Re: Power Supply Design

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- *From*: Mike <nomtrxspam@xxxxxxxxxxx>

- *Date*: Wed, 25 Jan 2006 16:59:32 −0500

<snip>
(The caps are electrolytic type and I know they
>are not suited at all for a pulse discharge but thats what they will be
>used for as they came to me free).
That depends on how large the discharge pulse is and the type of caps.
I did a test a few years ago and discharged a small bank of 3−1500uf
400v computer grade caps into a coil. The resulting current pulse was
850A peak. I triggered it with a microprocessor that counted the
discharges and finally shut it off after 11,000 charge/discharge
cycles. I then measured the discharge pulse and there was no
measurable decrease in peak current.

First and no offense indended, but
22,000uf charged to 300v is extremely dangerous so please be very very
careful! Also, Caps used in pulse discharge applications have been
known to explode, so enclose the entire capacitor bank in a sturdy box
to contain shrapnel. Especially when you're trying to get the power
supply working. If you decide to power it directly from the powerline
enclose the entire finished unit in a nonconduting box of some kind.

You will have a tradeoff betwee charge time, convienience, safety
features and cost. You can apporximate the charge time assuming a
constant current by using T=CV/I whre T is time (seconds),
C=capacitance (Farads), V is final charge voltage(volts), and I is
the charge current(Amps). If you do not use a constant current the
charge time can be estimated by T=6*RC, where R is the current
limiting resistance in series with a constant voltage supply.

For example,

..0222F charged at a constant 0.1A rate to 330V will take a bit longer
than .0222*330/0.1 or 72.6secs.

..0222F charged from a 330V power supply through a 1K current limiting
resistor will take about 6*.0222*1000 or 133secs.

Whatever you decide on, keep the following in mind.

The capacitor bank will be a dead short at the begining of charge and that some form of current limiting is a must!
It can be a current limiting transformer, a simple resistor, or linear current limiter. I've used a triac driving a voltage doubler even tho I've been told that that's kind of a no no. It worked well for me at low current.

A switch mode power supply is simple in concept, but very difficult to design, so I would stay away from that approach. You would most likely spend a bunch of money in blown up parts trying to get it to work unless you can find details on building one that meets your needs.

Also be sure to include some way to make sure that the caps can never be over charged, well at least try to keep them from overcharging, or you will be needing that shrapnel containing box for sure. The line voltage can get pretty high(130v), so watchout for fluctuations there.

Don't forget to add a bleeder resistor to discharge the capacitors when powered off.

And of course a proper fuse or circuit breaker for fire protection.

An easy way to do it would be a small variac powering a voltage doubler and a high wattage resistor between the voltage doubler and the capacitor bank. Just slowly bring the voltage up manually while watching the voltage on a meter. Maybe add an ammeter so you can crank it up as fast as you can while keeping the current to a safe level.
Note that most variacs are NOT isolated from the power line, they are autotransformers. Cheap and simple, but not very convenient and prone to getting over anxious and blowing something up.

One other thing, be sure to disconnect(relay?) the charge circuit just before discharging or you will be drawing current from the charge power supply. If you are using an scr to discharge, the current won't drop below the minimum current required to commutate the scr.

I built a 5000J cobalt magnetizer with a .072F capacitor bank charged to 375V and finally ended up using a 500VA isolation transformer and a 24v 4A transformer with secondaries in series feeding a heavy duty voltage doubler for the base supply. The base supply is connected to the capacitor bank through a high voltage 1.6A linear current limiter and a power relay. I have 2 seperate circuits monitoring the charge voltage and current. One shuts down the current regulator when the caps reach 375V, this regulates the charge voltage to compensate for powerline voltage fluctuations and to allow user adjustment of the final charge voltage, and the other circuit drops the power relay and shuts down the current limiter if the capacitor voltage goes over 380V or the current exceeds 1.75A. This arangement safely charges up in about 20secs.

Good luck and be careful!

Mike
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- ***Follow−Ups***:
  - ***Re: Power Supply Design***
    - *From:* Ancient_Hacker

- ***References***:
  - ***Power Supply Design***
    - *From:* Brian
  - ***Re: Power Supply Design***
    - *From:* Brian

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