By Jon Shea

TESTING AND CORRECTING AUTOTRANSFORMER POLARITY

October, 2008

An autotransformer, or "autoformer", is commonly used to change voltage such as 220 volts AC (VAC) to 120 volts. You may minimize the probability of electrical shocks as well as damage to equipment used with an autoformer by checking how it is connected to the 220 volt receptacle.

Background Information

An autoformer is lighter, cheaper and smaller than an isolation transformer. Though it costs and weighs less, it sacrifices the safety of electrical isolation of the two circuits, input (220 volts) and output (120 volts). Usually, the use of an autoformer does no harm other than giving users a little "bite" when they touch the equipment, especially if they are in their bare feet!

Depending on how it is wired to the power source, however, an autoformer could cause a more serious shock or even electrocution. And for delicate electronic equipment like fax machines, sound systems, computers and modems, the chance of damage by lightning or through connections to other equipment is increased. The chances of shock and damage can be minimized depending on how the autoformer is actually wired to the plugs and receptacles.

It is worth checking this out. The object is that the 120 VAC "neutral" wire is connected to the 220 volt "neutral" in the wall receptacle, not directly to the 220 volt "hot" wire in the receptacle. This is accomplished by being sure that the 220 volt plug or wiring is properly connected. If not, it may be corrected by simply reversing the two "hot" and "neutral" wires in the 220 VAC plug which goes into the wall receptacle.

How to Test Your Autoformer

By using a neon tester you can figure it out rather quickly:

1) Find a neon electrical tester. This may be either a small neon light with two leads or the screwdriver type with a neon lamp inside the handle. These are easily obtainable at your local hardware store.

2) First test your live 220 volt wall receptacle. It may just have two slots or holes, or two slots or holes and a brass pin, or three slots. One will be the "neutral" which is grounded or earthed outside the house; one will be the "hot" or 220 volts in relation to neutral and to earth; and the brass pin or third slot is the "earth" or “ground” connection.

Note: the following step is not dangerous with a neon tester. It is recommended that you stand on a dry floor and wear dry shoes. Do not use this method when using a different kind of lamp or a voltmeter. The neon method works because of the body’s “capacitive coupling” to earth.

3) Jab one lead of the tester, or the blade of the tester screwdriver, into one of the slots or holes (not the “earth” connection). Touch with your finger and thumb the other lead of the testor, or with your finger the metal tip at the top of the screwdriver handle. Look for a bright glow of the

neon lamp. (If you have rubber soles it may be harder to see the glow.) If you see a bright glow, you have the 220 volt "hot". If no glow, it may be the 220 volt "neutral".

4) Now try the other (non-earth) slot or hole. You should see the opposite of what you had in step 3. (If you have no glow from either hole, the circuit is dead; check out the house fuse or circuit- breaker.)

5) Finally for the 220 volt receptacle, test the third slot (“earth” or “ground”) or brass pin, if it has one. You should see no glow whatsoever, but if you do, have an electrician check your house wiring as this is a serious fault. OK, so far this was practice. On to the real test....

6) Plug in (or power up) the autoformer. Now identify each of the three conductors in the output 120 VAC receptacle or power strip. The "neutral" is the wider flat slot. The "hot" is the narrower flat slot. The "earth" or “ground” is the round, third, connection. (By the way, do not allow the use of 220 volt plugs for 120 volt devices as the probability is very high that someone will make the mistake of plugging them into 220 volts.)

7) Jab one lead of the tester or the blade of the tester screwdriver into the "hot" of the AC strip with power on. Touch the other lead, or the metal tip at the top of the screwdriver handle. You should see a medium glow, not as bright as it was for the 220 receptacle "hot" connection as in step 3 or 4.

8) Jab the "neutral" and try again. You should see no glow whatsoever.

9) Try the "earth". Again you should see nothing. However if you see a glow on this connection you should have an electrician check out the autoformer earth circuits, assuming that the 220 volt receptacle earth was ok. In any case, this fault is serious.

10) If steps 7 and 8 show different results (for example the "hot" has a medium glow and the "neutral" has a bright glow) open the 220 volt plug which the autoformer uses to plug in the wall, and exchange the two leads on the two “non-earth” connectors or pins. Then try the procedure 6-7 again and it should test as indicated. If not, ask an electrician to help you.

Note: For the following test, do not touch the bare leads of the neon tester.

11) Now you should be able to test the autoformer input and output voltages directly with your tester. Jab one lead into each of the two holes in the 220 VAC receptacle. It should give a bright light. (For the screwdriver type tester, use an extension lead connected to the top of its handle.) Then jab the tester leads into the "neutral" and "hot" slots in the 120 VAC receptacle. You should see a medium glow, not as bright as for 220. Finally, test between the "neutral" and "earth", and you should see no glow whatsover.

12) Having proven the connections for the receptacle you usually use, you must test it again for other receptacles if you move the autoformer around. Check out steps 3-5 for each one. The best "fix" is to reverse the leads as needed inside the wall receptacles so all the 220 volt "neutral" and "hot" connections are consistently the same. If you plan to do this, you might check which way most of them are already so you have to change only the few that are different.

Note that a 220 volt extension cord should not reverse the leads; if it does, correct that first, then the wall receptacles as well.

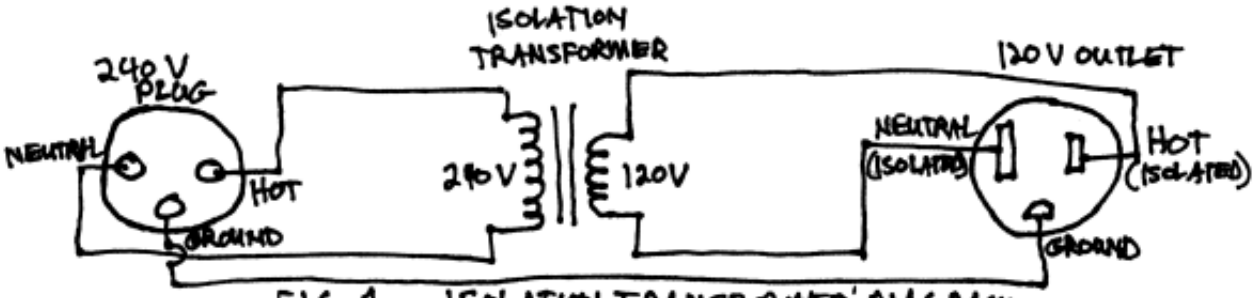

FIG. 1 – ISOLATION TRANSFORMER DIAGRAM

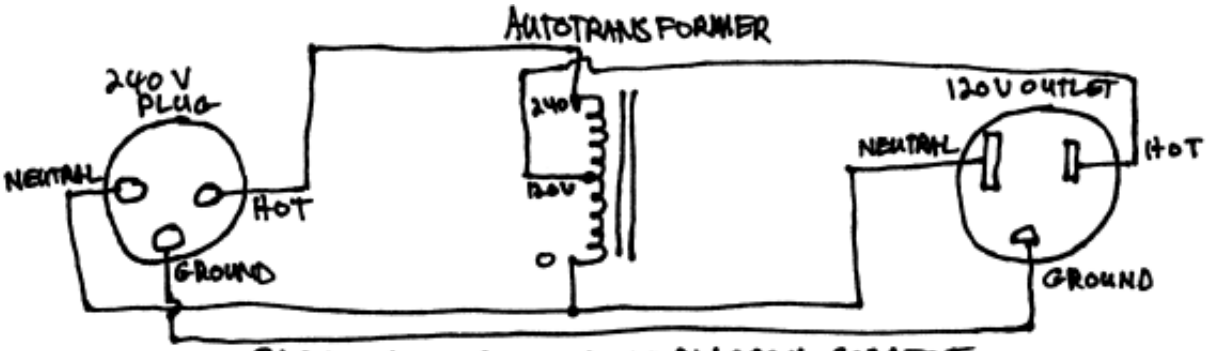

FIG.2 – AUTOTRANSFORMER DIAGRAM – CORRECT

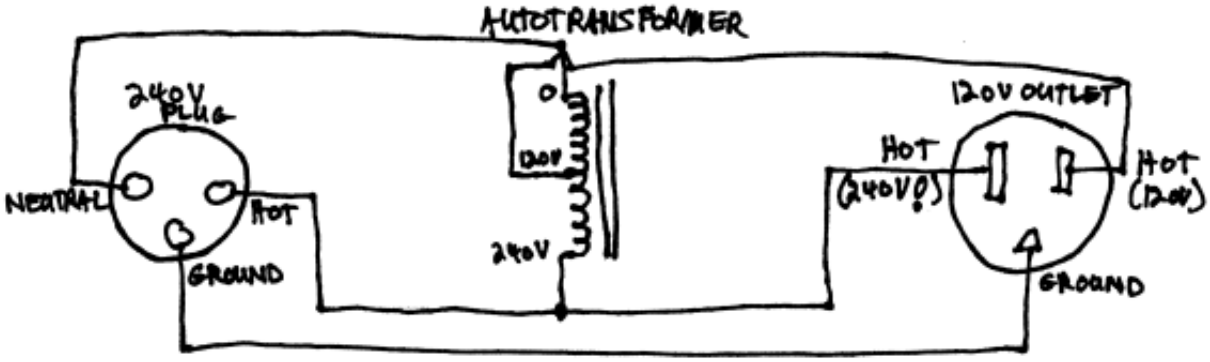

FIG.3 – AUTOTRANSFORMER DIAGRAM – INCORRECT!