

Amp Tips

by Dan Torres

Torres Engineering
1630 Palm Ave
San Mateo CA 94402
(650) 571 6887
fax (650) 571 1507
<http://www.torresengineering.com>
e-mail tech@torresengineering.com

“To Be or Not Tu-be 2.” Rectifier improvements.

This time we continue a series of articles concentrating on the rectifier circuit of tube guitar amps. Last month we installed a switch to change from a tube rectifier to a solid state circuit.

This month there are improvements to the actual rectifiers, both tube and solid state, and a neat (and unique) trick with the filter capacitors to take advantage of the ability to switch rectifiers.

Any and all work should only be attempted by a qualified tube amplifier technician.

Any suggestion, idea or instruction involving any electronic device should only be carried out by qualified personnel. None of these instructions are implied or intended for non-technicians or persons unqualified to work safely with high voltage AC and DC.

Do not attempt any electronic work without the proper tools, materials, work space, an isolation transformer, a "variac" type variable transformer and correct training in electronics.

Consider this paragraph to be inserted every 5 or 6 words in this article!

If your amp tech is still unsure, please see the full warning included on pages 4 and 5 of "**Inside Tube Amps**" by Dan Torres.

Overall, this is not a difficult project, but since you are working with the highest voltages and currents in the amp, it is necessary to have the proper experience, tools, and knowledge prior to attempting anything this dangerous.

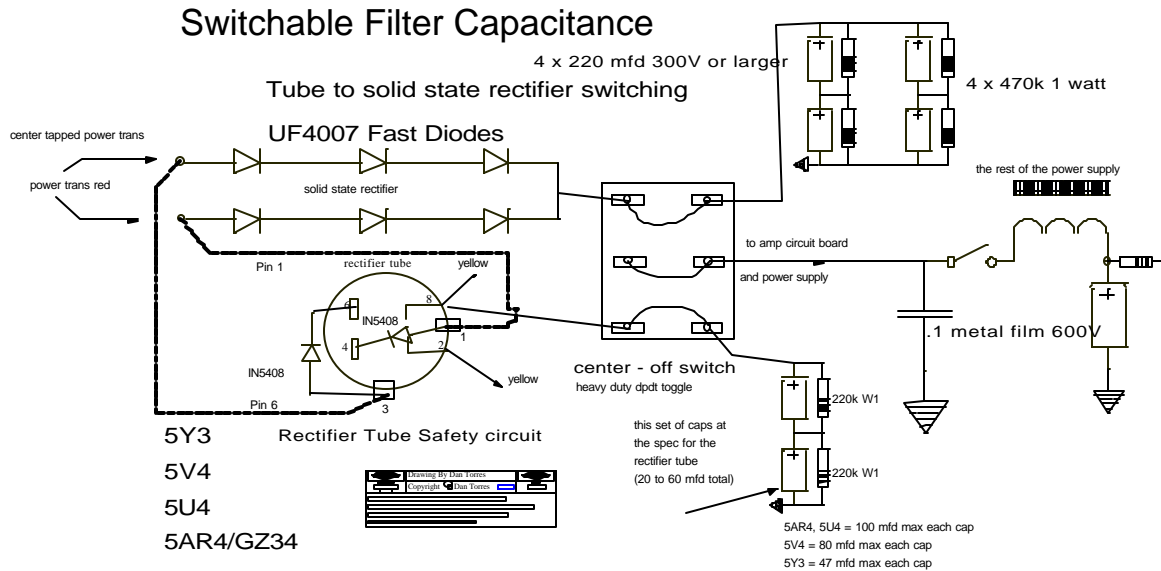
The power transformer secondary is a high voltage stepped up AC voltage. From 300 to as much as 500 volts on common amplifiers (a lot more on some.)

For a starter, only attempt this on amps of 50 watts or less output power.

This project requires a power transformer with a center tap wire. Usually a red/yellow wire.

Rectifier tubes require this kind of transformer, and solid state rectifiers “do not care” about it.

If your amp has a solid state rectifier as the standard installation, you will also need a supplemental 5 volt high current filament transformer for the rectifier tube.



Lets only work on amps that have a TUBE rectifier. Switching to a solid state rectifier is easier, and more within the scope and space of this article.

(Note: the Torres Engineering kit (www.torresengineering.com) will have parts and instructions for adding a rectifier tube, and for applying this technology to amps WITHOUT a center tapped power transformer.)

Ok, take a look at the drawings.

The first noticeable thing is the “rectifier tube safety” circuit added to the rectifier tube socket.

With standard rectifier tubes, 5Y3, 5V4, 5U4, 5AR4, many of the tube pins are not used at all and we can use those pins as “terminals” for the new parts. (If you are using different tubes, install the new parts on a terminal strip).

This is not a new trick, it comes from several very old tube audio books. I believe I found it in the out-of-print “Tu-be or not tu-be” by H.L. Eisenson (also credit for the title of this series.) It may also have been in “Audio Cyclopedia” (out of print) by Tremaine.

The pair of IN5408 diodes on the rectifier tube protect the tube from inrush voltage when it is turned on, and also keep the circuit from failing should the tube fail (the diodes will take over in place of the tube if the tube burns out.) This will keep you running on stage if there is a tube failure, and at the same time prevent that failure.

A good trick, easy to apply and it sounds very good. The IN5408 diode is fairly large, and the

layout provided works best on the tube socket.

Next is the replacement of the IN4007 diodes with UF4007 fast diodes. They make for a “sweeter” sounding and more efficient solid state rectifier. An easy change and not hard to apply.

Additionally an overall “rectifier output” safety circuit is added in the form of a single 600V .1 metal film capacitor permanently connected to the power supply.

This prevents the rectifiers from ever seeing an open circuit, and generally stops the annoying “pop” when switching amps on. Again, this will extend tube, diode, and filter capacitor life preventing excessive surges of voltage and unloaded capacitors.

The main modification here is the change in the entire filter capacitor bank.

A solid state rectifier allows for as much filter capacitance as you want in the first stage of the power supply.

More filter capacitance results in highly improved bass response (some tube audio amps use 1,000 to 10,000 MFD as the first filter cap,) and also can raise the voltage available.

But, as discussed in the last article, there are specific limits in how much capacitance a rectifier tube can operate with. Exceeding the specifications can blow the tube(s) up and will certainly cause very short life.

Multiple rectifier tubes increase the capacity (twice as much capacitance), but still have a limit.

The circuit shown here SWITCHES the first bank of filter capacitors with optimum sets for each rectifier. Very high filter capacitance for the solid state rectifier, and right on spec for the tube rectifier.

Of course you have to have the room for this, it is not too difficult to find space for the extra sets of capacitors in custom and/or older amps. Kind of hard to do in real modern printed circuit board amps.

The upper set of filter caps is shown as four 220 MFD caps, higher values can be used, but are not generally found at reasonable prices on the market.

In planning this project, I was looking for caps around 800 MFD at 350 Volt but find they are around \$40.00 each!

The last detail is the use of a DPDT CENTER-OFF switch. This acts as a secondary standby switch and, more importantly, adds a little pause even if you do not use caution switching rectifiers. The dpdt switch is “bridged” to get more current handling capacity.

The amp should ALWAYS be turned off when switching rectifiers for safety.

Next month, more development of the improved rectifier circuits. Have fun.

This article is for entertainment only. Any additional help will require the amplifier to be in our

shop for service.

Copyright © 2002 by Dan Torres

All rights reserved

may not be reproduced in any media existing now or in the future without permission.

Torres Engineering

1630 Palm Ave

San Mateo CA 94402

WEB SITE: <http://www.torresengineering.com>

(650) 571 6887 (9:30 A.M. to 5:30 P.M. Seven days a week! Calif time)

FAX (650) 571 1507 or (650) 571 0849

E-Mail tech@torresengineering.com

INSIDE TUBE AMPS - ISBN 0-9669743-0-1 is now available from **TORRES ENGINEERING, AMAZON.COM, BARNES AND NOBLE, ELDERLY INSTRUMENTS, MUSICIANS FRIEND, STEWART Mac DONALD, OLD COLONY SOUND, ANTIQUE ELECTRONICS, J.K. LUTHERIE, ANGELA INSTRUMENTS**, and more, mail order, on the web, in retail stores and presently many libraries are requesting copies for their technical or music sections. Check it out!

Ok, here's the warning rap.

Warnings and disclaimer

Tube Amplifiers, all components and related products are electrical products with extremely high voltages that if mishandled or if used carelessly or for improper purposes, can cause life hazards and serious personal injuries. Such equipment is dangerous even when turned off or unplugged.

You shouldn't be working inside the amp unless you know what you are doing.

Don't work on an amp plugged in.

Always discharge the filter capacitors before starting work. If you don't know how, contact us for a reprint on how to do it ("**What the Hell are filter caps?**")

Solder neatly, and use the smallest amount of solder you can.

Be careful, but have fun.

Dan Torres is one of the most sought after tube amp experts in the world. Dan is the author of the definitive book on Tube Amp Technology, "**Inside Tube Amps**". The latest new stuff from the Torres Shop are a whole series of new easy to build complete amp kits. Check out the catalog or web site for the latest. New technology every day!

This article was created, researched and written by the author. The ideas and/or opinions contained therein are solely those of the author.

Caution is advised when dealing with electronic and electric materials or valuable musical instruments.