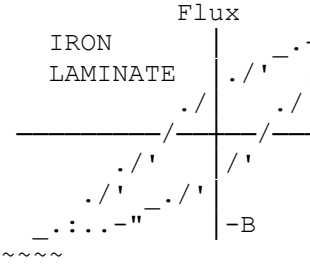
Constant Voltage Transformers

(8 Bit ASCII Graphics use code page 437 or 850)

By G8MNY (Updated Oct 07)

Here is information about the principle of tuned saturated transformer type, of constant voltage mains transformer for power conditioning. This is not the same as the modern uninterruptable battery SM mode (RF generators) fast inverters that fill in holes in the mains, but a far simpler highly reliable passive system.

MAGNETIC SATURATION

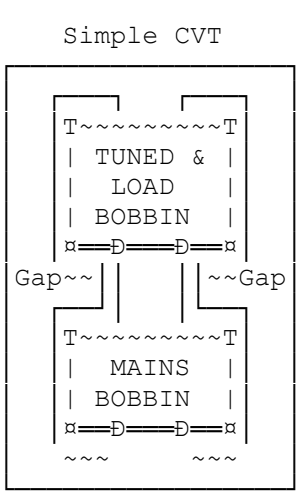


The BH curve shows the magnetic flux B saturate & flattens off as the magnetising effort in Amp Turns increases. This is the heart of the regulation principle.

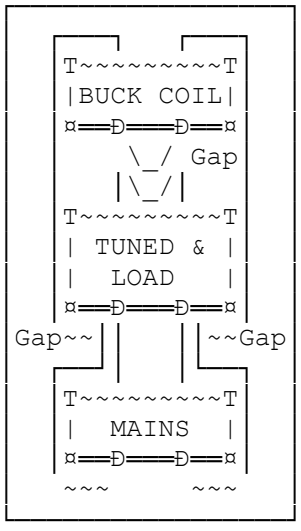
The transformer secondary it tuned with a capacitor, & it literally sucks all the power it can from the nearby primary magnetic circuit until the tuned core is saturated.

2 MAGNETIC CIRCUITS

Unlike a conventional transformer the primary & secondary are on different bobbins (coil formers) & are not tightly magnetically coupled. There is a magnetic filler piece put in between 2 bobbins typically with an air gap.



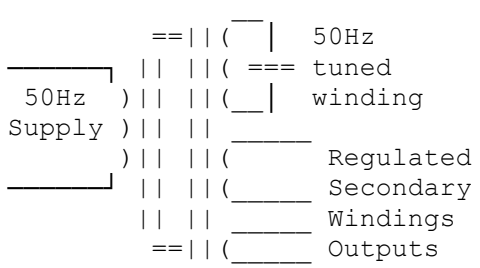
Specially shaped transformer laminates.



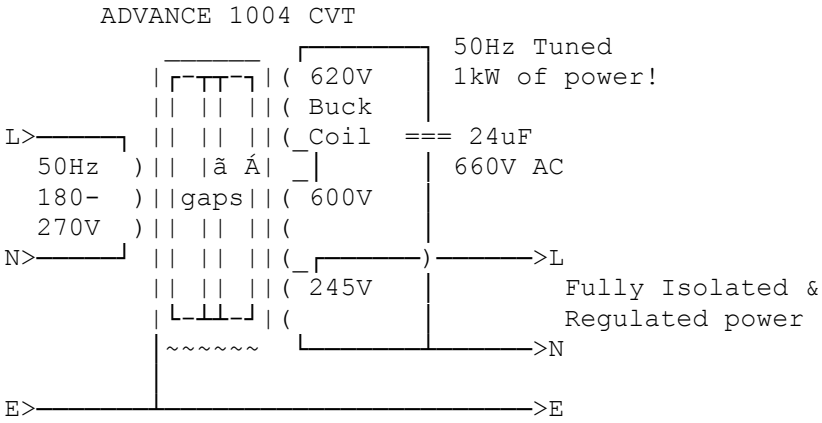
More Complex "ADVANCE" CVT

ELECTRICAL CIRCUITS

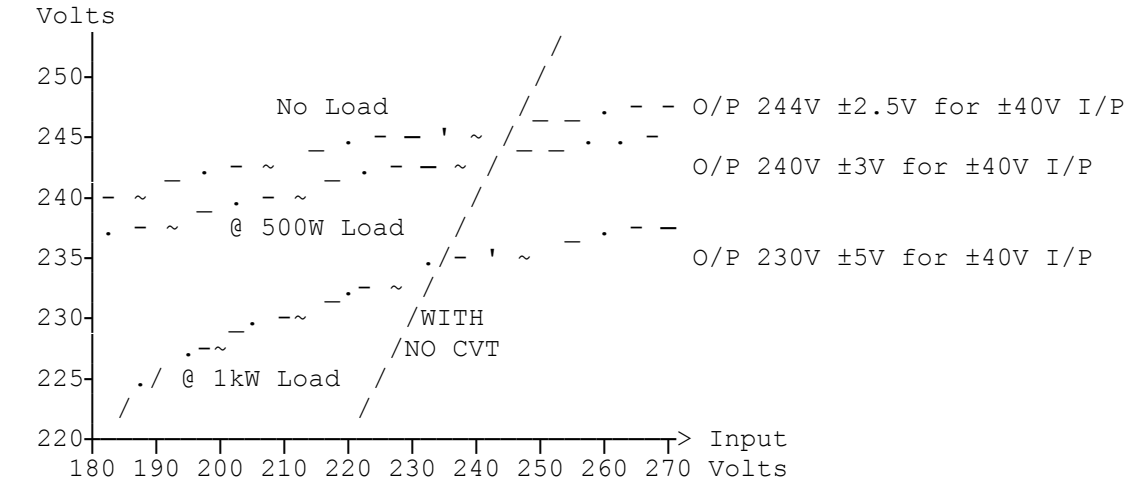
For employment inside equipment the secondary load windings are wound with the tuned circuit winding.
The power flowing in the tuned winding must equal the maximum load for the system to regulate.
With fairly fixed loads this simple circuit will do.



Specialist regulation transformers with greater regulation demands & changing loads use bucking arrangements to improve the regulation.



REGULATION



The regulation only occurs of course at the resonant frequency. The output is a fairly low distortion sine wave but not that good. Note that the output rapidly drops with the heavy overload, & in fact overloads tend to give a fairly safe constant current at just over the maximum current rating.

IN USE

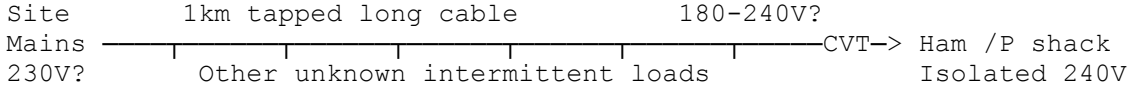
Although they are very useful for ensuring the correct voltage, more & more equipment is immune to small power line fluctuations, except extreme voltages, so the need for a CVT is less apparent today.

They are not so useful for computer kit as you might think, as the power off through one causes the supply to fail over a few cycles, exactly the brown out scenario that can damage data on computers! Also the very high power TURN ON surge of a CRT screen power (e.g. 100W screen running but a 4kW surge) ensures a glitch will be caused on a low power CVT if the CRT is on the same CVT as the processor.

They are also not much use on a generator supply, unless the frequency is fairly close to 50Hz for it to function properly.

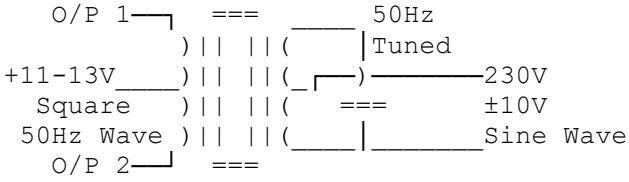
Power efficiency is also not good at about 10% of the full load is lost all the time as heat.

I have used the 1kW one for /P OK, on a VERY long multiple spurred mains feed (1km) where the mains was liable to be all over the place. The isolation was an added safety feature, as too was the RF mains isolation.

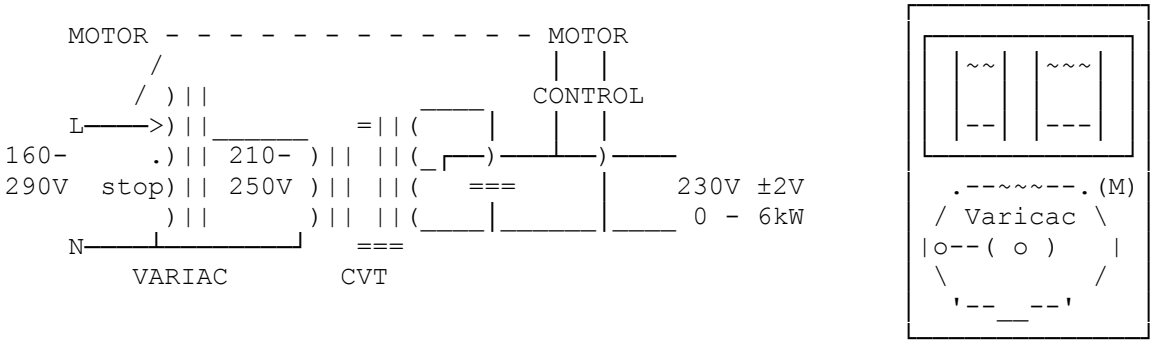


It worked OK that is, until someone turned on a small kettle (Diode load type!) that DC saturated the core!

AS A SINE WAVE INVERTER
Using the same magnetic arrangement, but starting with a square wave low voltage inverted input instead of the mains primary, then a simple inverter can give a regulated sine wave output, but the efficiency is low (70%).



WITH MOTOR DRIVEN VARIAC
For really good regulation the mains can be preconditioned with a motorised variac.



A decision circuit drives the motor to set the O/P exactly at 230V after a second or so. The CVT has to try to take care of spikes & dips that the variac motor control loop can't follow.

This arrangement takes care of changing losses due to varying loads too & used to be the Bees & Eees for fussy valve gear on unknown mains.

Why don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP