# Microphone build guide (C12, 2019 version)

This guide will explain how to build an excellent multipattern tube microphone.
All components are of the highest quality: Styroflex and Wima capacitors, 1% metal film resistors, a special quality 6072 tube and most important of all, a high quality microphone capsule.

But first a word of warning:
**Do not touch anything inside the microphone when the power supply is connected. The microphone works with high voltages, that in some situations can be lethal. When you work on the microphone, ALWAYS disconnect the power supply. Even when the power supply is switched off, the capacitors inside the power supply will keep a high voltage for a long time.**

As long as you keep this in mind, there isn't very much that can go wrong.
It might be a good idea to read through this information before you effectively start assembling the microphone, so you will have an idea about the steps that will follow.

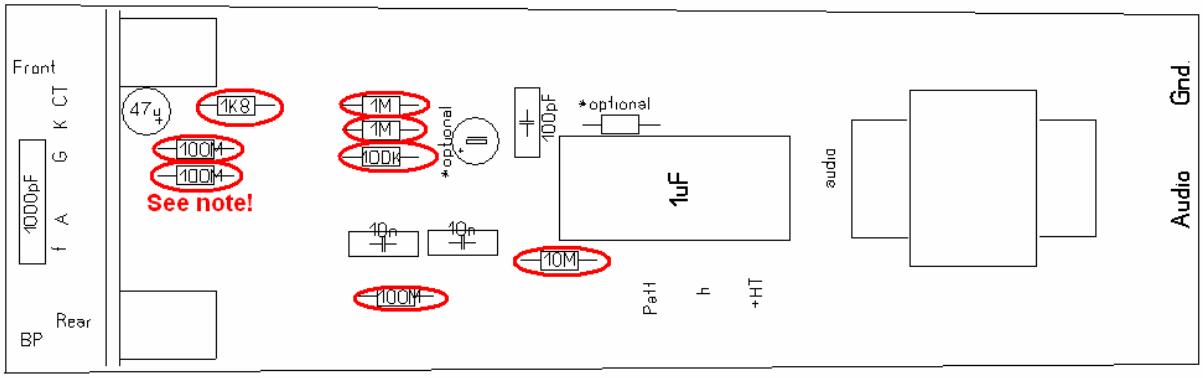
The microphone electronics are build on 2 printed circuit boards (PCB's).
We will assemble the separate boards one by one and build them later together.
We start with the small rounded printed circuit board.
First place and solder the tube socket to the PCB.
There are no other components on this small PCB.
The tube socket will later be hand wired.
Although this may look as extra work, it also has an advantage:
The 6072 tube contains **two** triode sections in one glass 'bottle'.
In this microphone we only use one half of the tube.
This means that if at a certain moment the tube is giving problems or eventually will fail, there is a second half that has never been used! In that case, it is only a matter of changing a few wires and we can use the other, until then never used, 'new' triode!

Before we start building, we have to make a few changes to the microphone body itself.
-First, we remove the screening cup, that is meant to place a transformer in.
In this design, the transformer is mounted on the PCB.
Also the screening cup takes too much place, so we can't mount the PCB in the microphone body.
Simply remove the four screws on the sides and take out the screening cup.
While we are busy with the microphone body, tighten all screws, they may have become loose during transport.
-The second thing we have to do, is to remove the metal strips that are holding the wires from the XLR connector in place on the sides of the body. With a small screwdriver you can easily remove those strips. We don't need them anymore.
Now we can start building the main audio PCB.

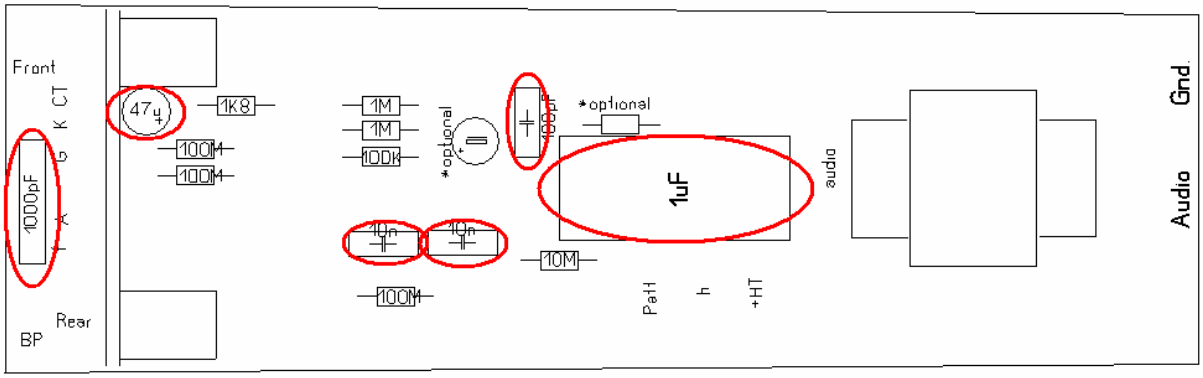
First place and solder 8 resistors on the PCB, the values are clearly marked on the screenprint:

1 x 10 K.ohm (brown/black/black/red)
1 x 100 K.ohm (brown/black/black/orange)
2 x 1 M.ohm (brown/black/black/yellow)
1 x 10 M.ohm (brown/black/black/green)
3 x 100 M.ohm* (brown/black/black/blue)

*Note: The original C12 microphone used relative low resistor values.
With 100 M.ohm resistors and a 80 pF capsule capacity, the low -3 dB point will be ~40 Hz.
If you want a better low frequency response, you can use the optional 470 M.ohm resistor instead of the marked 100 M.ohm resistor. This will lower the -3 dB pont to ~24 Hz.
In this case the 'lower' 100 M.ohm resistor will change to 470 M.ohm.



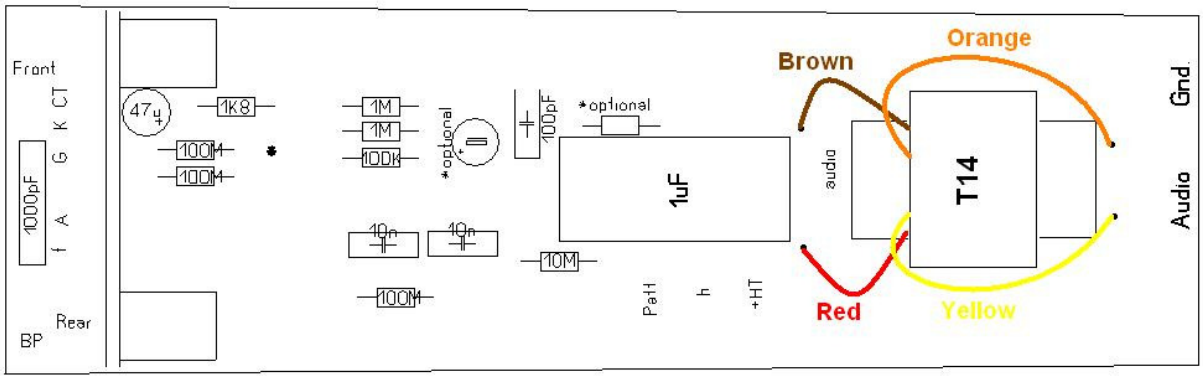

Now place and solder the two 10 nF (0.01) /630V capacitors, the 100pF capacitor, the 1000 pF styroflex capacitor and the 47 µF electrolytic capacitor.
Take care of the orientation of the electrolytic capacitor, the '-' side should be at the corner of the PCB, close to the bigger 3 mm. hole.
Finally we place and solder the yellow 1 µF/250 V capacitor.



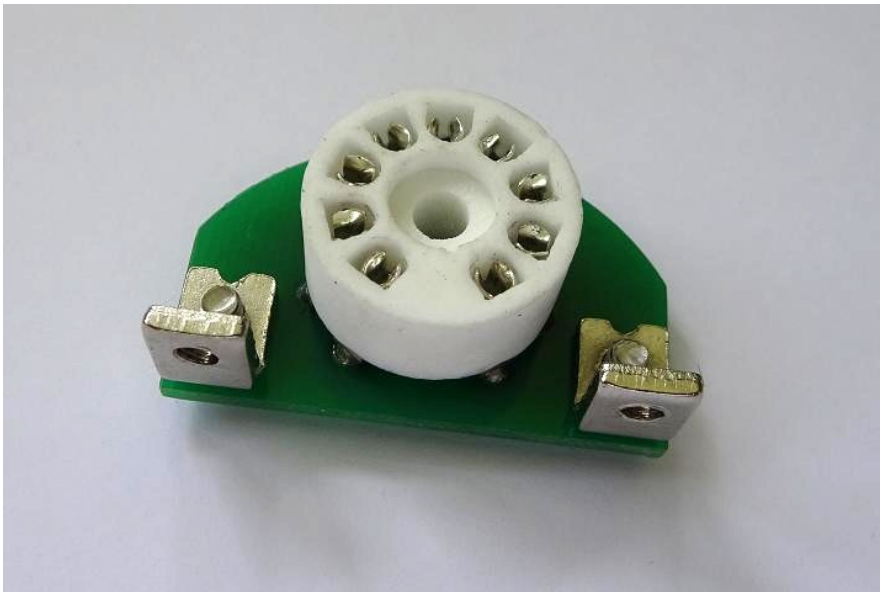

You will notice that there are some parts marked 'optional'.
Nothing should be placed here; we don't need them in this design.

Now we have to mount the T14 transformer.
Straighten the piece of 1 mm thick wire, cut two pieces and form them into a 'U' shape, with 17 mm. between the 'legs'. Insert the transformer in the rectangular hole and use the two 'U' wires to fasten the transformer. Cut the excess length and solder the wires.

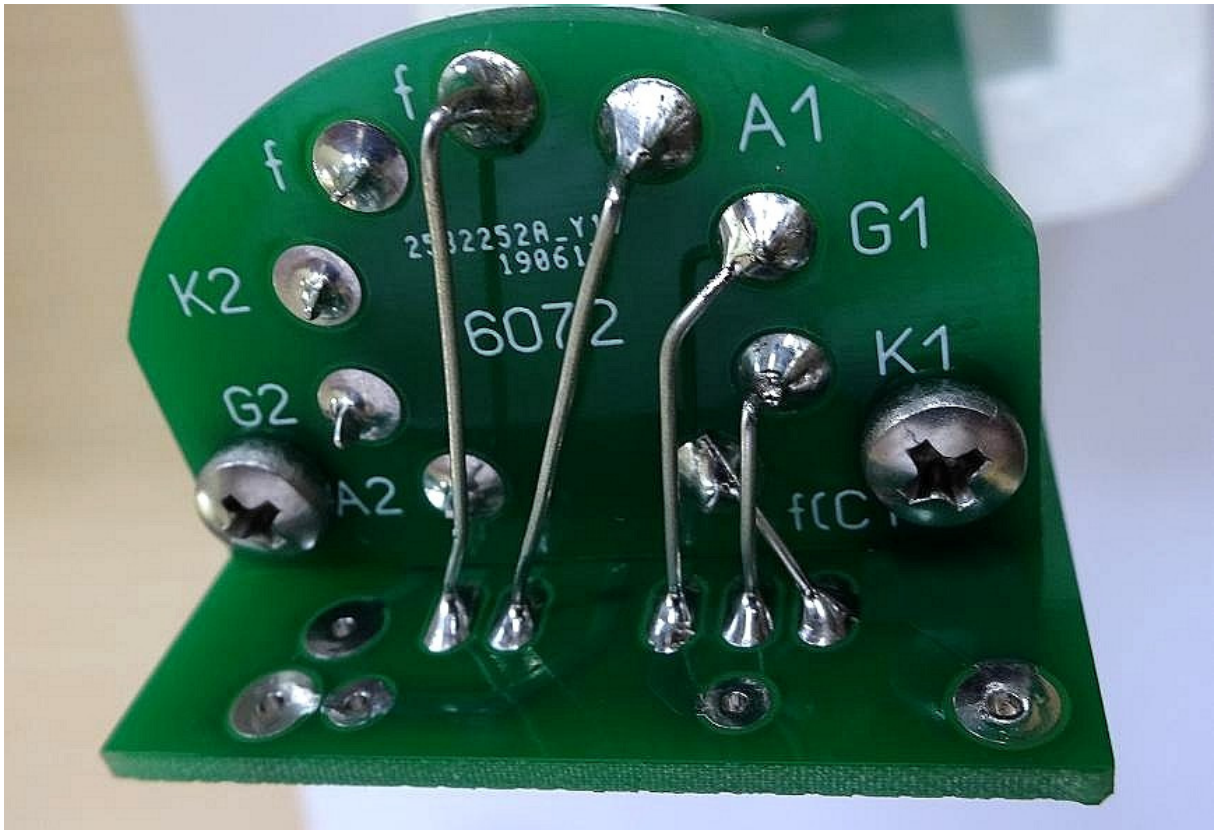
Now cut the transformer wires to length and strip and tin them.
Connect the wires to the PCB as shown in the picture below:




Now add two “L” brackets to the small PCB with the tube socket, like this:



Now mount the small tube PCB to the main PCB with two M3 screws, as shown below. We have to make a couple of connections now...



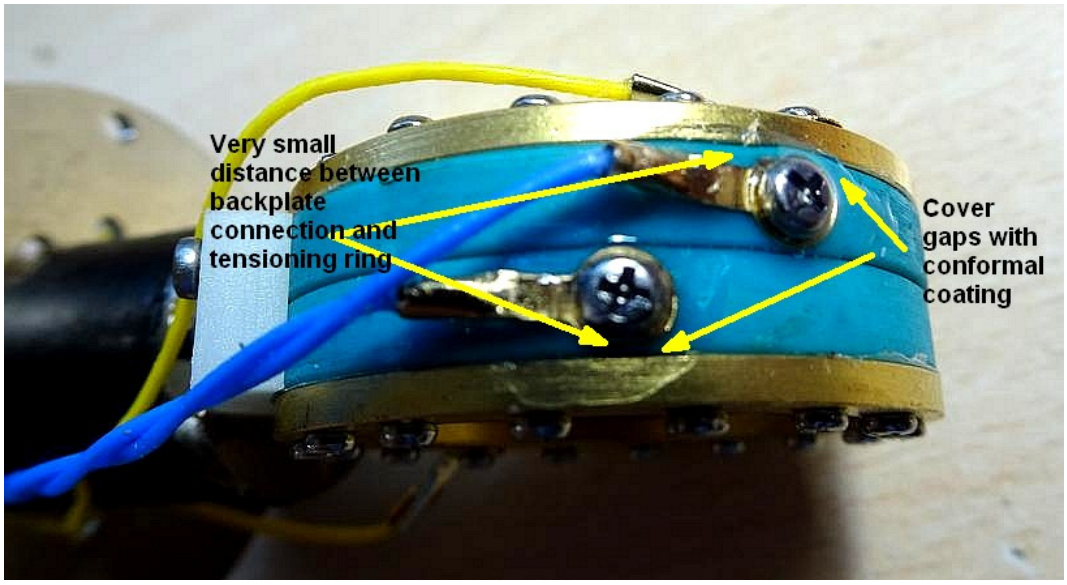

f(CT) of the tube PCB connects to CT on the main PCB
K1 of the tube PCB connects to K on the main PCB
G1 of the tube PCB connects to G on the main PCB
A1 of the tube PCB connects to A on the main PCB
F of the tube PCB connects to f on the main PCB

Here are the standard connections and the 'alternative' connections, in case you will ever want use the 'other' triode half of the 6072 tube:

| **Main PCB** | **Standard connection** | **Alternative connection** |
|---|---|---|
| CT | F (CT) – pin 9 | F (CT) – pin 9 |
| K | K1 – pin 8 | K2 – pin 3 |
| G | G1 – pin 7 | G2 – pin 2 |
| A | A1 – pin 6 | A2 – pin 1 |
| f | f (right) – pin 5 | F (left) – pin 4 |

You can use short pieces of blank wire for the connections, but take care that the wires don't touch each other or contacts of the tube socket they are not connected to.

The next step is to mount the microphone capsule on the saddle in the headbasket. Don't touch the membranes!
The CK12 capsule has the backplate connection(s) *very* close to the tensioning rings the membranes are connected with. This gives a risk of small leak currents, in the case of high air humidity or condensation. It is a good idea to cover the backplate connections with a thin layer of conformal coating, or eventually blank nail polish, to add some extra isolation to the backplate connections.




It is a good idea to mark which wire is coming from the front membrane and which wire is coming from the rear membrane. The backplate connection(s) usually have a different wire color, so the function of this wire is clear.
When you have placed the capsule and mount the headbasket in place, it is a good idea to check if the backplate connection(s) on de the side of the microphone capsule don't touch the inside of the headbasket. You can use a multimeter in the 'ohms' range to check this. Sometimes one side of the headbasket is more flat than the other side. Select the flattest side that will be close to the backplate connection(s).
If you don't measure continuity between the backlate wire(s) and the headbasket, you can connect the capsule wires to the main PCB.

The wire coming from the front membrane connects to "Front" on the PCB.
The wire coming from the rear membrane connects to "Rear" on the PCB.
The wire coming from the backplate(s)* connects to "BP".

*: Some capsules have a single backplate wire, some have separate backplate wires for the front and rear capsule half. If you have 2 backplate wires, simply connect them together.

You can mount the main PCB in the microphone body with the four M2x5 screws.
Note that one mounting hole has **no thread**, so use a M2 nut at the back of the rail.

Next step is to connect the wires coming from the XLR connector.

The **red** wire connects to **+HT** on the main PCB (= +120V)
The **yellow** wire connects to **h** on the main PCB (= Heater)
The **blue** wire connects to **Patt** on the main PCB (= Pattern)

On the bottom of the PCB:

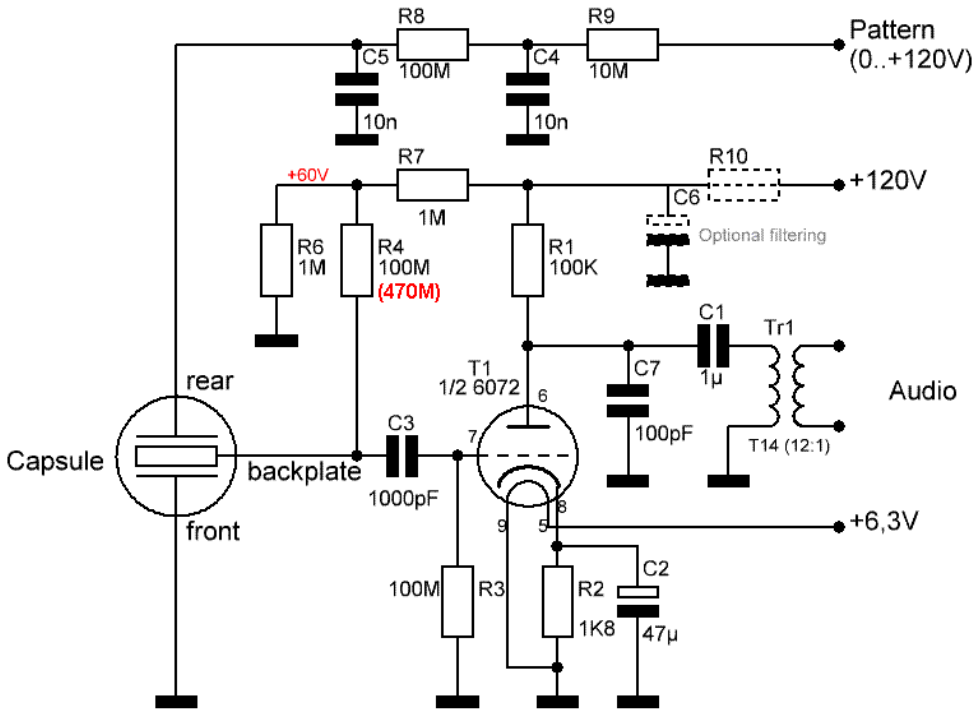
The **green** wire connects to the **'left' Audio** connection (where the yellow transformer wire is connected).
The **black** wires connects to the **'right' Audio** connection (where the orange transformer wire is connected).
The **white** wire is connected to **Gnd.**

The last thing to do is to insert the 6072 tube. This will be easier if you first push the end of a paperclip in all nine tube contacts. This will make the contacts a little wider so you don't need so much force to get the tube in.

If you make the microphone cable yourself:

You connect <u>all pins</u> in the XLR Male and female connector 1:1, so: pin 1 of the male XLR to pin 1 of the female XLR etc.
Pin 4 and 7 (center) are **connected together** and are *also* connected to the **<u>shield</u>** (screening) of the cable.
It doesn't really matter which colors you connect to which pin, as long as the pin numbers on both sides match.
But... if your cable has two conductors that are **<u>thicker</u>** than the other wires, use these thicker wires for **<u>pin 2</u>** (filament) and **<u>pins 4/7</u>** (ground).
Take care not to accidentally connect two pins together. Don't use too much solder!

Schematic:

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