when the battery is connected into the input grid circuit will not amplify signals and should generally be replaced. Because of the variations in different radio circuits, definite discard limits cannot be defined, and the radioman must use his own good judgment, based on his experience, in determining when tubes should be discarded. Additional data on tube testing will be found in the discussion of output measurements.

POTENTIAL MEASUREMENTS. After proceeding with the plate current measurements and tube testing until a tube socket is encountered in which the tube is passing incorrect plate current, and in which the replacement of the tube does not correct this condition, it is advisable to resort to more specific tests for the purposes of isolating the circuit which is defective. For this purpose the following procedure is recommended:

- I. Remove all test conductors from the tester panel.

- II. Set the "METER CIRCUIT SELECTOR" at the "DCV" position.
- III. Connect a test probe conductor between the "-TEST PROBE" pin jack and one of the twin jacks which corresponds to the cathode terminal of the tube circuit.
- IV. Connect one end of a test probe connector to the "+TEST PROBE" pin jack and apply the free end of this conductor to the pin jack terminals numbered "1," "2," etc., making sure the "RANGE SELECTOR" is set on the proper range, and measure the potentials applied to the tube with respect to the terminal which corresponds to the cathode element.

The potential readings obtained should be compared with those published for the radio involved in the tests in an effort to determine which circuit contains the defect causing incorrect plate current values. After determining the defective circuit, the ohmmeter should be utilized for locating the defective part. In the following paragraphs, some typical and representative potential analyses will be described.

FULL-WAVE TRANSFORMER RECTIFIER CIRCUITS. The following procedure is recommended for the analysis of full-wave rectifier tube circuits which are transformer supplied:

- I. Remove all test conductors from the tester panel.
- II. Remove rectifier tube from radio set socket and replace with analyzing plug. Do not put tube in radio tester socket.

- III. For the first plate potential measurement, set the "METER CIRCUIT SELECTOR" to the "ACV" position, "RANGE SELECTOR" to "1400," connect suitable test lead conductors from the "TEST PROBE" pin jacks on the bottom of the panel to one of the No. "3" and one side of the No. "4" twin jack (i.e., to one of the "FILAMENT" and one of the "PLATE" twin jacks). Close switch marked "DB-ACV-MFDS." and observe the meter indications of plate voltage. After observing the meter readings, remove the test probe conductor from the No. "3" or "PLATE" twin jack.
- IV. For the second plate potential measurement, insert the free test probe conductor into one side of the No. "2" (i.e., the second "PLATE") twin jack. If the meter reading differs considerably from that observed in the preceding subparagraph, some of the high voltage plate transformer secondary windings may be short-circuited, although a slight difference between these two readings may be caused by the capacity effects of the analyzing cable.
- V. For the filament potential measurement, set the "METER CIRCUIT SELECTOR" to the "ACV" position and connect a suitable voltage range of the meter from the "TEST PROBES" pin jacks to the No. "1" and "4" (i.e., "FILAMENT") twin jacks.

Depress switch marked "DB-ACV-MFDS." and observe meter reading.

- VI. Turn the radio "OFF," replace the tube in the radio socket, and remove all connectors from the tester panel.
- VII. The test readings obtained by the above procedure may be compared with those specified by the radio manufacturers concerned.

The primary function of the above test is to determine whether or not some of the turns of one side of the secondary plate windings of the power transformer are short-circuited. Since these windings carry the highest potentials of the transformer, they are usually the first windings to break down. It should be remembered that short-circuited windings in any transformer result in an over-saturation of the iron core with resultant over-heating and lowered secondary potentials.

TRIODE TUBE CIRCUIT TESTS. A triode tube is one of the general class in which the 01A, 45 and 27 belong. They consist of three elements which perform the actual work of the tube plus the necessary additions for heating the cathode which may be the filament itself or be heated indirectly by a filament. The following test procedure is recommended:

- I. Remove all test leads from the tester panel.
- II. For the plate potential measurement, set the "METER CIRCUIT SELECTOR" at the "DCV" position, connect the insulated test conductor from the "—TEST PROBE" to one

- side of the No. "4" twin jack (or to the corresponding "CATHODE" twin jack).
- III. Connect one side of the No. "2" twin jack (or corresponding "PLATE" twin jack) with a test conductor to the "+ TEST PROBE" pin jack, observe the meter indication of the plate voltage, and remove the test probe conductor from the No. "2" (or "CATHODE") twin jack.
 - IV. For the cathode potential measurement of 5-pin triode tube circuits, insert the free test conductor plug into one side of the No. "5" (or "FILAMENT") twin jack. If the meter needle backs off scale, reverse the connections. After observing the meter reading, remove the test conductor from the No. "5" (or "FILAMENT") twin jack.
 - V. For the filament or heater potential measurement, set the "METER CIRCUIT SELECTOR" at the proper position, and connect a suitable voltage range of the "RANGE SELECTOR" to the No. "1" and to the highest numbered twin jack for the socket being used. After observing the meter reading remove the test probe conductors from the panel.
 - VI. Turn the radio "OFF," and replace the tube in the radio tube socket, and remove the connectors from the tester panel.
 - VII. The test readings obtained by the above procedure may be compared with those

specified by the radio and tube manufacturers concerned.

"TOP CAP" TUBE CIRCUIT TESTS. In the normal use of the screen grid tubes, such as the types 24 and 35, a small negative potential is applied to the top contact of the tube which is generally called the "control grid" connection, while a positive potential is connected to the No. "1" pin jack of the tube base. The following procedure should be followed in testing screen grid tube circuits, or other circuits which involve tubes with "TOP CAP" terminals:

- I. Remove all test lead conductors from the tester panel.
- II. For the plate potential measurement, set the "METER CIRCUIT SELECTOR" at the "DCV" position, connect a test conductor between the "-TEST PROBE" pin jack and one side of the twin jack corresponding to the "CATHODE" element of the tube, connect the "+TEST PROBE" pin jack with a test conductor to one side of the twin jack corresponding to the "PLATE" element of the tube, observe the meter reading of the plate voltage, and remove the test probe conductor from the "PLATE" twin jack.
- III. For the screen potential measurement, insert the free test conductor plug into one side of the twin jack corresponding to the "SCREEN GRID" element. After observing the meter reading, remove the test conductor plug from the "SCREEN GRID" twin jack.

- IV. For the cathode potential measurement of a heater type tube, insert the free test conductor plug into one side of the twin jack corresponding to the "FILAMENT" of the tube (either side). If the meter needle backs off scale, reverse the connections. After observing the meter reading, remove the test conductor plugs from the tester twin jacks.
- V. For the input grid potential measurement, connect a test conductor between the "-TEST PROBE" and one side of the "T.C." twin jack, and connect the "+TEST PROBE" pin jack to one side of the twin jack corresponding to the "FILAMENT" on tubes without separate cathodes, or the "CATHODE" twin jack on the cathode type tubes. Set "RANGE SELECTOR" to 35 volts. If this grid of the radio tube socket being analyzed is resistance-coupled to the preceding stage, a more accurate reading of the applied control grid potential will be indicated by making the test between the "CATHODE" twin jack and one side of the "FILAMENT" (or, between "CATHODE" and "GROUND" or "CHASSIS".) After observing the meter reading, remove the test conductor plug from the tester panel.
- VI. For the heater or filament potential measurement, set the "METER CIRCUIT SELECTOR" at the proper position, and the "RANGE SELECTOR" to a suitable range

and connect test leads between "TEST PROBES" pin jacks and the No. "1" and No. "5" twin jacks (or corresponding "FILAMENT" twin jacks). After observing the meter reading, remove the test probe conductors from the tester panel. Observe polarity when measuring D. C. voltage.

VII. For the screen grid current measurement, set the "METER CIRCUIT SELECTOR" at the "DCMA" position, connect a test probe connector between the "+TEST PROBE" and the upper side of the No. "3" (or corresponding "SCREEN GRID") twin jack, connect a test probe conductor between the lower side of the No. "3" or "SCREEN GRID" twin jack and the "-TEST PROBE" pin jack. Observe meter indications.

VIII. Turn the radio "OFF," replace the tube in the radio socket, and remove the connectors from the tester panel.

IX. The test readings obtained by the above procedure may be compared with those specified by the radio and tube manufacturers concerned.

RESISTANCE ANALYSIS. For general radio analyses, it is recommended that the plate current indications be relied upon as having primary importance, because correct plate current values almost invariably indicate correct potentials applied to the tube sockets. Whenever a socket is encountered

during a general analysis in which the plate current fluctuates or is radically low or high, it is then advisable to concentrate the investigation at that socket in an effort to determine the cause of the incorrect plate current condition. This investigation may lead to the use of the ohmmeter functions of the tester for point-to-point tests of the component elements of the circuits of the socket. Before undertaking such tests, the radio must be disconnected from the power supply outlet. The resistance analysis may be made between the pin jack terminals of the analyzer cable circuits, or from these terminals to the chassis or other reference points without removing the analyzing plug from the socket in which the circuit defect apparently exists. Resistance analyses should not be made in lieu of the usual current and potential analyses because some types of resistors change in resistance values when operating under their normal loads. Furthermore, it is generally advisable to disconnect resistors from parallel circuits in order to test them, whereas, current and potential values can be analyzed without disturbing normally permanent connections.

OHMMETER ADJUSTMENTS. Before using any range of the ohmmeter, the following adjustment procedure should be followed:

- I. Set the "METER CIRCUIT SELECTOR" at the "OHMS" position.
- II. Connect test lead conductors to the "OHMS" pin jacks.
- III. Set "RANGE SELECTOR" to the 2M, 20M, or 200M position. (Whichever desired.)

- IV. While holding the free contact ends of the test lead conductors together, rotate the "OHMMETER ADJUSTER" control knob for an exact full-scale pointer deflection for indicating zero ohms.
- V. The resistance value of an unknown resistor, if disconnected from other power supplying circuit and connected between the free contact ends of the test lead conductors, will be indicated on the "OHMS" range. The indications will be direct for the "2M" range, should be multiplied by 10 for the "20M" range and by 100 for the "200M" range.

HIGH RESISTANCE MEASUREMENTS. A miniature "power pack" is included in this tester for extending the resistance-measuring ranges from 200,000 ohms to 2 and 20 megohms, and these high ranges may be used in the following manner:

- I. Set the "METER CIRCUIT SELECTOR" switch at the "OHMS" position.
- II. Connect the tester to a convenient A.C. power supply outlet.
- III. Connect alligator clip test lead conductors to the "OHMS" pin jacks.
- IV. Short leads, temporarily, by clipping together and lay on bench. Push the "MEGOHMS-CAPACITOR LEAKAGE" switch with the right hand, and rotate with the left hand, the "ZERO OHMS ADJUSTER" control knob for an exact full-scale meter pointer deflection of zero ohms.

- Release "MEGOHMS-CAPACITOR LKG." switch and then release short on test leads.
- V. The resistance value of an unknown resistor, if disconnected from other power-supplying or grounded circuits and connected between the free contact ends of the test lead conductors, will be indicated on the ohms range by pressing the "MEGOHMS-CAPACITOR LKG." switch. The indications of the meter should be multiplied by 1,000 for the 2 meg. range by adding three zeros to the figures of the "OHMS" range of the meter and should be multiplied by 10,000 for the 20 meg. range.

ELECTROSTATIC CAPACITY LEAKAGE MEASUREMENTS. No polarity need be observed as to connections to the pin jack terminals for electrostatic condensers.

PROCEDURE

- I. Connect tip ends of alligator clip test leads to "ELECTROSTATIC CAPACITY LEAKAGE" pin jacks. Connect supply plug of tester to convenient wall socket.
- II. Connect insulated alligator clip ends of test leads to capacitor to be tested. Electrostatic capacitors have no polarity, however, they must be free of any other circuit.
- III. Close switch marked "MEGOHMS-CAPACITOR LEAKAGE." "METER CIRCUIT SELECTOR" switch may be left in any position.
- IV. Observe indication on "LEAKAGE INDICATOR" glow lamp.

OPEN CIRCUIT CAPACITORS. If an open circuit capacitor be connected between the "ELECTROSTATIC CAPACITOR LEAKAGE" pin jack terminals, the neon lamp will not glow. It is, therefore, obvious that this tester will indicate open-circuited capacitors as well as other capacitor defects; this is a feature which is not included in many other types of capacitor testing instruments.

LEAKY CAPACITORS. If a leaky capacitor be connected between the "ELECTROSTATIC CAPACITOR LEAKAGE" pin jack terminals, one electrode, only, of the neon lamp will glow intermittently; that is, the glow will come and go, at regular intervals, as long as the capacitor remains connected. The interval of time between each glow will be determined by the capacity of the capacitor and by the amount of the leakage.

SHORT CIRCUITED CAPACITORS. When a short-circuited capacitor is connected between the "ELECTROSTATIC CAPACITOR LEAKAGE" terminals, one electrode, only, will glow continuously.

GOOD CAPACITORS. When a good capacitor is connected between the "ELECTROSTATIC CAPACITOR LEAKAGE" terminals, the neon lamp will remain unilluminated indefinitely after a momentary glow of one element which may not occur at the instant the capacitor is connected.

OUTPUT MEASUREMENTS. The sensitive A. C. potential measuring facilities, which are made possible by the use of an instrument rectifier associated with the meter of this tester, are ideally suited

for output measurements. The meter may be connected (1) between the power tube plate terminals and the cathode or filament of the tube, or the chassis of the apparatus, without the use of output adapters, (2) across the voice coil of the speaker or (3) across the secondary of an output transformer. This gives comparative voltage readings only and is not to be confused with the "DECIBEL" scale.

MISCELLANEOUS CONNECTIONS. In view of the fact that all of the analytical circuits may be broken by inserting two test leads, numerous other uses may be found for these facilities, such as the connection of headphones, loudspeakers, etc., in the plate circuit during the analyses for special tests. In some types of audio circuits phonograph pick-up devices may be inserted in the cathode circuit or in other circuits for demonstrational purposes. A gas test which may be useful in the course of the analysis of the amplifier circuits of radios may be very simply devised by the use of a 250,000-ohm metallized or other resistor with terminals arranged for plugging into the input grid twin jacks. Observe the effect of this resistor on the plate current, and the effect compared with that produced by replacing the tube with another of the same type; the more gassy the tube the greater the effect upon the plate current produced by the resistor, as gaseous tubes are generally evidenced by a small value of current in the input grid circuit which will produce across the resistor in the circuit a potential which reduced the negative input grid potential in most types of tubes. It is for this reason that gaseous

tubes should not be used in resistance-coupled input circuits. These miscellaneous tests are enabled only in point-to-point analyses which utilize the circuit principles of this tester.

SUGGESTIONS FOR PROJECTION ROOM TESTING. This instrument is admirably adapted to testing all circuits, pieces of equipment, etc. used in theatre sound equipment. This covers such items as the main amplifier, head amplifier, field supplies, optical system adjustments, exciter lamp currents and instruments, etc.

It is suggested that in amplifier routine servicing, which should be done at least once every two weeks, the following tube characteristics be determined on each and every tube:

- (1) Filament voltage.
- (2) Plate voltage.
- (3) Plate current.
- (4) Grid voltage.
- (5) Cathode voltage.
- (6) Grid shift or change in plate current.

A record should be kept of each reading on each tube and the tube readings kept with these obtained on the previous inspections to note any variations which might be indicative of either tube or amplifier trouble. It frequently happens that a tube which may be depreciating can be located by this method before it has depreciated to a point where it might affect the quality and volume of the sound. A record should also be kept of the line voltage at the time of these inspections, noting also the time of the day in which the inspection was made so that any

general increase or decrease in all of the tube readings might be laid to variations in this line voltage. The tubes in the head or "peck" amplifiers and any other tubes used in the entire system should be so checked.

The voltage of the exciter lamp in each projector may also be checked using either the A. C. or D. C. voltage reading facilities of the analyzer. This will indicate variations in the exciter lamp supply rather than lamps which are becoming useless. If the exciter lamps are fed from a D. C. source, the actual current consumption can be measured in the amplifier by taking advantage of the higher current ranges connected by means of the binding posts.

Charging and discharging currents of storage batteries can likewise be checked and also the rectifier current output of some tungar rectifier bulbs.

The voltage of both storage and dry batteries may be very conveniently checked by means of the D. C. voltage reading facilities of the analyzer. These facilities also efficiently check the voltage being delivered to the field coil of the stage speakers and monitor, giving a direct indication of the efficiency of the rectifier supplying this field current, if so used.

The "DECIBEL RANGES" of the amplifier are an effective means for checking the average level of power being delivered by the amplifier to the stage speakers. If the speaker line running between the amplifier and the stage speakers is of 500 ohms

impedance, the analyzer will read the level directly in decibels when connected directly across this line.

This decibel reading feature is also extremely advantageous for use in fader settings. On each machine a frequency reel (if available) should give equal decibel levels for comparable frequencies. If one machine reads higher than the other, the volume control for that machine (which may be in the head amplifier or otherwise) can be adjusted so that both machines give the same volume for equal fader settings.

The enclosed sample inspection report, Form #7374, gives an idea of the means for keeping a permanent record of most of the points mentioned above. Additional copies of this record can be obtained from Supreme Instruments Corporation as noted on their "General Parts List."

Various other tests can, of course, be made, the number being limited only by the ability and engineering knowledge of the operator.

GENERAL INFORMATION. Testers which are designed for operation on 25 cycle power supply will not include the lowest capacity-measuring range.

TRANSPORTATION DAMAGES. The office of origin of the transportation agency which accepted this tester for the original shipment assured the shipper against external and concealed damages in transit. If the tester be received in a damaged condition, or if some part of the tester be damaged in transit, the user of the tester should ask the transportation

agency which delivered the tester, for a concealed damage report which should be forwarded to the factory, with the Return Registration Card, for factory instructions as to the procedure which should be followed for effecting the necessary repairs or replacements.

SUPREME SERVICE STATIONS. For the purpose of effecting prompt repair of damages sustained by inadvertent misuse, or for any other reason, the addresses of the Supreme Service Stations may be obtained from the Supreme factory offices. If it should be necessary to ship a tester to the factory or to a Supreme Service Station, the shipment should be made via Express — never via parcel post -- and a letter should be written and forwarded, separately, advising of the shipment and including complete instructions as to the desired handling and disposition of the merchandise; otherwise, the merchandise will be refused by the consignee.

If a separate letter is received by the factory, ahead of the tester's arrival, the proper acceptance forms will be made out by the factory, the tester will be received and usually repairs will be effected at once and the tester reshipped. If the tester is not within the 90 day guarantee period, repairs will be made up to \$5.00 without sending the user an estimate unless we receive specific instructions to send an estimate in any case. If the necessary repair charges total more than \$5.00, an estimate will be sent in any case, unless the factory has received specific instructions to repair the tester regardless of cost.

When the user sends his Registration Card to the factory within 10 days after receipt of the tester, he will be furnished with a pocket size "Guarantee Card" which should be included with the tester shipment to either the factory or an Authorized Service Station if the tester is still within the 90 day period.

When repairs are requested of the factory or a Service Station by a customer having a "Guarantee Card" and including same in shipment, and the guarantee is found to be still in effect, the factory or authorized Service Station will make the repairs in accordance with the guarantee policy herein stated and will return the tester to the user without charge with the exception of (1) an instrument rectifier replacement (instrument rectifiers are not guaranteed) and (2) transportation charges which must be borne by the customer.

Our Service Stations are not authorized to make no-charge repairs on Supreme testers unless the "Guarantee Card" (furnished the user by the factory upon the return of the User's Registration Card) accompanies the tester and the tester is returned before the expiration of the 90 day period.

All disputes regarding repair charges should be referred to the "Service Engineer" at the factory.

REPLACEMENT PARTS, ETC. If some part of the tester be damaged in service, or if the user should want to order circuit drawings, analysis charts, test leads, or other accessories, his order should be accompanied by a deposit amounting to not less

than fifty cents. Since an order amounting to less than fifty cents cannot be assembled, packed and shipped without financial loss, a handling charge may be made so as to make the order total fifty cents, including transportation charges. If an order be accompanied by a deposit which does not cover the cost of the merchandise and transportation charges, the shipment will be made via Express C.O.D. for the balance due. A list of replacement parts may be obtained upon request.

We do not recommend the installation of instrument rectifiers by the user as this invariably leads to difficulties with the factory. Servicemen do not have proper calibration standards by which the A. C. ranges can be recalibrated. Instrument rectifiers are very liable to damage by inexperienced repairmen and are, therefore, not guaranteed in any manner, even when new. Instrument rectifiers should be replaced by the factory or an Authorized Service Station.

GUARANTEE. The tester is not guaranteed unless the ownership thereof is properly registered. When the user registers his ownership of this tester within 10 days after he receives it he will receive, in return, a "Guarantee Card" stating that the tester will be guaranteed to be free from defects in material or workmanship. Any such defect in material or workmanship will be corrected, without charge, when the tester, together with the "Guarantee Card," is delivered to the Supreme Instruments Corporation, Greenwood, Mississippi or to any authorized Supreme Service Station, within 90 days after its

receipt by the user; provided that (1) the free repair or replacement of materials shall not include the cost of the installation of instrument rectifiers which are incapable of withstanding appreciable electrical overloads and are not, therefore, guaranteed by the manufacturers, and (2) the user accepts the obligation of the payment of all transportation costs involved in the corrections effected under the conditions of this guarantee policy, in accordance with the Standard practices of the Radio Manufacturers Association.

SUPREME INSTRUMENTS CORPORATION

GREENWOOD, MISSISSIPPI

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