

3. SERVICE OF THE 299

All electrical equipment requires maintenance. The 299 was designed to operate trouble-free for many years. Certain checks done at the end of every year, however, will help to keep the amplifier in good condition.

- A. Check the tubes, particularly those in the power output stage and the rectifier every year. If the tubes are outside the manufacturer's ratings or show gas, they should be replaced. Gassy tubes may damage other components of the circuit.
- B. When the amplifier is being checked yearly, clean the tubes of dust so that they may radiate their heat more effectively.
- C. If at any time the hum or noise increases noticeably, check the power tubes. This symptom is often an indication of gassy tubes. If both tubes check properly and the amplifier is without hum when the amplifier is disconnected, then check the amplifier. If the hum continues, have a service man check the amplifier.

NOTE: DO NOT USE TUBES OTHER THAN THOSE SPECIFIED FOR THIS AMPLIFIER, THE INTRODUCTION OF ANY UNSPECIFIED PART VOIDS YOUR WARRANTY.

- D. If the amplifier blows fuses frequently, have a service man check the amplifier. If no trouble is apparent, check the line voltage. Should the line voltage rise above 125 volts, drop the line voltage by means of an auto-transformer or place a voltage regulation transformer between the amplifier and the line.

NOTE: DO NOT USE FUSE SIZES OTHER THAN THE FUSE SIZE SPECIFIED. TO DO OTHERWISE MAY RESULT IN PERMANENT AND COSTLY DAMAGE TO THE AMPLIFIER IF THE FUSE IS TOO LARGE AND WILL REQUIRE FREQUENT REPLACEMENT OF FUSES IF THE FUSE SIZE IS TOO SMALL.

E. Power Tube Bias Control:

This control is located on the rear apron of the amplifier. To adjust the control, uncover the bottom plate of the amplifier; place a DC Voltmeter across filter resistors R209 and R210, two 330 ohm 10 watt wire wound resistors connected in parallel; and adjust the control until the voltage across the resistors is 24.5.

F. DC Balance Controls:

These controls should be adjusted when the power tubes age or are replaced. Their locations are between the power tubes on the top of the 299 chassis. To set these controls use the following procedure:

- (1) Connect a DC voltmeter whose minimum range is 1 volt full scale between both plates of the power stages.
- (2) Adjust the DC Balance Potentiometers for minimum reading on the DC voltmeter.

G. AC Balance Controls:

These controls should be adjusted when the power and phase inverter tubes age or are replaced. They are located to the rear of each phase inverter tube on the top of the 299 chassis. To adjust them, use the following procedures:

Two methods for setting the control will be described. The first method, which makes use of tools that are available to the ordinary service man, is less accurate than the second method, which makes use of equipment that is found only in complete electronics laboratories. The difference in accuracy between the two methods is very small, but it may be significant for some laboratory measurements.

FIRST METHOD

A. Equipment Necessary

1. Low distortion audio oscillator, sine-wave. Note: Many oscillator kits are apt to have high distortion.
2. Resistive load of proper value (for instance, 16 ohms for the 16 ohm tap) and wattage. Note: Many commercial wirewound resistors have considerable residual inductance; care must be taken to avoid these.
3. Oscilloscope. Note: Many oscilloscope kits have nonlinear sweep circuits and are apt to give distorted displays.

B. Procedure

1. Connect audio oscillator to proper input jack. On the complete amplifiers a high level input is normally used. There are two reasons for this: First, the frequency dependent of the recording equalizer circuits are avoided; second, better distortion measurements can be made with the lower noise level available. Connect audio oscillator to the 0.5 volt input in the power amplifiers.
2. Adjust all tone controls to their FLAT position; all rumble and scratch filters, including the dynaural, OFF; and the loudness volume control to VOLUME.
3. Turn the loudness control on complete amplifiers or the level control on power amplifiers to their maximum position.
4. Turn dynamic power monitor (where included) to OFF, and set damping control (where provided) to normal operating position.
5. Connect resistive load to proper output terminals, and connect the oscilloscope input in parallel. Note: Make sure the oscilloscope ground is properly oriented. (See Figure 5.)
6. Turn all equipment on.
7. Set audio oscillator to frequency desired if the amplifier is to be used at a fixed frequency. Otherwise, set the audio oscillator to 1000 CPS.
8. Increase the output of the oscillator until the sine-wave just begins to clip. (See Figure 6.) With screwdriver, adjust balance control

until clipping is symmetrical; that is when equal amounts are clipped off the top and bottom of the wave peaks. It may be necessary to increase the output slightly as the balance control is adjusted.

Note: Do not overdrive the amplifier so that it clips most of the sine-wave; this adjustment should be done with the barest amount of slipping.

9. This completes the adjustment. If the clipping cannot be made symmetrical, check the output tubes in a transconductance tube tester. They may be seriously unmatched.

SECOND METHOD

A. Equipment Necessary

1. Low distortion audio oscillator, sine-wave, whose distortion characteristics are at least five times better than the distortion level being measured. 1/20 per-cent distortion or better is required.
2. Resistive load of proper value (for instance, 16 ohms on the 16 ohm tap) and wattage. Note: Many commercial wirewound resistors have considerable residual inductance.
3. Wave analyzer whose characteristics are at least five times better than the distortion level being measured. 1/20 per-cent distortion or better is required.

B. Procedure

1. Connect audio oscillator to proper input jack. On the complete amplifiers, a high level input is normally used. There are two reasons for this: First, the frequency dependent of the recording equalizer are avoided; second, better distortion measurements can be made with the lower noise level available. Connect to the 0.5 volt input in the power amplifiers.
2. Adjust all tone controls to their FLAT position; all rumble and scratch filters, including the dynasural, OFF; and the loudness-volume control to VOLUME.
3. Turn the loudness control on the complete amplifiers or the level control on power amplifiers to their maximum position.
4. Turn the dynamic power monitor (where included) to OFF, and set damping control (where included) to normal operating position.
5. Connect resistive load to proper output terminals, and connect wave analyzer in parallel. Note: Make sure the distortion meter ground is properly oriented.
6. Turn all equipment on.
7. Set audio oscillator to frequency desired.

8. Set output of audio oscillator for power level desired from amplifier taking care that the amplifier is neither overloaded nor is the signal level so low that the noise interferes with the measurements. Adjust the balance control for lowest second harmonic indicated on the wave analyzer. Best power rating for adjustment is usually about three quarters of rated power.