



NILES®

TECH SUPPORT

W H I T E P A P E R R E P O R T

**How Loudspeakers Can Be Damaged By
Too Little Amplifier Power**

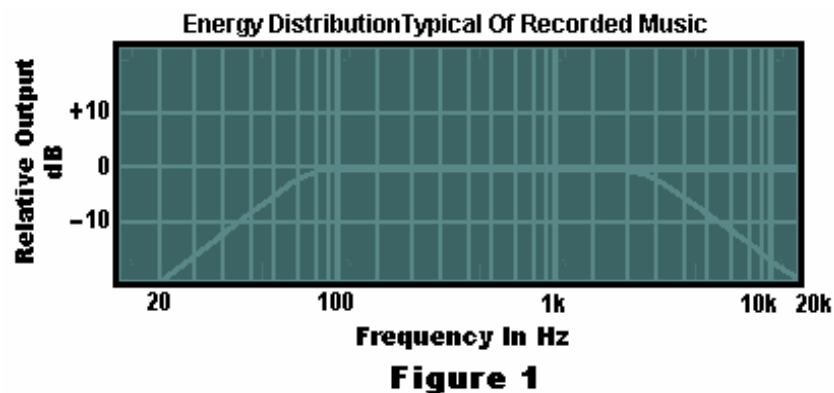
Why Too Little Amplifier Power Can Be As Harmful As Too Much

We occasionally hear of Niles® equipment owners who damage their loudspeaker systems or speaker selection systems using amplifiers rated at less, rather than more power output than is recommended. Understandably, they often find it difficult to understand how such an amplifier could damage their Niles loudspeakers when the amplifier's power rating falls within the recommended power handling specifications of the speakers. In order to fully understand this, it is necessary to understand the nature of music as it relates to amplifier power and distortion.

The Nature of Music

Not all musical notes are created equal. There is much more power in the lower registers of music than in the midrange and treble. As shown in Figure 1, the energy content of treble frequencies is typically 10 to 20 dB less than bass and midrange frequencies. Therefore, even if we allow for 10 dB peaks in high frequency program material, which is common, the high frequency drivers of a system will be called upon to handle only about one-tenth the power that the low and midrange frequency components must sustain.

This natural distribution of musical energy works to our advantage. It means, for example, that a loudspeaker system capable of handling 100 watts should have a tweeter capable of handling 10 watts. Thus, if the tweeter is designed to handle 20 watts of power, there is a 100% safety factor built into the high frequency component of the loudspeaker. The result is that the capabilities of the components of the loudspeaker system parallel the natural energy distribution of music shown in Figure 1.



The Nature of Amplifier Power

The power output specification of an amplifier is not an absolute. Under certain operating conditions the amplifier can exceed its advertised output. If asked to produce more power, the amplifier will do so, but at much higher distortion levels. For example, an amplifier rated at 10 watts could be overdriven to produce 20 watts of output power. Under the same circumstances, an amplifier rated at 20 watts could deliver 40 watts of power to the loudspeakers. A 35-watt amplifier could produce 70 watts and a 50-watt amplifier could be overdriven to deliver 100 watts. The additional power generated by overdriving an amplifier is rich in harmonics (distortion) and can be very damaging to loudspeakers and other components.

Here's What It Looks Like On A Scope

When a sine wave test signal (a signal consisting of a fundamental frequency without overtones or harmonics) is displayed on the screen of an oscilloscope, its top and bottom extremes will exhibit normally rounded contours as shown in Figure 2.

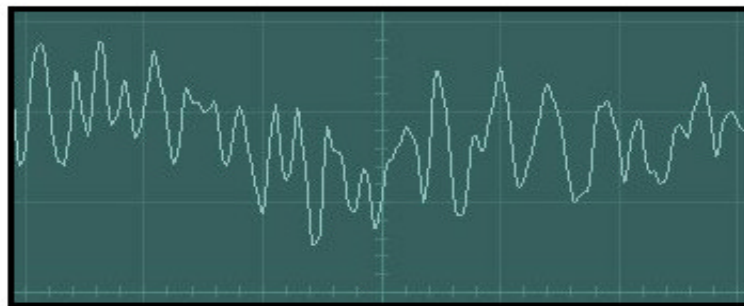


Figure 2

When an amplifier is overdriven, the contours are "clipped" off, producing a near square wave, having flat areas at the top and bottom limits, in which the average power approaches the peak power. This can be seen in Figure 3.



Figure 3



What Are The Consequences?

When this occurs, up to twice the amplifiers rated output can be delivered to the loudspeakers as well as other components, which may not be capable of handling the abnormal load. When loudspeakers are unable to reproduce the distorted or "clipped" waves they can be easily damaged. An amplifier with a higher power rating, however, can generate the required power levels without clipping, allowing the loudspeakers to receive programming material containing the normal distribution of energy levels. Under these conditions, damage to the loudspeakers or other equipment is unlikely.

What Can The User Do?

There are no hard and fast rules. Very few amplifiers have meters that are capable of accurately indicating when an amplifier is being overdriven to the point that it could cause damage to loudspeakers. Relying on the position of the volume control offers no better guarantees as half of a rotation often produces considerably more or less than 50% of the amplifiers power. While there are no absolutes, following a few simple guidelines can certainly help.

Dos And Don'ts

1. Do purchase an amplifier that will provide more power than you will actually need. If the amplifier has enough reserve power, it is unlikely to damage loudspeakers due to distortion.
2. Do exercise caution. Avoid turning on the system when the volume control is excessively high or playing the system loudly with excessive bass boost.
3. Don't drive an amplifier into clipping. Clipping sounds like a phonograph stylus mistracking, and can occur on loud passages when the system is played at high volume levels. If clipping occurs, reduce the volume or install an amplifier that can provide the required power without distortion.
4. Don't make or break connections to the amplifier while it is operating. Inserting connectors into, or removing them from an amplifier, preamplifier, or receiver while it is operating can momentarily produce a loud buzz and quickly damage loudspeaker components.

Summary

Niles loudspeaker systems are efficient and will produce reasonable listening levels with very little amplifier power. However, a small amplifier should not be driven to the point of distortion in order to achieve desired listening levels. It is always better to select an amplifier with a power rating that is greater than the maximum power that will be used. The margin of reserve power will ensure that the amplifier will not attempt to deliver more power than its design allows. This will result in distortion free sound reproduction and virtually unlimited loudspeaker life.

