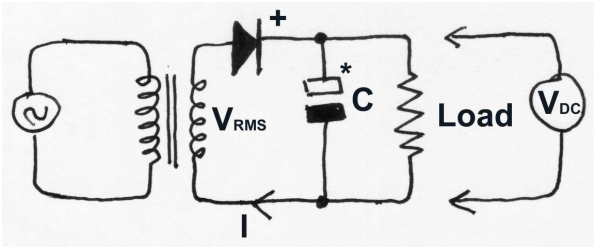
ShaK Nowtz by "Mad" FranK, G3ZMF

SHAK NOWTZ No 1: RECTIFIER & REGULATOR TIPS

1 TRANSFORMERS

Half Wave



* Capacitor value 4C/ amp. This refers to a rule of thumb where for determining capacitor value depending on the load current to be smoothed, with or without any regulation. 4C = 4000µF/amp load to reduce ripple voltage.

$V_{LOAD} = 0.9 \times V_{RMS}$

ie 10 V AC secondary = 9V DC on load
I (full load current) = 1.8 x Secondary
Max rating as only passing load current for 50% of cycle.

But remember, off load the voltage is higher ie:

$V_{OFFLOAD} = V_{RMS} \times \sqrt{2}$ (ie 10 V x 1.414 = 14.14 volts)

Special note: any good power supply unit (PSU) will have properly "current rated" smoothing capacitors, eg computer grade. These are usually labelled, for example, 30,000µF, 40 V DC, 28 A. Yes, they are big, but the results are worth it! These can be picked up at rallies or the CATS Bazaar for anything from 10p to £2. Don't panic about £2 for a new capacitor - just remember that a new one can cost £20 or more.

WARNING! Don't just fit the capacitor and switch on, as you could wreck the rectifier and/or the transformer. All capacitors that have been unused for more than 6 months should be "reformed": that means putting from half to full working voltage across them but with a resistor in series to limit the initial current to, say, 10mA.

Use your Ohm's Law! Measure the AC voltage, multiply by 1.414 (√2) to give you peak voltage after rectification, then divide by 0.01. For example:

10V (RMS) = 14 V DC ÷ 0.01 =1400 Ω

Then use the standard E12 value of 1500 Ω (or 1k5). A ¼ or ½ watt resistor will be fine.

I have always used "bleed resistors" across the smoothing capacitors (or capacitor bank): firstly, to drain off the voltage after switch-off, and secondly to reduce the peak voltage by a little bit, remembering that load volts = 0.9 x V RMS.

Diodes should be rated for 2 x full load current (or more.)

ANOTHER WARNING: OK, you have a transformer that gives 15V AC output and you have calculated that half wave rectification (on load) = 15 x 0.9 = 13.5 V…. Very nice for that mobile or base station rig that needs 12.0 to 13.8 V. **BUT**, you forgot about PEAK volts !!! 15 V AC x 1.414 = 21.2 V. **OUCH !!! BANG!!!** Because many of the rigs internal components are probably rated to a max of 16 V. **DON'T DO IT ! USE A REGULATOR (SEE LATER)**

Hopefully by now I have (a) encouraged you to use those 15 V transformers but (b) stopped you blowing up your loverly rigs! *(You might consider also using crowbar overvoltage protection – Ed.)*

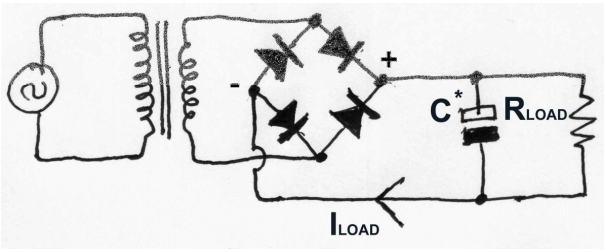
OK, let's go onto full wave rectification now:

2 FULL WAVE RECTIFICATION

(Four Diode Method - or twice the voltage if you only want half wave rectification)

Aye, aye, sounds like summat for nowt! No it's not! You **MUST** check the total load of the transformer and do not exceed it. Yes, you can have 2 x volts for the "job" – but it will be half the current.

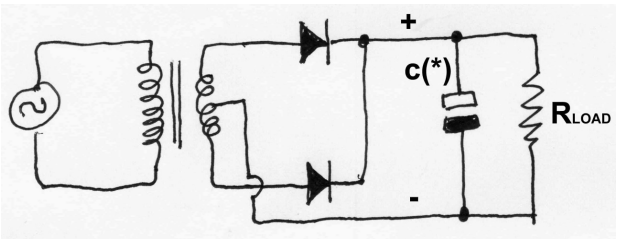
Full Wave From A Half Wave Winding



(*) 1C/ Amp refers to 1000µF/amp (full load) as a rule of thumb – see previous notes. Diodes rated for full load current

This circuit produces √2 (or 1.414) x VRMS; ie 10 V AC = 14.14 V peak. In practice = about 1.25 x V_{RMS} on load, BUT very unstable, due to load variance

3 FULL WAVE RECTIFICATION
(Two Diode Method)



(*) Use 1C/ Amp as per bridge rectification; otherwise the full current rating of the transformers can be utilized. The diodes are rated at full load current

4 REGULATORS

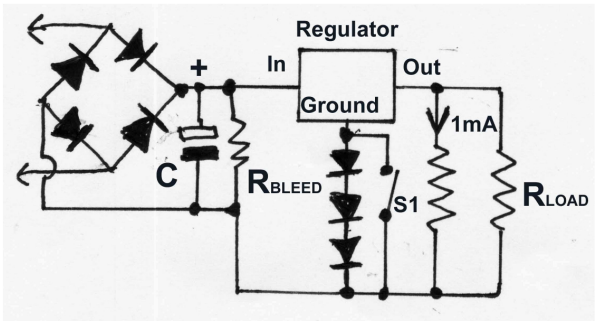
There are numerous "one-device" items that can accept a wide range of input voltages, to give a very good output at a regulated voltage, many with "current- limit- foldover" facilities built in. **BUT AGAIN – BE WARNED** – Don't try to get 2 pints from a 1 pint bottle!! In the next article, I'll explain how to get 20 pints from a 1 pint bottle.

From the low current devices available to the "monsters", you must respect their ratings.

For example, the 78L05 is a 5 volt output regulator, full load is around 50 mA and input voltage from 8 to 15 V. Likewise, a 78CT12 is a high current device that delivers a 2 volt output ± not much, at 1 amp (or more) and again has a limited input of 15 – 30 volts. **BUT - DON'T FORGET** – any volts dropped towards the output voltage, at the current rating = power loss = heat. So heatsinks and/or fans to cool them are most essential – or else **BANG!**

"Don't panic Mr Mainwaring, we can jiggle your volts!" Yes you can!

A very easy way to get a few more volts from a 12V regulator is to "jack up its ground connection" - but in this case you **must** insulate the device from its heat sink.



In this circuit, the regulator is insulated above ground/chassis so that diodes (eg the 1N4001 series) can be put in series @ 0.6 V/ diode in the "ground" line of the regulator. This "pushes" the output up by the total of the diode forward drop voltages. So, three diodes at 0.6 V per diode each = 1.8 volts, plus the 12volts of the regulator = 13.8 volts. The switch (S1) across the diodes allows you to switch between 12.0 and 13.8 volts for a 12 volt regulator. **BUT**… don't overload the regulator.

OK! That's enough for this lesson

73 de "mad" Frank, G3ZMF