Technical note

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Damping factor

The damping factor is determined by the quotient of the speaker impedance and the output impedance of the amplifier. To state the damping factor figure of an amplifier is meaningless, as the speaker impedance's varies with the frequency and the various types and brands of loudspeakers existing.
The figures of the true damping factor are only valid for a specific amplifier/ loudspeaker combination. This fact gives one of the reasons why Lab.gruppen don't publishes the damping factor figures.
The only figures that are relevant for amplifiers are the output Impedance figures. Most amplifiers on the market only show low output impedance (or high damping factor) at low frequencies and high(er) at high frequencies. This is due to the improper design of the output network and/or frequency dependent feedback. Lab.gruppen design has the feature to have nearly constant impedance over the audio frequency band with a value of 0.05 to 0.07 ohms (50-70 mohms) . This causes less coloration.
Another feature of the power supply in the fP 2200 - fP 6400 (thanks to the stabilised power supply), is that the output impedance doesn't rise during clip situations. In most conventional amplifiers the impedance rise 10 or l00 times during clip. That causes uncontrolled movements of the speaker-cone.
The conclusion must be that the Lab.gruppen switch mode power supplies sound better or have better definition, especially in the bass region, compared to conventional designs.

Damping factor influences on active and passive frequency divided loudspeakers

Another reason not to publish the damping factor is that it's not relevant to the audio quality of the power amplifier. For example; a professional loudspeaker driver has a DC-resistance between 2 and 5 ohms, which is connected in series with the driver in the equivalent circuit diagram of the driver. In this case, the damping factor has more to do with the speaker itself than the amplifier, as the speaker driver is connected directly to the power amplifier just as in an actively divided system (see example below).
In a passively divided speaker system the filter network circuit are placed between the power amplifier and the speaker driver. In this case, however, the filter impedance determines the damping factor of the speaker driver. The output impedance of the power amplifier can influence the characteristics of the filter response, but it's not sure that a lower impedance (higher damping factor of the power amplifier) will give a better response. A classical example is the tube amplifier, which has relatively high output impedance and which gives a very good sonic result in most cases.

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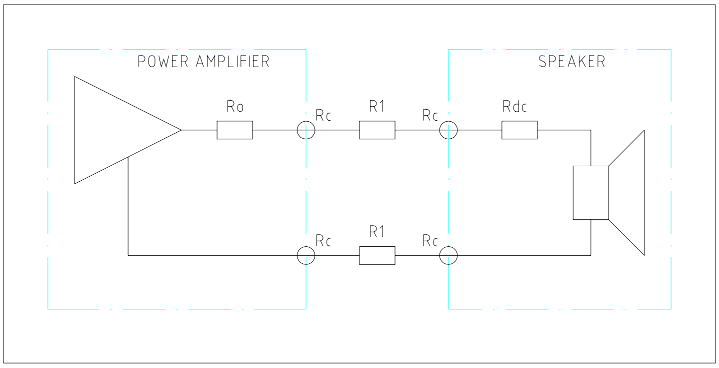

Example of total resistance between power amplifier and loudspeaker.

Ro = 0.01 – 0.1 Ohm	Output impedance for damping factor between 100 – 1000
Rc = 0.01	Connector resistance
Rl = 0.07 Ohm	Copper wire 10m long and 2.5mm^2 area
Rdc = 2 – 5 Ohms	Loudspeaker driver, Dc-resistance

<u>Calculation of total resistance between power amplifier and loudspeaker:</u>

Rtotal = Ro + 4 Rc + 2 Rl + Rdc

With values from above: Rtotal max = 5.28 Ohms Rtotal Min = 2.12 Ohms

Damping factor will vary between 8/5.28 = 1.51 and 8/2.12 = 3.78 i.e. in reality 2.5 times!

Conclusion

The conclusion must be that it's not necessary to keep the output impedance at an extremely low level, but to keep it constant for all audio frequencies and at all output levels, including clip level, to get a tight control over the speaker movement. The total DC-resistance between the power amplifier and the driver (including connectors, wiring and filter) shall be kept at least 10 times lower than the DC resistance of the loudspeaker driver. This will also make sure that the frequency response of the loudspeaker, will not be influenced by its impedance vs. frequency curve.

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