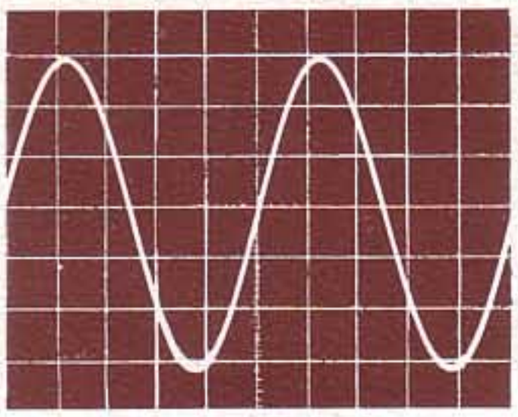
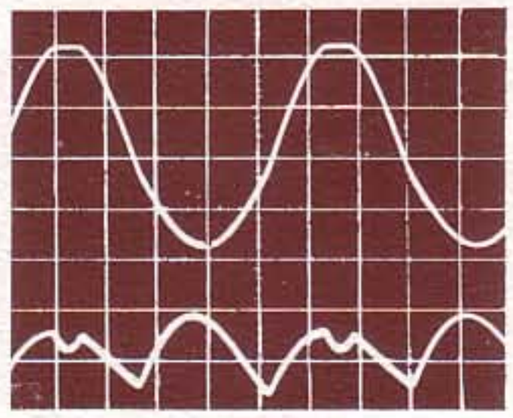
The AMPLIFIER TEST CLINIC



Originated in 1962 to help you better understand your amplifier.



This graph is important to you. It shows valuable information showing the general condition and ultimate capabilities of your amplifier.

HOW THE TEST IS DONE:

Your amplifier was tested for total harmonic distortion at its maximum useable continuous power output. Amplifiers are tested with all channels operating simultaneously. If your amplifier did not reach advertised power, it was tested at a lower power. This distortion measurement was made with audio frequency tones from the low bass to very high treble. The amount of distortion tells how much your amplifier changes the music you hear.

WHY THIS KIND OF TEST IS USED:

Many tests are possible. Total harmonic distortion is the single most revealing test since it covers all audio frequencies, and is essential to locating and solving problems in an amplifier.

HOW DISTORTION AFFECTS YOUR MUSIC:

HIGH FREQUENCY DISTORTION causes listener fatigue and harshness of sound.

LOW FREQUENCY DISTORTION causes bass instruments to lack clarity, definition and fullness.

SOME TYPICAL CAUSES OF HARMONIC DISTORTION:

HIGH FREQUENCY DISTORTION in a transistor amplifier is usually caused by inability of the transistors to switch on and off fast enough. In a tube amplifier high frequency distortion can be caused by an inadequate transformer design.

LOW FREQUENCY distortion in a transistor amplifier can be caused by inadequate power supply capacitors. At low frequencies, power supply capacitors are asked to provide current over a relatively long time period. If the capacitors are of inadequate size they will run out of charge part way through the cycle. Once this charge depletion occurs, there is an abrupt power supply voltage change, causing all frequencies to be distorted. In a tube amplifier low frequency distortion can be caused by inadequate output transformer size.

THE TESTING PROCEDURE

1. Your amplifier's tone controls are set to flat, the balance is set in the middle and the volume or gain is set to maximum.

2. The audio outputs of each channel are connected to isolated precision load resistors. 4, 8, or 16 ohms is selected to represent the impedance of your speakers.

3. Power line voltage maintained at 120 volts is applied to your amplifier by a high power variac.

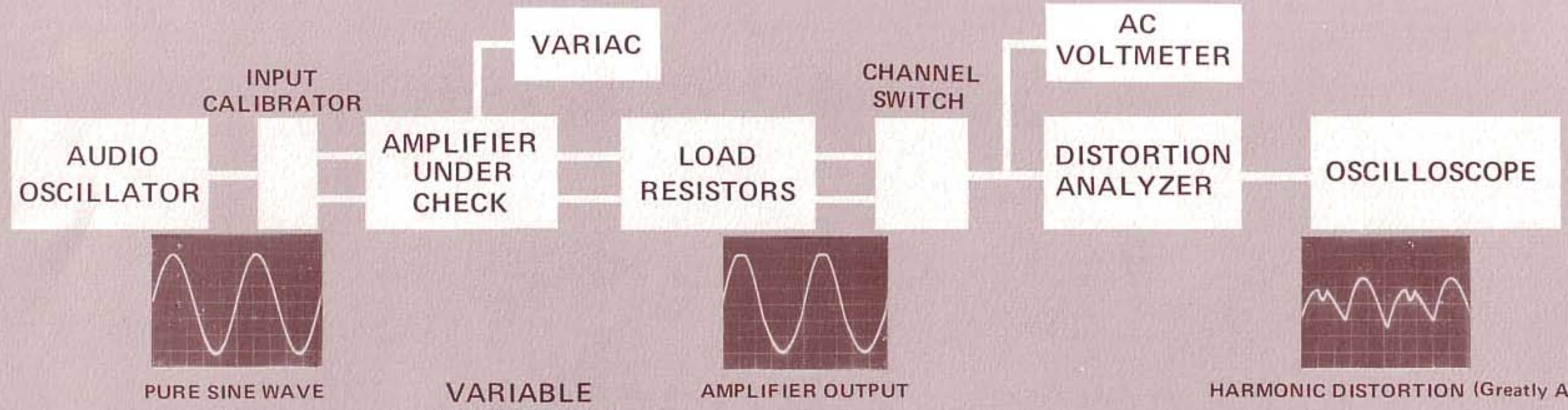
4. The outputs from the audio oscillator are connected to the inputs of your amplifier. Phono inputs cannot be used since only inputs without frequency equalization produce valid results.

5. The oscillator is set to 1000Hz. The output level of the oscillator is increased until visible distortion or clipping of the amplifier output wave form is observed on the oscilloscope. The test is then run at a reduced output just below the visible distortion point, or at rated power, whichever is lower.

6. All channels of your amplifier are driven simultaneously. The amplifier outputs are sampled, one channel at a time, by a harmonic distortion analyzer and oscilloscope. The analyzer, by means of variable filters, removes all output of the original test frequency. All remaining signals are measured and displayed as total harmonic distortion, since they appeared in the amplifier output but were not present in the original test signal. The test is usually performed at 20 Hz, 1000 Hz, and 20,000 Hz. Additional test frequencies are used when required for the most accurate and correct graphical representation.

7. The distortion measurements are then plotted on a graph of distortion versus frequency.

OUR TEST GEAR AND WHY WE CHOSE IT



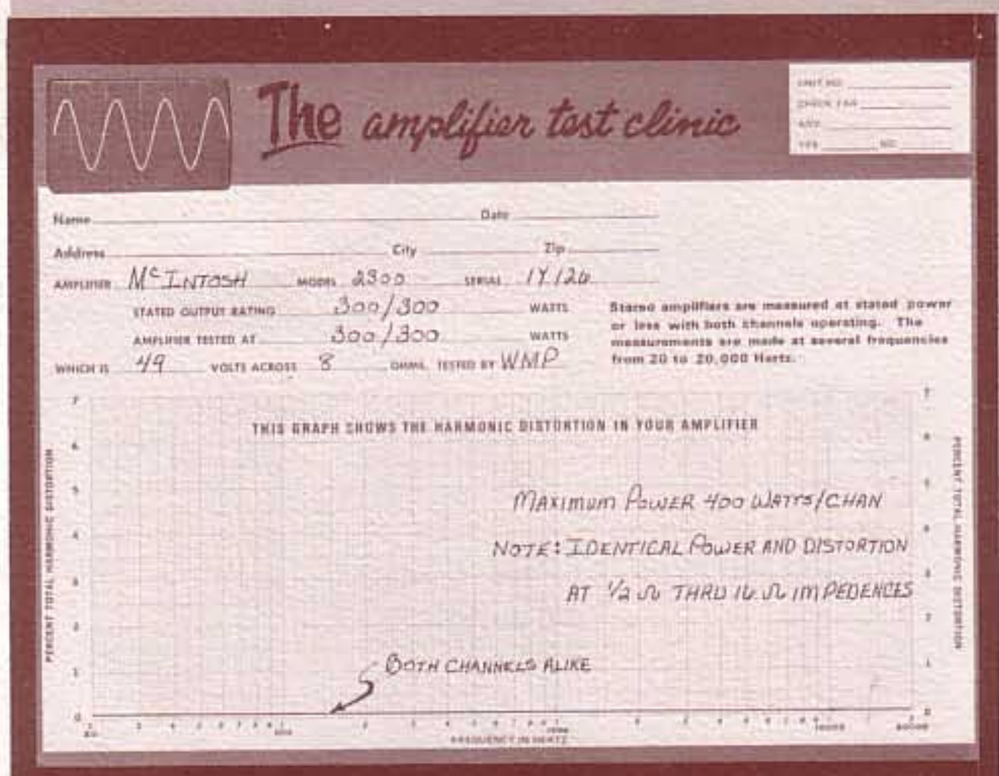
	AUDIO OSCILLATOR	INPUT CALIBRATOR	VARIABLE POWER LINE AUTOTRANS FORMER	LOAD RESISTORS	AC VOLTMETER	DISTORTION ANALYZER	OSCILLOSCOPE
TYPE	Hewlett Packard 200-CDH20	Bourne's 10-turn helical pots	General Radio W10MT3W variac	Eight Precision Ward Leonard 100 Watt non-inductive resistors.	Hewlett Packard 400-E	Hewlett Packard 333-B	Hewlett-Packard 120-B
USE	Introduces sine wave test signal to amplifier	Provides adjustable left and right input signals	Maintains 120 volts line voltage to unit	Simulates speakers with resistive loads	Measures A.C. output from power amp which is converted to power output by $P=E^2/R$*	Measures extraneous harmonic component in output signal, calibrated in total harmonic distortion.	Displays output of distortion analyzer. Shows output of amplifier or distortion components
REASON FOR SELECTION	Reliably low distortion signal with dependable operation under heavy usage including frequent shipping. Typical distortion: .025% 100 Hz to 20 kHz; .035% 20 Hz -100Hz.	Extreme accuracy in adjustment of input levels to amplifier	Corrects line voltage as low as 104 volts back to 120 volts with maximum wave distortion of 1.4%. (EIA standard is 2% allowable)	Constant load over entire frequency spectrum with power handling capability of 400 watts per channel	Extreme accuracy and reliability under heavy usage including frequent shipping. Accuracy: ± 1% full scale; 40 Hz to 1 MHz.	Extreme accuracy and reliability under heavy usage including frequent shipping. Measurement capability: .01% harmonic content	Extreme reliability under heavy usage including frequent shipping. Has large high intensity screen.

*$P=E^2/R$ P= Amplifier output power in watts

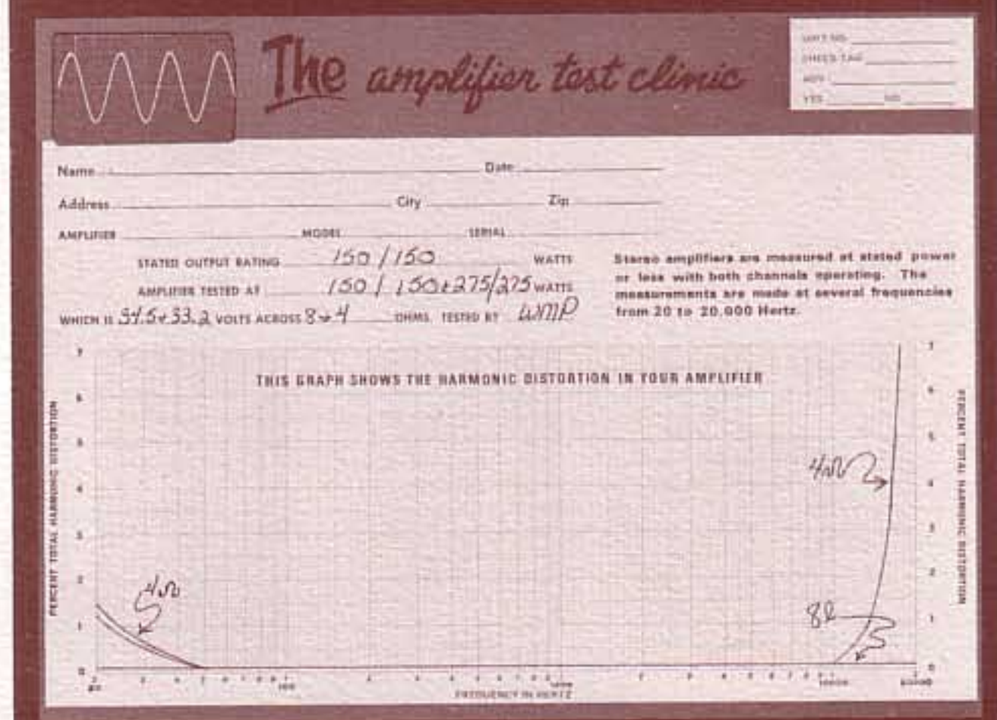
E= Amplifier output RMS voltage

R= Speaker or load impedence in ohms

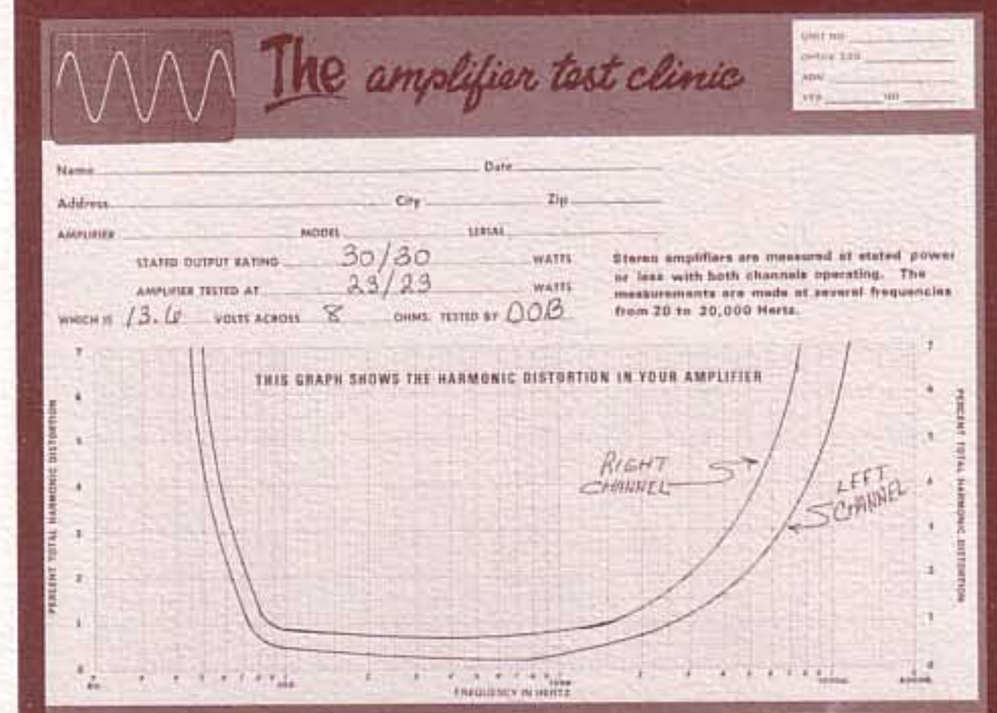
An Ideal amplifier.



A high powered direct coupled transistor amplifier with low distortion at 8 ohms but high and low frequency distortion at 4 ohms.



A medium priced transistor amplifier showing power supply and output coupling capacitor limitations at low frequencies, and transistor limitations at high frequencies.



A moderately priced tube amplifier before and after replacement of tubes.