

Why simple wattage specifications are of no use to you

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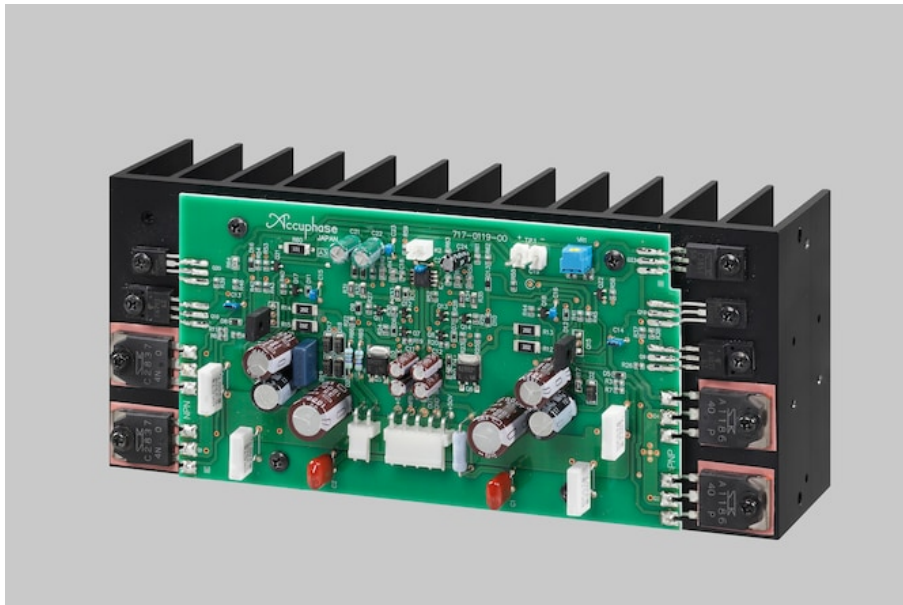
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Few specifications in high fidelity are surrounded by as much nonsense, half-truths and myths as power specifications in watts. How loud and how well you can listen to your favorite music has nothing to do with brochure show-offs and boring data sheets. An excursion into the swampy terrain of watts and volume.

"This is a 100-watt speaker" boasts the Internet site, the brochure or the seller. If you're smart, you'll get out of the game here, because the slogan is complete nonsense. At least when it comes to normal hi-fi speakers. And even more so if it's supposed to say something about the possible volume at which you can listen to music at home."

Watt is the physical unit for power. However, in more than 90 percent of all cases, hi-fi speakers are passive speakers, which means that they do not produce power, they need it. The power is supplied by the amplifier or its power amplifiers. They breathe life into the speakers. Here, statements like "100 watts per channel" are at least no nonsense, but possibly come closer to reality. But in reality, the wattage specification of an amplifier unfortunately has little to do with what actually comes out of your speakers.



Power amplifier for one channel of a integrated transistor amplifier: the large power transistors are mounted on heat sinks, just like their drivers, because they can get very warm. Source: Accuphase

Interaction between amplifier and speakers

How loud you can listen to your favorite music depends on the interaction between loudspeaker and amplifier. There are active loudspeakers that contain the power amplifiers - often several, for example for bass, midrange and treble. One can assume that both are perfectly tuned to each other and that protective circuits protect the components inside. But in high fidelity, active loudspeakers are still the exception. Where they are the rule, for example in the computer sector as desktop boxes or in the Bluetooth mobile world as portable squawkers, they usually sound far from high fidelity.

So let's talk about the normal high-fidelity case, i.e. the relationship between amplifier/power amplifier and loudspeaker. This relationship is more complex than two wattage numbers could grasp. Above all, they have almost nothing to do with the amount of noise you can make without endangering your hearing and equipment.

The efficiency of the loudspeaker, on the other hand, is crucial. It tells you how much level results from one amplifier watt. One speaker may only need one watt for a bass drum kick at stomach massage volume, but another may need 1000 watts or more.

Loudspeakers are completely different food processors depending on construction, equipment and wiring. The efficiency in percent indicates how much of the supplied electrical power of the amplifier is converted by the speaker into audible sound. Beware: Most electrodynamic loudspeakers have an efficiency of 3% to 5%. This means that the amplifier uses a large part of its power for nothing. More precisely: for heating up the components in the loudspeaker.

This information is seldom or never found in brochures. Instead, reputable manufacturers take a measurement in the room. How much sound pressure in decibels (dB) does a loudspeaker produce at a power input of 1 watt, measured at a distance of 1 meter. The unit of measurement here is dB/W/m.

Cause and Effect

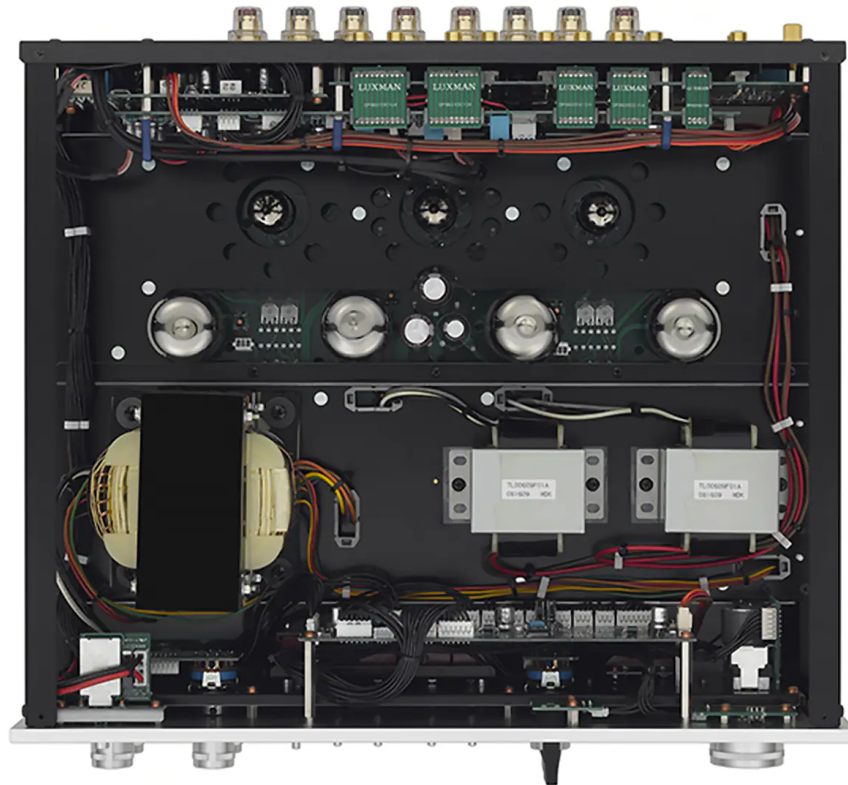
If a loudspeaker has a high efficiency, it will produce a higher volume than a loudspeaker with a poor efficiency. A quite low efficiency is about 78 dB/W/m, a quite high efficiency 94 dB/W/m. Here, 10 dB plus means a doubling of the subjectively perceived loudness. And for this, every sound transducer needs ten times the electrical power. If a loudspeaker has an efficiency of 80 dB/W/m, it needs 10 watts for a hi-fi level of 90 dB, 100 watts for a level of 100 dB and 1000 watts for a peak of 110 dB. In the above example, the speaker with the poorer efficiency needs about 26 times as much power to play just as loud. In particular: the speaker with good efficiency needs only 4 watts for 100 dB, the one with poor efficiency 106 watts. You see: A simple wattage specification for loudspeakers is useless.

Why are there still pure wattage specifications for passive loudspeakers? This has a little to do with hi-fi history. Audio technology was (and to some extent still is) about the power handling of loudspeakers. It indicates how much power in watts an amplifier can send into the loudspeaker without exceeding a certain degree of distortion, or without thermally destroying the loudspeaker or its tweeter. This is a matter of continuous/rated power handling and peak/pulse or music power handling. Nowadays the power handling is only a theoretical value, because the drivers can withstand much more. Above all, weak amplifiers endanger the loudspeaker more than strong ones, as strange as that may sound.

Hazard Pay

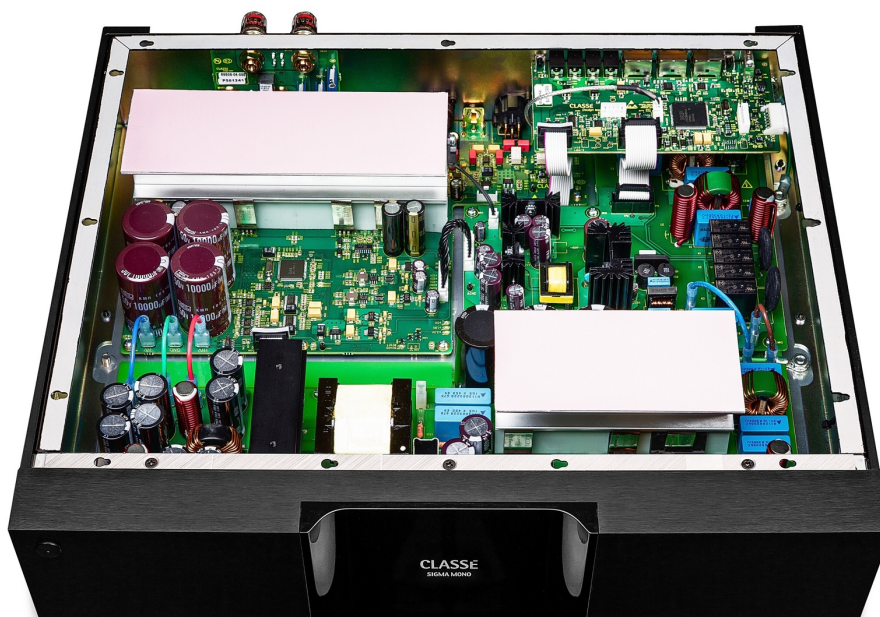
What was that? More powerful amplifiers endanger loudspeakers less than weaker ones? Yes. Weak-bodied amplifiers are prone to clipping, or severe distortion when overloaded, and that's much more damaging to tweeters than a slight overdose of power. 10 distorted watts sound much worse than 100 undistorted watts.

More specifically, amplifiers are all about stability. Electrical power is the product of voltage and current. So a loudspeaker never does a power amplifier the favor of loading it with a certain electrical resistance value. The lower the resistance drops, the more current the power amp has to supply to maintain power. And then you add in nasty things like phase rotation - it's complicated.



In tube amplifiers, the tubes must not be covered under any circumstances, they need to have space for their heat emission. The four power tubes can be seen well, the fat cylinders. Source: Luxman

Switching amplifiers, often wrongly called "digital amplifiers", are currently in vogue. They are just overcoming their teething troubles and are being used more and more in high-fidelity applications. Here, in this context, it is important that they can generate very high power with far fewer losses than transistor and even more so tube amplifiers. The losses of the latter manifest themselves in strong heat development. But regardless of this, most modern, competently built amplifiers today have protective circuits embedded in them, which on the one hand protect them from their own thermal death, but on the other hand also shield the loudspeakers from abuse.

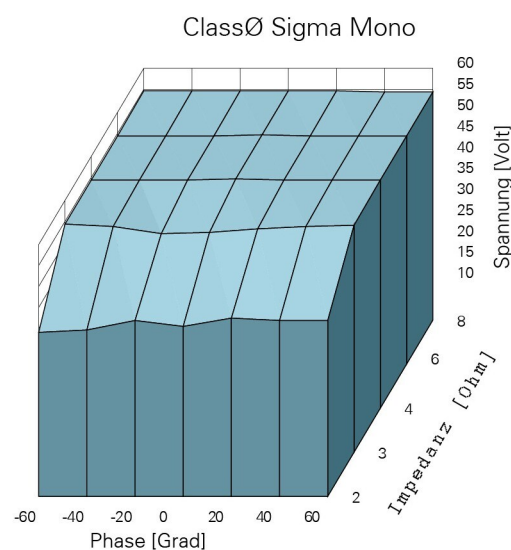


Inner workings of a switching amplifier: it generates its power without a gigantic power supply and large transistor banks. Source: Classé Audio

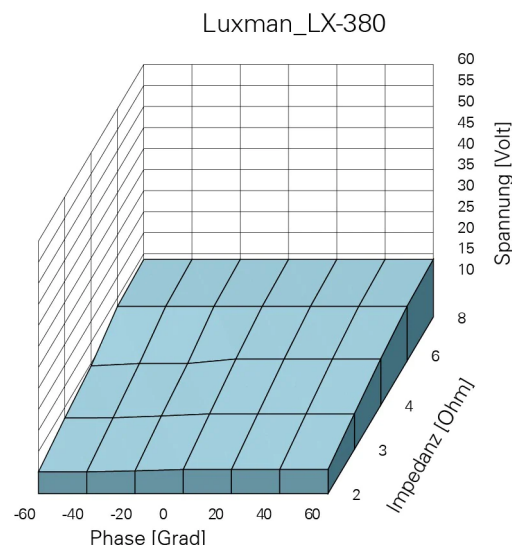
The power of an amplifier, i.e. the product of voltage and current, depends on many factors. The supposedly precise specification "x watts at x ohms" is after all an approximation to the grim reality of the relationship with the loudspeaker.

The more important criterion stability describes the ability of a power amplifier to deliver current even to very "difficult" loudspeakers. Physically correct: To be able to maintain the output voltage at very low ohmic loads of less than 2 ohms or phase rotations between voltage and current of loudspeakers/crossovers of up to 60 degrees caused by inductive or capacitive loads. The load stability depends mainly on the design/dimensioning of the power supply and on the current stability of the output transistors or the output tubes. In this respect, extremely good power amplifiers can deliver an output of 40 volts in a stable manner even at 2 ohms and 60 degrees of phase rotation.

For this purpose, the HiFi magazine "AUDIO" years ago developed the stability diagram often incorrectly referred to as a "cube". It indicates the stability of a power amplifier in three dimensions: The higher and flatter the level of the measurement, the more powerful and stabler the amplifier. However, this says nothing about the sound. Weak tube amplifiers can sound better with high efficiency speakers than power monsters with normal speakers.



Stability diagram of a very powerful amplifier: At 8 ohms it delivers almost 55 volts, stable up to 3 ohms. Even at 2 ohms with 60 degrees phase rotation it still delivers 40 volts. Source: AUDIO



Stability diagram of a rather weak tube amplifier: No more than 15 volts are available. Source: AUDIO

How many watts do I need?

Although the relationship between speakers and amplifiers is complicated, there are a few simple rules of thumb.

- 1) If you don't listen louder than upper room level, you don't need to worry about the wattage of normal speakers and amplifiers.
- 2) If you like to turn up the volume, buy a really strong and stable amplifier first. Review magazines that don't just talk about sound, but also publish proper measurements can be helpful. If you can't get such results, the information in brochures can help at least a tiny bit. Make sure that the specified power at 4 ohms, if possible even 2 ohms is higher than that at 8 ohms - This will give you an idea of the stability. Better 100 than 10 watts, but whether it is 160 or 150 watts doesn't matter.
- 3) Are you a friend of loud levels, but don't want to spend as much on the hi-fi system as on a small car? Then pay attention to the efficiency. Reviews can also help here. If you don't have any at hand: Product specifications for efficiency, if available, should indicate 90 dB/W/m or higher.

The most important tip, however, is still: Have a listen. After all, wattage numbers tell you nothing about the sound quality.



Some amplifiers offer connections for speakers with different nominal resistance, here 2 ohms, 4 ohms and 8 ohms. This can help. Source: McIntosh