

Bennett/Trex/HCMI* Advanced Troubleshooting

kVp? and kVp C? errors:

The very first thing before doing anything else is to check the driver assemblies for signs of arcing, cracked or blown up IGBT's or blown out fet's and burnt inverter driver boards. It's normally pretty apparent to see, especially on FET drivers assemblies. If in doubt, remove the 3M filament tape that is wrapped around the fet's and diodes on each driver to visually inspect. IGBT's are easier to spot when they have blown out, but not always. Visually inspect for minor cracks. If the last time the generator was fired and the operator says it sounded like a shotgun, about 99%, you have blown drivers. Once in a great while, they may say more like a sizzle, but anyway, they need to be inspected. If you have shorted drivers, the display should boot to "dc ref" error, because on non-stored energy units, it probably took out one or more DC bridges on top of the cap bank and a buss fuse, but don't rely on that 100% to tell you, you have blown drivers or not. Inspect them regardless. It is possible the driver blew in such a way that it may be open, but not shorted and would not pull down the cap bank/bus voltage.

The reason for checking the drivers is that if a major tube arced occurred, it may have also damaged the hi-voltage transformer tank. Sometimes a arcing tube may only take out the tank, or it may just take the drivers and not the tank. In severe cases, both. The problem is if you have a tube arcing, you can replace FET or IGBT drivers and transformer tanks all day long. The next time the tube arcs, it pops the tank or blows up the drivers, or both. The problem can be on the anode or cathode side. I've even seen cases where first the cathode side blew drivers and the tank, all parts replaced on the cathode side and then the anode side blew up. I've only seen that a few times, but it all came down to an arcing x-ray tube. And a tube doesn't always arc only at higher kV's.

It's not a cheap road to go down, but either a known good tube or preferably a new x-ray tube should be installed. Replacing the hi-tension cables is not a bad idea either. If you do this, new tube, cables, replace drivers and/or the tank, **DO NOT** attempt to put the old cables and tube back on the generator. You'll undo everything you just fixed if the tube is arcing. I can speak myself about that one. The very first Bennett generator I worked on years ago, that very thing happened. Someone suggested, since it was all up and running now, to try putting the original tube back on and save several thousand dollars. Well, I did and there was no savings. It actually blew drivers and the tank.

A bad kV board by itself can also give you kV's errors and it's a simple matter of replacing the board. That one though is only about 10% of time, the problem. Now here's one method I don't agree with. Swapping the kV boards and changing the jumpers as a test. The reason I don't like this one? I've seen kV boards fail and the problem on the board was it would drive on it's own to high kV. In other words, you might select a low kV and it will try to drive considerably over the maximum rating of kV and then blow the tank (and possibly drivers). If this is the case and you swap kV boards, now you have problems times two, by installing a bad kV board on the side that didn't have a problem. It is rare and the majority of the time it will not be a problem, but for the price of replacement kV board, why take the chance? I've also seen problems with the micro effect the kV boards, but it is rare.

*If an HCMI, contact us for more info as there was an issue that effected the kV boards concerning the power supply p.c. board. This was an HCMI generator issue, only. The troubleshooting procedure for an HCMI generator with blown IGBT's is slightly different. This was **not** an original Bennett or Trex issue.

So, to troubleshoot kV errors:

1. Inspect the FET or IGBT driver assemblies
(If you have blown drivers, it's time to decide at this point about tube replacement and replacement of the blown drivers)
2. Check all power supply voltages, including the DC bus or each bank of batteries (if Stored Energy)
3. Try a known, good kV board
4. If you still get kV? or kV-C? errors, try another hi-voltage tank

kV boards, drivers and tanks do fail on their own which doesn't make this troubleshooting always the easiest, but as a rule, blown drivers are normally an indication that the x-ray tube is arcing. Also keep in mind that a tube arc may take a tranformer tank and not the drivers, but it may with continued use. In other words a slight tube arc may only take the tank. A severe tube arc can take out drivers and the tank.