

U220FC Filter Capacitor Board in SB-220

Rev 2 Oct 10, 2023

The U220FC, besides providing four mounting holes, precisely fits the factory filter capacitor bank housing of the Heathkit SB-220.

Heat is the enemy of electrolytic capacitors. This heat primarily comes from charging and discharging (ripple) currents. Ripple current can be a few amperes. This ripple current heats the capacitor internally. The capacitor temperature primarily determines a filter capacitor's life.

A second significantly less troublesome source in the SB220 is the equalizing or bleeder resistors. They are pretty much out in free air, but lacking a barrier do conduct and radiate some heat into the capacitors.

The factory housing is not a good thermal design, it holds the capacitors inside a thermally isolated area, and the capacitor tops are directly exposed to heat from the bleeders.

Our board reduces capacitor operating temperatures by up to fifty degrees Fahrenheit during normal use.

Our board improves system performance by:

- 1.) using lower ESR 105c-rated capacitors
- 2.) placing a good thick circuit board as a heat dam between resistors and the capacitors
- 3.) allowing the capacitors to completely float in free air, with plenty of air space around capacitors for natural air convection
- 4.) adding a 10kV rated surge limiting resistor in series with the HV lead to the tube compartment. This reduces arc fault currents
- 5.) Adding an optional negative rail clamp to protect meters, if you have not already added one by adding one in some other way

Installation SB-220 U220FCp

This universal board can be used in basic simple form but also allows build-outs to more complex applications. It can accommodate HV multipliers for metering and add a good negative rail clamp for additional arc protection. In a normal unmodified SB220 application, multiple parts are not loaded. For example, the high-voltage metering resistors are not loaded.

This board wires like the original board with the exception that an HV wire must be run from the board to the HV feedthrough insulator. This is so tube arcs pass through R9, reducing

NOTE: To make things easier and better for everyone, we now include the fault-limiting diode and three capacitors. We do as much wiring as possible. Heathkit rectifier terminal B (small blue in some amplifiers) must connect to the place in our pictures, to terminal label **B-**, or to our **rec-** (they all share the very same connection point). Our supplied small black wire connects from our D1 anode to any good chassis ground. The Harbach board has negative rail-to-ground protection, although a second protection at the filter board helps contain fault currents to a limited circuit area.

Blue arrows show rec+, HV lead to feedthrough (tubes), and our safety ground black wire
Red arrow shows power transformer wire connection point
Yellow shows acceptable rectifier board B- connection points. All are equally good.

The basic SB220 installation assembly will look like this:

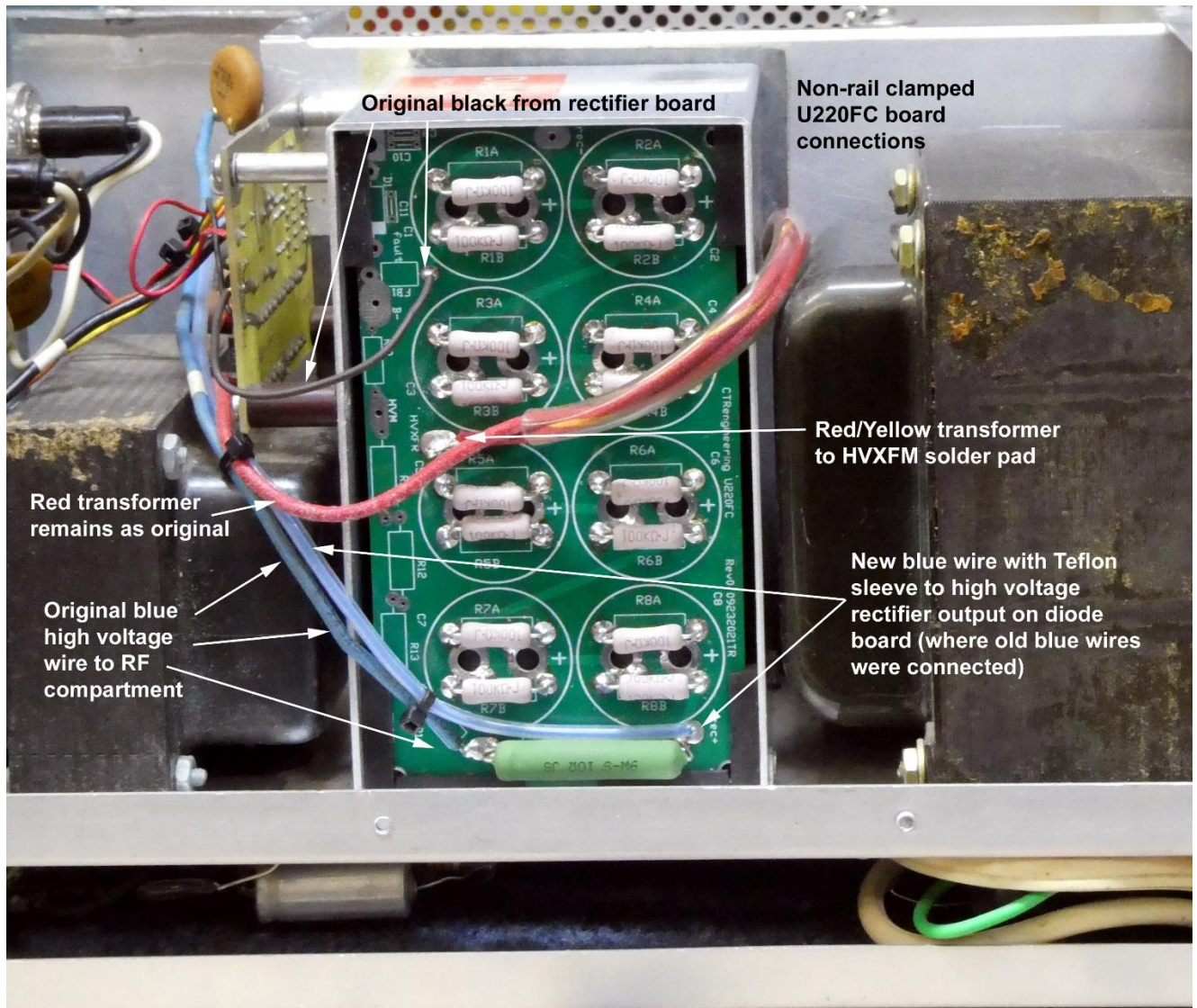


Figure 2 Wire connections

- 1.) Remove the cabinet, chassis cage top, and side panel to gain full access to filter caps.
- 2.) Loosen four #6 nuts under the chassis that hold the filter capacitor housing
- 3.) Disconnect the wires and slide the old filter bank out
- 4.) Remove and save the old parts, including plastic capacitor holders
- 5.) Position the new filter bank in place as shown and tighten the housing nuts. The housing pushes against the rubber edging to lock the board in place.

- 6.) The board has a great deal of in-and-out room. Position or hold the board outward near the outside edge of the Heathkit U-enclosure. This makes wiring easier. The position shown in Figure 3 is ideal, with resistors just level or beyond the enclosure.

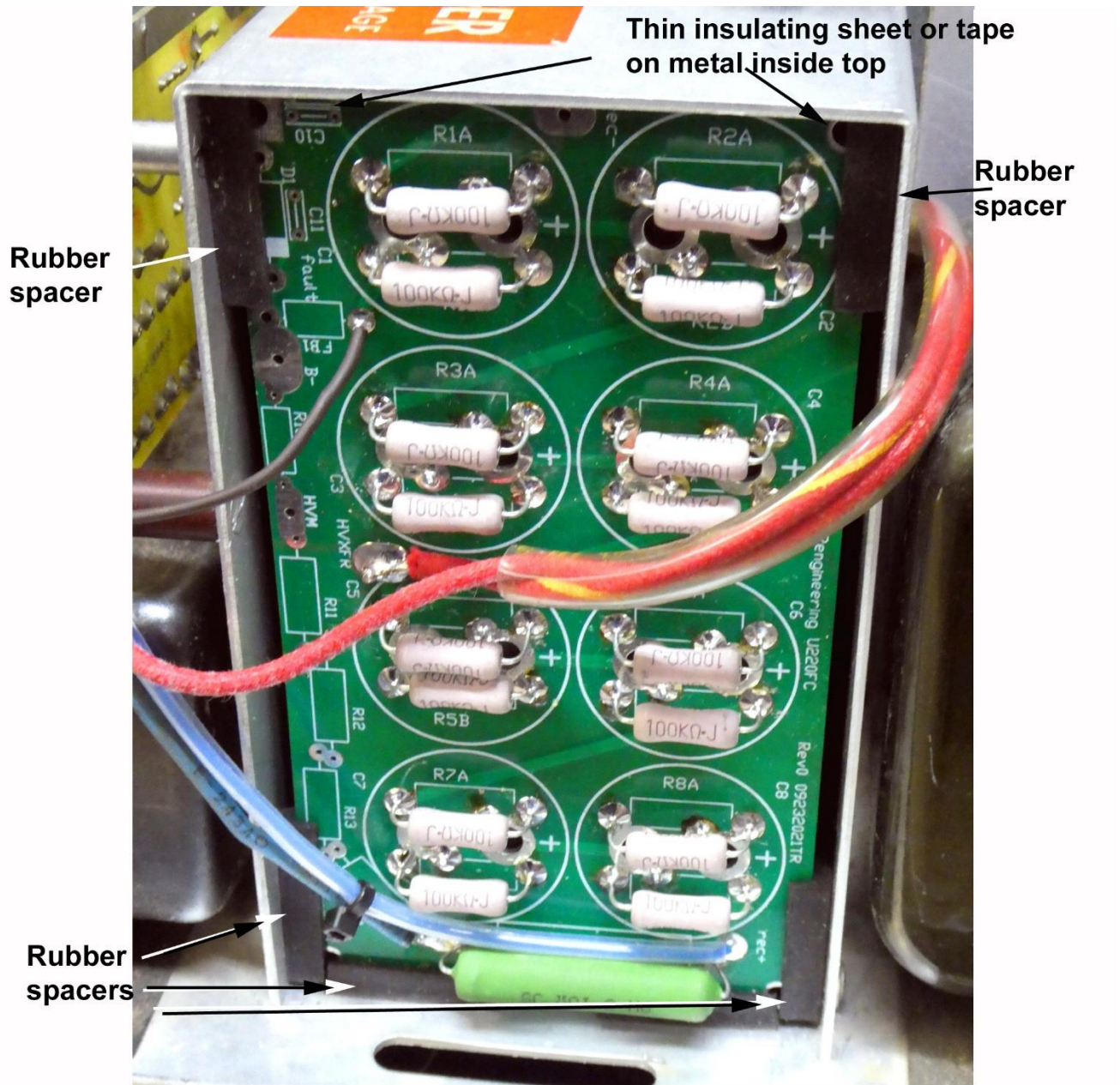


Figure 3 Board in place

- 7.) Attach the existing wires as shown below. This unit pictured does NOT have the negative rail clamp diode. The negative rail clamp adds one jumper and additional small parts. With rail protection added, the upper left mounting pad has to be chassis grounded. The Heathkit original rectifier wire from Heath board terminal B connects either to pad **B**- by FB1 or to **rec-**.

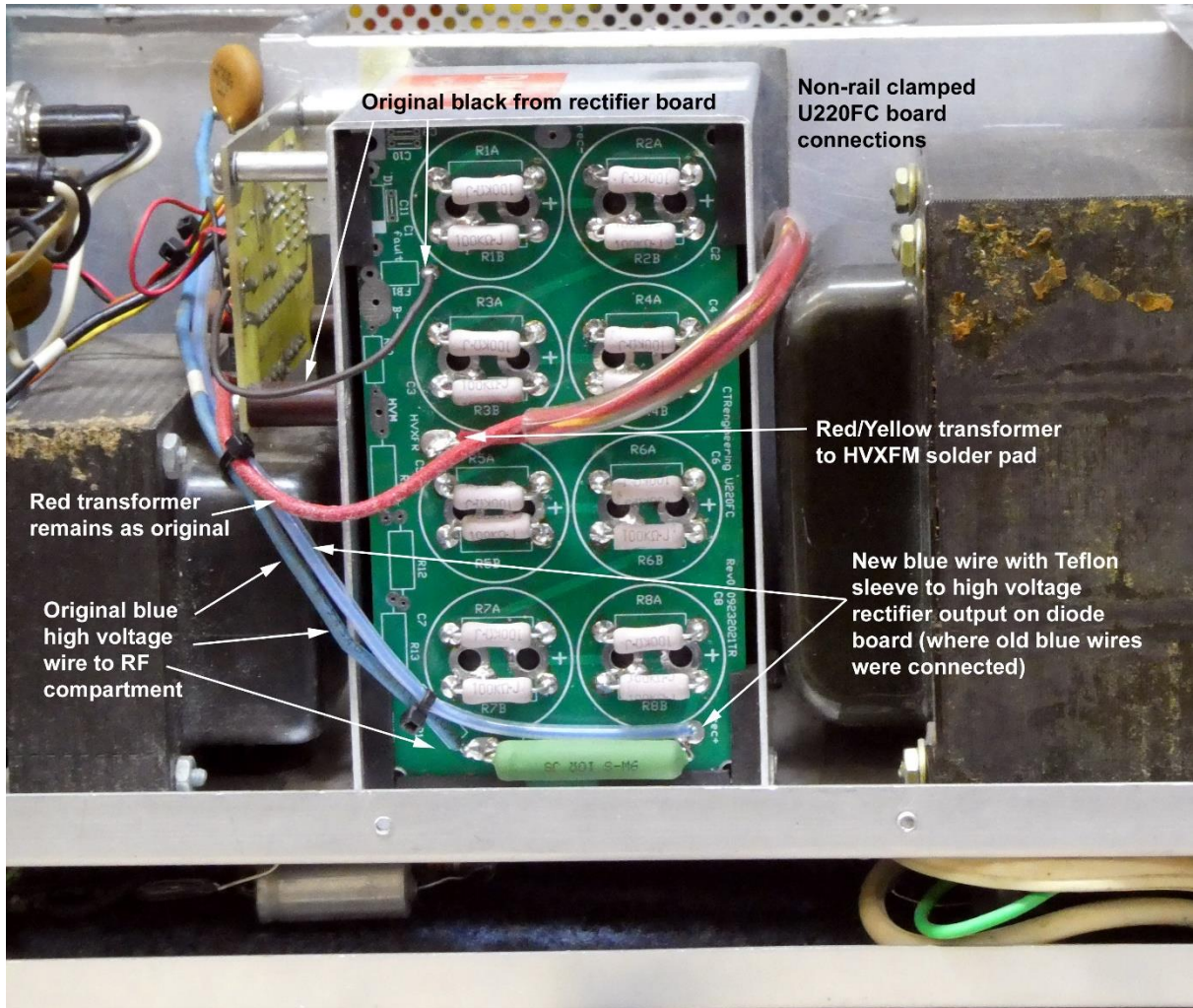


Figure 4 fully wired board (without optional rail clamp diode)

Using a stock rectifier board, adding a protection diode with the jumper and capacitors is best. (This is not required with a Harbach rectifier board since it has a protection diode on board, although extra protection never hurts!) Using a filter-bank mounted protection system, the ground point in the upper left corner must be grounded to the chassis (far upper left corner pad)!!