

# Re: power supply design

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*Source:* <http://sci.tech-archive.net/Archive/sci.electronics.design/2006-01/msg00730.html>

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  - *Date:* Wed, 04 Jan 2006 21:59:07 -0800
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On Wed, 04 Jan 2006 19:12:46 -0600, Abstract Dissonance wrote:

- > I'm going to build a power supply for my projects and I was wondering a few
- > things. One thing is simply does it matter if the filter cap is to large?
- > Most power supply circuits I've seen use around 2200 to 4700uF's and I was
- > wonder that it couldn't hurt if it was larger as it should "filter" it even
- > better? Obviously if its to large it would take longer to charge but after
- > that it should work fine? I'm not talking a drastic increase in the
- > capacitance but maybe 2-10 times as much?
- >

The point of the filter cap is to prevent the supply from drooping below the point where the regulator can no longer regulate. Now, with a typical diode bridge scheme after a transformer, what happens is that the cap gets charged up to the peak voltage - 2x the diode drop twice a cycle. So, if you want a maximum of I amps, and the peak is Vp, and the minimum voltage you can have before your regulator drops out is Vmin, then an approximation is given by

$$I = C * (Vp - Vmin - 2*Vf) * 2 * AC\_frequency.$$

So,

$$C = I / (Vp - Vmin - 1.4) / 2 / AC\_frequency$$

As an example, if you want a 10 amp max supply, and your transformer gives you 21.2V peak voltage, and you want a regulated 12V, using a regulator with a 3V dropout, then the smallest C you can use is  $10 / 4.8 / 2 / 60 = 17.36\text{mF}$

You can do the math for your situation.

Using a cap that is bigger than you need is not really an issue, except that it'll store more energy (make sure you use a bleed resistor of like 100k to keep it from storing power over long periods). Also, the cost of caps goes up quicker than the rating.

- > Another thing is about regulation and overvoltage protection. Can anyone
- > recoment some sites that discuss then for use in power supplies? I've

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- > seen several schematics of basic power supplies and it seems pretty
- > simple but I'd like to know a little more about it just to be sure.
- > (i.e., is simply a zener diode good enough for the overvoltage
- > protection?) what about other cheap ways to make the power supply more
- > safe?

A zener isn't really adequate unless you have a tiny supply, because if your supply can provide a large amount of current, then the power dissipated by the zener is  $V_z * I$ . If  $I$  is 10, for example, and  $V_z$  is 12, then you need a zener that can dissipate 120W until the fuse blows. If it fails before your fuse blows, your circuit is toast.

A better way is to use what is called a 'crowbar' circuit, which consists of a device called an SCR, and a zener reference. When the zener conducts, the SCR turns on, and it CAN handle the current until the fuse blows. There are other schemes as well, search for "crowbar" and "SCR".

If your regulator is meant to be adjustable, then you need to figure out another way to limit current. Often, regulators do this for you, using a scheme called 'foldback' current limiting, which just means that if you short the output, it won't give you the full current you've designed, but will 'fold back' the amount of current to a far smaller value.

As far as regulators go, you can get one that can handle up to an amp at radio shack. That isn't too bad, actually. It is named an LM317, and can regulate voltages from about 1.5V up to 34V, using a few resistors. There are also fixed regulators, like the 7805, which regulates 5V with no external components (well, maybe some capacitors to prevent oscillations; look at the package).

If you are looking for a general hobby supply, however, I'd buy one. you can get them that have adjustable voltage, and also adjustable current, which is often useful. They often have a display of the voltage and current, and various other features. I have one of these:

<http://store.yahoo.com/webtronics/00addcreposu.html>

I like it, but are various issues with it; the pots they use are fairly cheesy, and tend to be hard to adjust. Also, they don't have 'kelvin' leads, meaning that the regulation happens at the supply, and not at your circuit. Better supplies will allow you to have 4 wires, two for the current, and two for the regulation. Not doing this causes issues with higher current applications, because resistance in your wires drop some voltage.

You can also occasionally pick up nice bench supplies on ebay.

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Regards,  
Bob Monsen

Re: power supply design

"I am turned into a sort of machine for observing facts & grinding out conclusions"

— Charles Darwin

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- *Follow-Ups:*

- ◆ *Re: power supply design*
  - ◇ *From:* Abstract Dissonance
- ◆ *Re: power supply design*
  - ◇ *From:* Frithiof Andreas Jensen

- *References:*

- ◆ *power supply design*
  - ◇ *From:* Abstract Dissonance

- Prev by Date: *Re: LDO question*
- Next by Date: *Re: Photoresistor triggered solenoid, need help*
- Previous by thread: *Re: power supply design*
- Next by thread: *Re: power supply design*
- Index(es):
  - ◆ *Date*
  - ◆ *Thread*