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## Why do some AC adapters and power supplies generate a whining noise, and what can I do about it?

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I have many different AC adapters and power supplies for a variety of devices, ranging from small 5V/1A USB chargers to laptop power adapters and desktop PSUs. However, I often hear a whining noise from some of these power supplies. This happens most often when they are not connected to a device or otherwise in use, and stop making noise when I connect a load to it such as by plugging in a device that is not fully charged.

Why do some AC adapters and power supplies make this whining noise? Why do some *not* make this noise? Is there anything I can do to suppress it?

power-supply noise charger community-faq-proposed

edited Oct 28 '14 at 16:02

bwDraco  
24k ● 24 ● 94 ● 128

asked Oct 27 '14 at 20:36

Rishat Muhametshin  
480 ● 1 ● 5 ● 8

It sounds some of these chargers are just cheap, the noise, means their output isn't "clean" – Ramhound Oct 27 '14 at 20:41

1 [en.wikipedia.org/wiki/Magnetostriction](http://en.wikipedia.org/wiki/Magnetostriction), [en.wikipedia.org/wiki/Coil\\_noise](http://en.wikipedia.org/wiki/Coil_noise) (I'll be writing a full answer shortly) – bwDraco Oct 27 '14 at 20:59

I have a AA battery charger I bought from SparkFun. It makes this very low—but perceptible—buzzing noise that drives me nuts. Not sure what causes that but I do know I just use it as a backup charger now since the noise is quite distracting. [sparkfun.com/products/retired/10052](http://sparkfun.com/products/retired/10052) – JakeGould Oct 27 '14 at 21:12

I've edited the question to expand the scope to computer power supplies to ensure that it is on topic for Super User. – bwDraco Oct 27 '14 at 21:49

3 @Ramhound Audible noise from a power supply does not imply noise in the electrical output. – Andrew Medico Oct 28 '14 at 3:40

### 5 Answers

Most power conversion devices contains coils, such as transformers or inductors. These components use electromagnetism to convert AC mains power to low-voltage DC power. The varying magnetic fields generated by these components can cause them to physically vibrate at high frequency, resulting in a high-pitched noise.

Most modern AC adapters are [switched-mode power supplies](#). The internal switching frequency of an SMPS is typically low when unloaded and increases with load up to a certain point depending on the design. The no-load frequency is often low enough to be within the human hearing range. In addition, in low or no-load situations, the [PWM](#) used to regulate voltage at the [inverter stage](#) will be at a low duty cycle creating a "spikey" output profile which is more prone to causing vibration in coils, and the transformer itself will tend to vibrate as well (see Daniel R Hick's answer below for more details). Together, these can lead to audible noise especially in cheaper units which fail to suppress this noise.

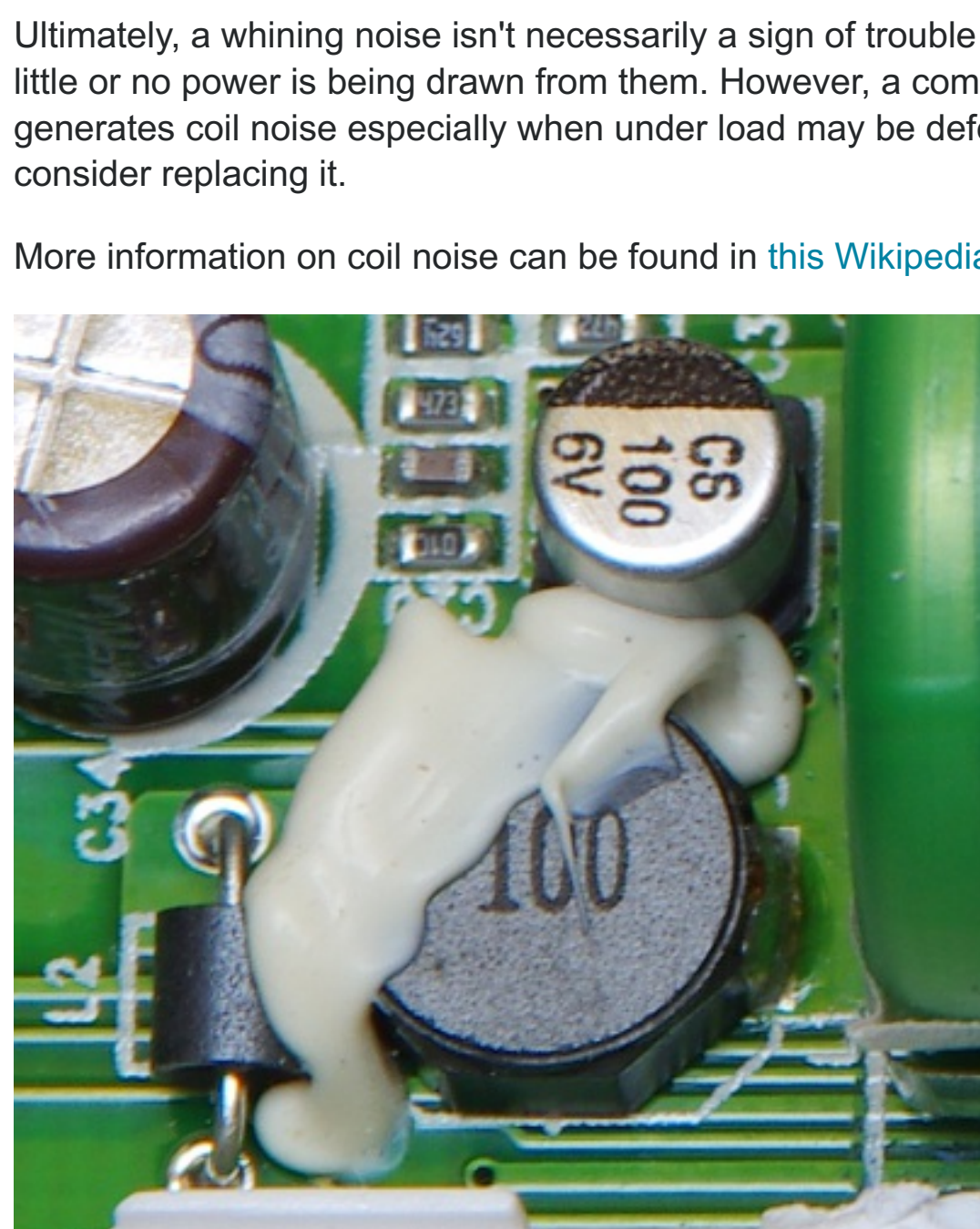
Under load, a properly functioning SMPS should operate at a frequency well above the human hearing range, typically 50 kHz or higher (although some older designs operate at 33 kHz). However, the same noise can occur under load with a poorly designed or defective power supply as the coils may vibrate under electrical stress at a [subharmonic](#) frequency.

Coils used as inductors or transformers in other electronic devices, including those on motherboards, graphics cards, or other computer components, can also vibrate during operation. As such, a defective device can generate audible coil whine during operation.

This is why you sometimes see weird gobs of glue on coils inside electronic devices. The glue helps reduce the vibration and noise the coils generate during normal operation. It is entirely possible for users to apply glue onto coils using a glue gun to suppress coil whine, and people have successfully done so on their computer parts. However, you generally can't do this easily on small wall chargers of the sort you mentioned without risking damage to the charger or exposure to potentially dangerous voltages.

Ultimately, a whining noise isn't necessarily a sign of trouble in cheaper wall chargers when little or no power is being drawn from them. However, a computer PSU or laptop charger that generates coil noise especially when under load may be defective and you may want to consider replacing it.

More information on coil noise can be found in [this Wikipedia article](#).



edited Feb 19 at 18:04

answered Oct 27 '14 at 21:22

bwDraco  
24k ● 24 ● 94 ● 128

You need to elaborate on the "unloaded power supply" aspect, and how that correlates to the OP's observations. – sawdust Oct 28 '14 at 0:09

@sawdust: I'm not too familiar with how switched-mode power supplies work, so I'll need some time to research the topic. – bwDraco Oct 28 '14 at 0:49

6 No, I was not asking for technical details. I meant that the phrase "unloaded power supply" could mean nothing to a layperson. "Unloaded" is what happens when "plugged in but not connected to a device". – sawdust Oct 28 '14 at 0:54

2 Your first sentence isn't quite true, but close enough! – Jason C Oct 28 '14 at 4:48

1 @JasonC: Addressed. – bwDraco Oct 28 '14 at 11:04

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A "switching" power supply (like virtually all modern computer power supplies) works by "rectifying" the incoming 120V 60Hz (in the US) AC power into DC (at around 170 volts), "filtering" with capacitors, then using a semiconductor circuit to "chop" the DC voltage around 1000 times a second to turn it back into crude AC. (What's referred to as a "square wave", vs the "sine wave" of ordinary AC.) This "chopped" voltage then runs through a transformer to produce the desired output voltages. The outputs are again rectified to DC and filtered, to produce the desired voltages for the computer.

With this scheme, basic voltage regulation is performed by adjusting the "duty cycle" of the chopped voltage. When the power supply is lightly loaded the circuitry doesn't produce a nice symmetrical "square wave" but instead a series of narrow spikes, and that "spikey" waveform is more likely to produce annoying audible noise in the transformers and other components and is also more likely to produce "electrical noise" that you would, eg, hear in a nearby radio.

Additionally, when a power supply is lightly loaded more of the magnetic field inside a transformer escapes to the case of the transformer and to surrounding components (since less is captured by the "secondary" coil of the transformer), and this "escaping" magnetic field is more apt to cause noise.

answered Oct 28 '14 at 12:01

Daniel R Hicks  
5,010 ● 1 ● 15 ● 36

The transformers are created in part by gluing plates of metal together. The AC fields causes back and forth forces in the metal plates. As the transformer ages the plates begin to separate and allows for movement on the plates which vibrate causing the humming sound you hear.

answered Oct 27 '14 at 23:37

SpecialK  
51 ● 1

3 Loose windings on transformers can also cause whine. Corsair tries to mitigate this issue through tighter QC on the transformers, rejecting those with overly loose windings. [corsair.com/en-us/blog/2013/september/coil-whine](http://corsair.com/en-us/blog/2013/september/coil-whine) – bwDraco Oct 28 '14 at 0:47

2 A coil of copper wire, without any "core" metal plates, can be made to whine. As the magnetic field increases and decreases (generally about a thousand times a second) the force of the field causes the dimensions of the coil to change slightly, and this vibration leads to whine. Even the wires on a printed circuit board can whine (slightly) under the right circumstances. – Daniel R Hicks Oct 28 '14 at 11:49

Is there anything I can do to suppress it?

As they've already told you, glue, because

- glue adds damping to the vibrating coil, then the coil's stationary response gets smaller as well as the noise produced
- glue adds constraints to the coil, then the coil's (mechanical) fundamental frequency increases above your hearing capability.

Another solution that wasn't mentioned (disclaimer: I haven't read ALL the comments...), and an environmental sound one! *consists in unplugging the adapter* (that's what I do all the time with the charger for my Nokia cellphone!)

edited Oct 29 '14 at 10:14

Michael Kjörling  
18k ● 3 ● 49 ● 82

answered Oct 29 '14 at 8:48

G. Boffi  
21 ● 1

I came to this page as I bought a new Craftsman C3 19.2 V Li-ion battery / charger which started making that whining noise as I plugged in. I came up to look for some answer, while reading it, I realized I had one or two wireless charging toothbrushes (Philips Sonicare and an Oral B) next to it. I moved the charger little away and the buzz went away. I presume the buzz is from electromagnetic interference from these wireless charging units that gets picked up by the transformers in the charger.

edited Nov 29 '15 at 11:05

DavidPostill  
49.8k ● 17 ● 95 ● 119

answered Nov 29 '15 at 2:30

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