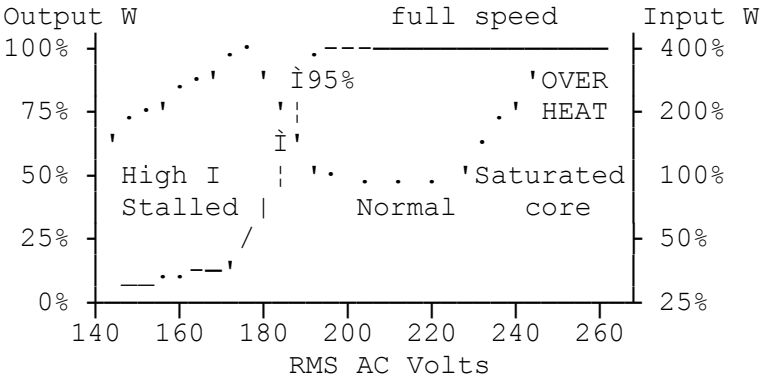
Saveplug Motor Economiser

By G8MNY (Updated Jan 13)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

PRINCIPLE

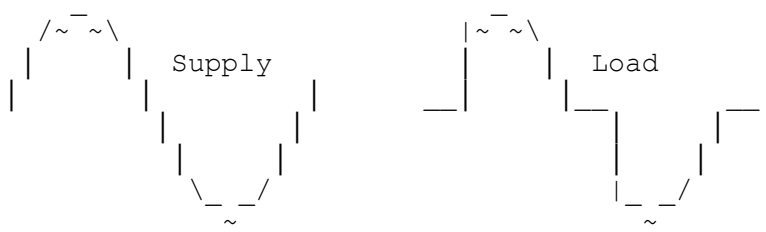
These plugs can reduce the power used on fridge/freezer compressors and central heating pump motors. They reducing the mean supply voltage and a shaded pole AC electric motor or a capacitor start AC motor, will normally run at reduced voltage with very little reduction of mechanical output.



A stalled motor looks like a transformer with a shorted secondary and it takes about 4-15 times the normal power/current.

N.B. In a compressor situation, the motor can easily be stalled by powering off and on just after the pressure builds up. To stop motor burn outs there is a built in thermal switch to turn off the power for a few minutes, letting the gas pressure leak away and the motor restarts again from no back pressure. (This is why you can't reliably run a 100W motor on a small 600W generator/UPS!)

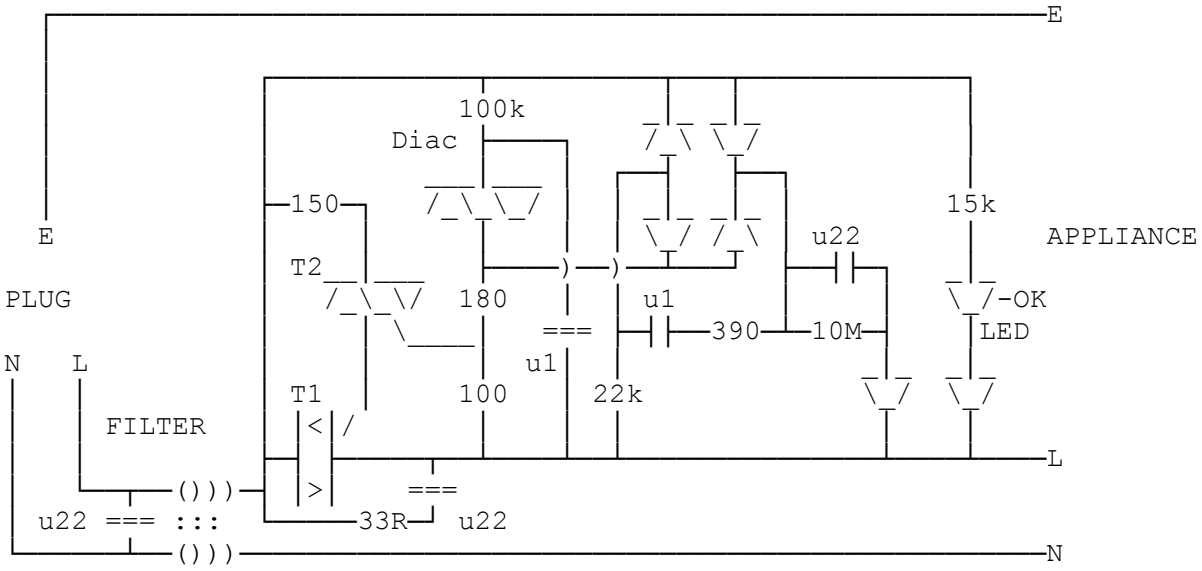
WAVEFORM



On resistive loads the waveform looks something like this, but motors are not resistive!

The power saving is not all it seems, as the slightly higher pulse currents can also increase the motor copper losses and with the plug heat as well may negating any saving.

CIRCUIT



OPERATION

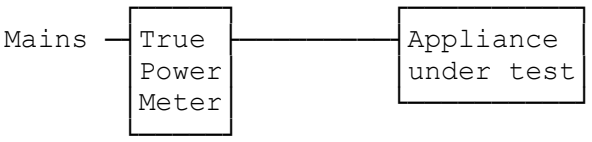
Mains is fed through a filter in to power Triac T1 a BTA15, it is triggered by the smaller Triac T2 a 2N6073. This in turn is triggered by the Diac. (this can be just 2 identical low voltage transistors back to back). The u1 cap charges up through the 100k, reaches the Diac's breakdown voltage T2 triggers and then T1. T1 triggering also removes the power to T2 and hence T1 gate drive. T1 stays conducting until that half cycle AC current goes to zero (due to motor inductance this will be later than the AC voltage zero).

The bridge rectifier and load across the Diac is some stabilising circuit for peak loads.

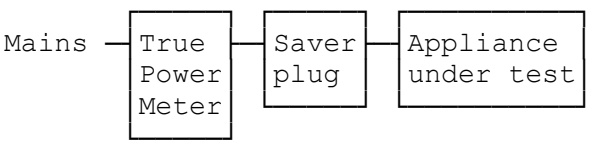
Note the fraction of mains removed is always about the same and not voltage regulated (pity). On 250V in you get about 230V RMS out.

POWER SAVED

To determine this any power measurement needs a good true RMS power meter, it is no good using a mean or RMS amp and volt meter! For complex wave shapes phase angles between I and V, instant multiplication of these must be done. With modern uProc meters this is now possible to good accuracy!



Get the full range of Powers used, including stalled/start motor power.



Get the full range of Powers used, including stalled/start motor power. Check the motor always starts!!

Power savings will very much depend on the normal mains supply voltage and the amount of over saturation that occurs in that make of motor at that voltage.

Typical savings on say a 100W 220V motor on max EU 253V might be 50W with 5W warming the plug. The same motor on 230V might be 10W with 4W lost in the plug. A less saturated 230V motor on 253V might not see any saving. You do need to measure it to know if it is worth while fitting the plug!

RADIO NOISE
The plug is well filtered to the mains side, but none to the motor, so the wiring to that needs to be short if LF QRM is to be kept low.

See my tech buls on "UK 13A Fused Mains Plug", "Maplin Mains Meter 2000MU-UK" "AC Theory", "Transistors, SCRs and TRIACs", "Variacs", "Economy Turn ON Timer" and "Meter Movement Types".

Why don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP