

METROPOLITAN RADIO REPAIR

By Bill Garman

This repair instruction guide is written for the layman who wishes to try to repair the Pye PE-86 CR radio used in the Nash Metropolitan, but who doesn't have a signal generator, or other expensive equipment. To do it yourself, you'll need an electric multimeter, a soldering pencil, rosin core solder, (do not use acid core solder) a small screwdriver, and needle nose pliers. The first thing to check is the tuner. Does it turn? If the tuner is seized up, and cannot be freed with a bit of oil, you are the proud owner of a parts radio. No need to go any further with this radio.

Before starting, be aware that there are voltages present inside an operating radio in excess of 400V that could hurt or kill you. Be careful.

References will be made to the Metropolitan Auto Radio Service Manual available from Metropolitan parts vendors, or found free on the internet. References will also be made to the color coded diagram attached, with symbols that approximate the location of components inside a radio that has been opened up for repair. For ease of use, radio components are drawn in **black**, battery power is drawn in **red**, case ground is drawn in **green**, and other colors are used at random in an effort to help keep the circuit wires separated, and easier to follow.

If you are sure there is power to the radio and the antenna is connected and it does not work, take it out of the car. Disconnect the battery before starting. Disconnect the power by removing the power lead from the ignition switch assembly and unplug the antenna from the radio. Pull the radio knobs off and remove the two nuts over the tuning shafts and wiggle the radio and speaker assembly out of the dash.

When you have it on your bench, you'll need a charged up battery and an antenna such as the cheapest one you can buy at any auto parts store. When working on the radio, be sure to maintain a full 12 volt charge in the battery. If a battery loses enough of a charge, the radio will not operate properly, or not at all. Do not use a battery charger while working on the radio as most chargers will introduce too much electrical noise. There are two quick checks that can be made to fix a broken radio, 1) see if it has power, 2) listen to hear if the vibrator is humming. Test number 1, check for power. Connecting power correctly depends on the type of vibrator in the radio. The vibrator looks like a small tin can that is 1-1/2" in diameter, 3" tall, and is secured to the radio frame with a metal strap screwed around its base. If the vibrator is an electronic replacement, it will probably be labeled as Positive or Negative Ground, and the battery must be connected to the radio to match the polarity of the vibrator. If the vibrator is not an electronic replacement, but the original magnetic style, the radio can be connected either way; Positive or Negative ground, it does not matter.

Connect one battery terminal to the radio case, and the other terminal to the radio power supply lead, and turn the radio on. In a couple of minutes the tubes should begin to glow; if not, there is probably a bad power connection. Set your multimeter to read 12 volt D.C. and hold one test lead on the radio case and touch the other test lead to each side of the fuse holder. If you lose voltage, check to make sure that the fuse is good. If the fuse is good, check out the fuse holder. In a radio this old, it is common to have a bad fuse holder or the fuse clamps might be loose or corroded. Clean, and squeeze the clamps together, then put the fuse back in. If all else fails, you may need to replace the fuse holder. You can install a fuse in the power cord and move the input power line to the other side of the fuse, but **do not operate the radio without a fuse**. Do not short across the fuse, even for test purposes. If a fuse is defeated and there is an internal problem, there will almost certainly be catastrophic damage. If a fuse blows out instantly when the radio is powered up, check out the light bulb socket as light bulb sockets may short out causing fuses to blow out. Once you have power past the fuse holder, follow the wire to the switch that is located on the back end of the volume control. Test for power on both sides of the switch. A bad switch is very common in these radios. If you don't have power across the switch, short out the terminals across the switch. An under dash toggle switch might have to be installed if the switch is bad. With power past the switch, the tubes should be glowing. The circuit to the tube's heating elements is separate from other circuits, even if the radio doesn't work, the tubes should glow. Sometimes wiggling a tube in its socket will improve a connection.

Never just buy a bunch of new tubes, and plug them in, and expect amazing results. **BAD TUBES ARE ALMOST NEVER THE PROBLEM.**

Test number 2, check the vibrator. Unless someone has replaced it, the radio will have a mechanical vibrator. If the radio has a mechanical vibrator and you know you have power, you should be able to hear the vibrator hum. If it is not humming, it does not work. If the vibrator is bad it can be replaced with either a mechanical vibrator, or even better, with a new solid state vibrator. The vibrator is shown in Picture 1. Now would be a good time to convert the car to negative ground, so get a vibrator for negative ground, such as a 2015-N from Antique Automobile Radio. Get the Tech Bulletin for converting your car to Negative ground.

If the tubes light up and the vibrator hums and you don't have any music, there might be a bad capacitor or other more serious problem. Now let's open up the radio case. Be aware that the speaker has only one wire going to the radio circuitry, the other speaker connection is to case ground. With the radio case opened up, a jumper wire needs to be connected between the radio case, and the cover that the speaker is mounted to in order for the speaker (and dial light bulb) to work.

Test Number 3, Check for a bad capacitor C22. Only go here if the tubes light up and the vibrator hums and you don't have any music, otherwise go on to the next paragraph. Capacitor C22 is a big capacitor inside the radio, near the edge and close to the transformer that may have wax leaking from it. You could try powering off the radio and cutting one lead on this capacitor to see if the radio plays for a few seconds. If it does, you need a new C22.

The first internal circuit to examine is the vibrator. The vibrator is used to convert 12 volt D.C. power to a form of 18 to 20 volt alternating current at a frequency of 120 hertz. The A.C. current is used to operate the main **power transformer**. A transformer will not work on direct current. It must have A.C. power in order to work. The power transformer is used to boost the voltage to a much higher voltage (up somewhere around 416 volts A.C.) The higher A.C. voltage from the transformer is then sent to the 6X4 tube to be converted (rectified) back to a higher D.C. voltage. (the design voltage is 185 volts). We now have a high enough D.C. voltage to operate the other tubes. All this must be done because tubes require a D.C. voltage higher than 12 volts in order to operate.

The base of the vibrator has two 220 ohm resistors, represented by a zig-zag line connected together on one end, and connected to the case grounded pin socket. The resistors are sometimes burned up, broken, or crumbling, and need to be replaced, otherwise they are probably O.K. With a meter set to read A.C. voltage, you should get a reading of somewhere near twenty volts between the two smaller vibrator pins that connect to the T4 Power Transformer. From either small pin, to the larger power supply pin on the vibrator, you should get around ten to twelve volts. If you do not get any A.C. voltage at these points, the vibrator is not working. You must have a working vibrator to test the radio any farther. To replace the vibrator, loosen the retaining band around the base, and wiggle while you pull to remove. The vibrator will pull straight out, but sometimes they are stuck in place tight enough that you must slide a screwdriver underneath, and pry to get it to come out.

If the vibrator doesn't work, it is sometimes possible to start them working again. If you un-crimp the bottom of the vibrator, and pull the guts out, you will see the center vibrating reed, with a set of points on each side. Buff the points with a very fine sandpaper, (1500, or 2000 grit) then re-crimp the bottom, and retry the vibrator.

Now we need to test for power through the transformer. The transformer output is connected to the 6X4 rectifier tube pins; one, and six. (all the tubes in this radio have the pins numbered one, through seven, working clock ways from the gap in the pins) **Be very careful when testing the output voltage of the power transformer, the design voltage is 416 volts A.C. but can be even higher.** From either pin one or pin six of the 6X4 tube you should get a reading of around 216 volt A.C. to case ground. If you do not have the high voltage coming from the transformer, but you have already verified that the vibrator is working, the buffer capacitor is most likely bad, and shorting out the transformer secondary winding. The buffer capacitor is numbered as C22, and is connected to pins one, and six of the 6X4 rectifier tube. The buffer capacitor is special, in that it is insulated to a rating of 600 volts, and .01 microfarads. No other capacitor in the radio is rated for such high voltage. The buffer capacitor is prone to failure, and should always be replaced with a modern one of equal electrical value. Note that the replacement is not going to look anything like the big paper caps that you remove. If the buffer capacitor is shorted, you will likely have no voltage at the transformer secondary output, and the voltage reading at the vibrator feeding the transformer may be reduced considerably.

The power transformer may appear to look bad, with something oozing out of it, and all over inside of the radio. It is not uncommon for some of the beeswax to have melted out of the transformer, and run down into the radio, however don't lose hope; the transformer may be fine, just scrape out the extra ooze, and discard it. If you cut out the ballast capacitor, and the transformer comes to life, with

full voltage, you have proven the transformer to be working, however don't give in to the temptation to operate the radio without the capacitor, because without this capacitor, the vibrator will soon fail.

If you have a functional speaker, and an antenna attached, you might be able to tune in a station at this time. Fifty plus years, out in a car, with high humidity, arid weather, bugs, and any number of other abusive elements, probably have not been kind to your speaker. Whereas the speaker is a common 4"X6" oval 4 ohm impedance, I have found it quite difficult to find one with a magnet small enough to fit into the radio frame. You can fix the speaker by dusting off the pieces, and cutting a piece of paper towel to the size you need to repair the torn speaker. Soak the paper towel in some watered down Elmers glue, then carefully place it on the speaker. Let it dry. Sometimes this will fix a torn speaker to be as good as new. The Metropolitan parts vendors are your friend, and may be the easiest place to find a speaker that will fit into the radio, however some vendors are friendlier than others; check around for the best price, also be aware that the speaker may be one of the costliest part to replace. You may buy a cheap antenna from an auto part store, or from a salvage yard, but I have had good results from using about six foot of insulated wire, with the end stripped, and pushed into the center connection of the antenna socket, and allowed to drop down to the floor.

If you have reached this point, and can tune in at least one station, you have crossed the most common hurdles. If you still don't have a response from the speaker, I have recorded a few places to check for different voltages from five working radios that might pinpoint bad resistors, or capacitors. **Be careful.**

- On the 12AV6 tube, the number three pin has 12 volts; the number seven pin has a voltage from 57 to 62
- On the 12BA6 tube, the number three pin has 12 volts; the number five pin has a voltage of 109 to 149; and the number six pin has a voltage of 54 to 70.
- On the 12BE6 tube, the number one pin has a negative voltage of -4.6 to -5.8; the number four pin 12 volts; the number five pin has a voltage of 56 to 67; the number six pin has a voltage of 57.5 to 68.
- On the 6AQ5 tube, the number one pin has a voltage of 1.2 to 2.8; the number two pin 6.6 to 7 volts; the number four pin has a voltage of 6 to 6.4 volts; the number five pin has a voltage of 155 to 188; the number six pin has a voltage of 114 to 151;
- The number seven pin has a voltage of 1.5 to 4 volts.

It is common practice to replace all capacitors except the mica, and variable adjustable capacitors. The can that holds the three electrolytic capacitors 17, 20, and 21 can be replaced as a unit; but it can be costly. It is much cheaper to replace the three electrolytic capacitors individually. The electrolyte in paste form will probably have dried out, causing the capacitors to fail. When replacing electrolytic capacitors, be sure to observe the polarity (Neg. side to case ground)

If you still have no response from the speaker, your radio needs professional help. If you can tune in one or more stations, you might want to try to improve the performance, for this you can replace the front of the radio, and remove the cover from the back side. Among the tubes, you will find three tuning transformers in round aluminum cans; the two taller cans (1-3/8" X 2-1/4" tall) are T-1, and T-2, and the shorter can (1-3/8" X 1-1/2" tall) is L-2 the antenna coil. When you look into the hole on top of these cans, you will notice a small screwdriver slot in an adjustable iron dust core. When you make adjustments with these iron powder cores, be aware that the cores are crumbly; use a screwdriver that fits the slot, and is not old and rounded on the end. If you have found a station on the high end of the dial (1600 kc), alternately adjust T-1, and T-2 for most volume. Next look for a station near the lower end of the dial (540 kc) especially if it is a weak station and adjust the L-2 antenna coil for most volume. After adjusting the L-2 antenna coil for most volume, try tuning up through the dial. You may find out now that you can tune in a lot more stations. Now we're having fun. Replace the back cover, and locate the hole for access to the antenna trimmer adjustment.

The antenna trimmer adjustment screw is accessed through a hole in the end of the case. This hole is located about 1" below the antenna socket, and is half covered up by the back cover. The back cover is notched out with half of a hole to allow access to the trimmer adjust screw. Install the radio in the car, and tune in a station near 1500ks. Adjust the antenna trimmer screw for maximum volume, now your radio is adjusted for the height of the antenna on your car, and you are done.

For electronic parts, and tools; soldering pencil, .031" diameter rosin core solder, capacitors, resistors, and vibrators, orange drop style capacitors except for the electrolytic capacitors. I have found Antique Electronic Supply on the internet to be a good source.

Note that the factory schematics and pictures can be found at www.mocna.us in the Metropolitan library.

For speakers: 4" X 6" Oval 4 Ohm
S&M Electro-Tech, Inc
8836 Xylite St NE
Blaine, MN 55449
(763) 780-2861

Or
Metropolitan parts vendors