## 10.7 Power Supply

The power supply delivers the operating-voltages (and -currents) required by the amplifier to be able to work: plate-voltage, filament-voltage and, if applicable, bias-voltage for the grids. The most important components of the power supply (mains transformer, rectifier, and filter capacitor) will be investigated in the following. Power supplies in guitar amplifiers fitted with tubes generate 500 – 1000 V, and consequently observing pertinent safety regulations is imperative: **touching of live components or wires may be fatal!** For this reason, only trained professionals are allowed to work on such amplifiers. Particular consideration needs to be given to the fact that even devices that are switched off and disconnected from the mains power may be storing deadly voltages for hours. Again: such equipment may be opened by qualified personnel only!

### 10.7.1 Tube filament

The cathode of a tube will emit the required stream of electrodes only as it glows. A dedicated secondary winding of the mains transformer delivers the necessary power (2 – 16 W depending on the tube) for the associated heating. Most tubes are heated with 6.3 $V_{\sim}$ , rectifier tubes with 5.0 $V_{\sim}$, as well. DC-heating is possible but uncommon. In order to minimize the effects of capacitive coupling between filament-circuit and signal-circuits, the heating voltage often is of symmetric configuration, either via a middle tap in the filament-winding of the mains transformer, or via two resistors or a potentiometer.

The connections to the tube-filaments are mostly designated with *f* (from the Latin filum) in the socket-diagrams; in the actual circuit diagrams, they are not included to keep the drawings neat. Filaments are positive-temperature-coefficient (PTC) resistors – their resistance increases by a factor of 7 – 8 when heated. It can therefore be beneficial to a long tube-life to limit the switch-on current – but this is not mandatory. On the other hand, the **filament voltage** should be neither too high nor too low: ±5% is stated as acceptable tolerance and ±10% would already be too much. The reason is that at too high a voltage, part of the cathode material evaporates, and at too low a voltage, undesirable intermediate layers form.

The filament circuits carry large AC-currents, possibly upwards of 5 A. At a distance of 2 cm from a wire subject to such a current, we find a magnetic flux-density of 50 µT, i.e. there will be 100 µT between two wires positioned at a distance of 4 cm. This magnetic field will induce, into a conductor loop of 3 $cm^2$, a hum-interference of 10 µV at 50 Hz (or 60 Hz, depending on your geographic location). Such an interference voltage will not be a big problem in a power stage, bit it might in the preamplifier. The filament supply-wire pairs therefore usually are installed twisted around each other; the magnetic fields generated by the individual wires largely compensate each other that way, as do the induced interference voltages.

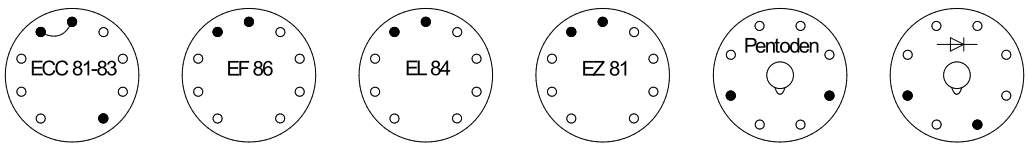


**Fig. 10.7.1:** Filament connections of some selected tube sockets (seen from below). “Pentoden” = pentodes

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