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## How to nullify noise

Posted on 12/29/2015

Posted by **Hypertherm**

Articles, Tips and techniques, Powermax30 XP plasma system, Noise

### Symptom

The cutting machine behaves erratically during piloting of the plasma torch: the CNC may "lock up," or the torch carriage or beam may lose position and "run away." The machine motion is normal in a dry run or manual operation.

### Background

The high voltage spark required to create a pilot arc in plasma systems (3,000-10,000 VAC) creates radio frequency (RF) electrical noise. This noise can interfere with operation of nearby electrical equipment.

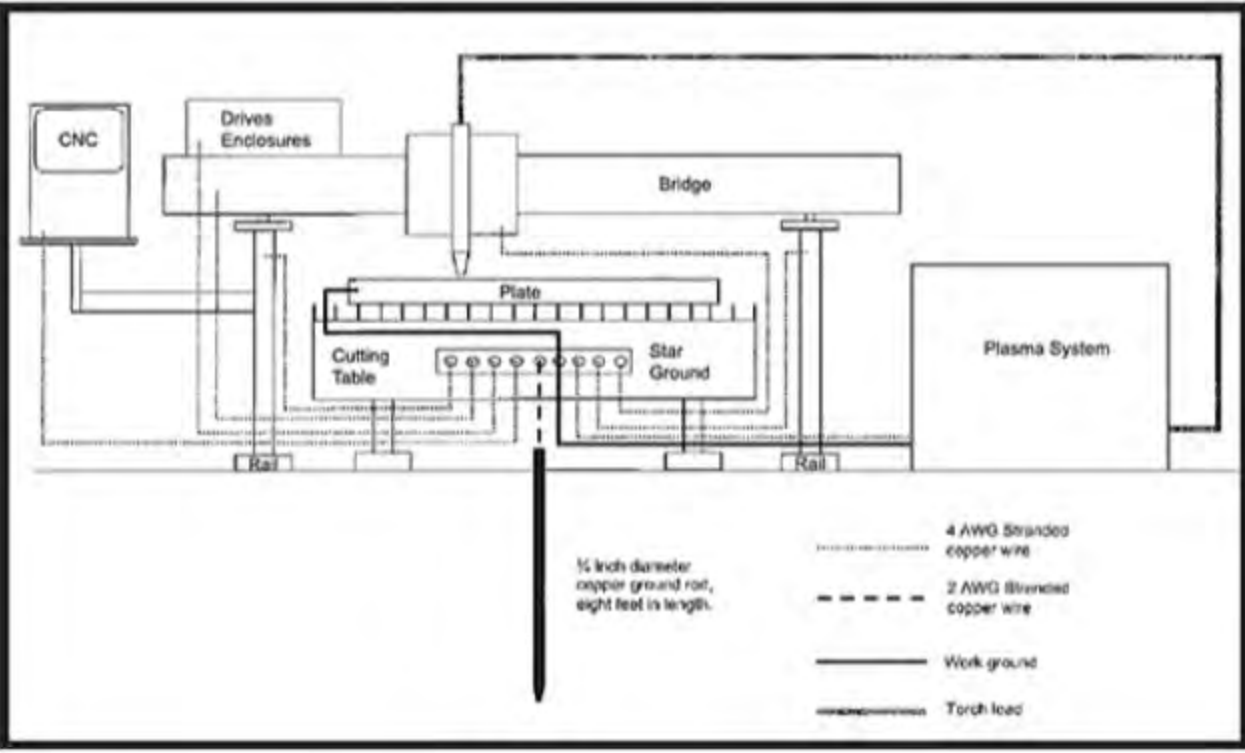
**Read all safety information in your operations manual before operating or repairing PAC equipment. PAC systems use high voltage and direct current (DC) electricity. Electric shock can injure or kill.**

### Earth ground vs. noise ground

Although used interchangeably, these terms represent two different grounding schemes. The earth (or power) ground uses the earth as the conductive current return path to the lowest potential point of a power generation system. A true earth ground, as defined by the National Electric Code, consists of a conductive (usually copper) rod or pipe driven into the earth to a minimum depth of eight feet. The rod should be at least 7/8 in. diameter to ensure a proper ground.

While the earth ground conducts electricity, the noise ground diverts RF electrical "noise" to the earth. RF noise emanates radially from the pilot arc cable inside the lead set. If not shielded and grounded properly, any component on the cutting machine can act as an antenna—picking up RF from the plasma leads and transmitting it to electronic equipment. Encoder wires, motor wires, THC cables and CNC cables are particularly susceptible. If these cables and devices pick up noise they may malfunction, causing erratic machine performance.

The work cable is neither an earth ground nor a noise ground, although it is connected to the same terminal strip as the earth and noise grounds (see Fig. 1). The work cable is the positive (+) lead from the PAC power supply to the workpiece. This cable completes the circuit from the torch back to the power supply, allowing main DC current flow during a cut. (PAC is a DC electrode negative (DCEN) process with the electrode inside the torch negative (-) and the workpiece positive (+).



### Earth grounding recommendations

Install only one ground rod, but make it as deep as necessary to obtain the proper resistance reading for your particular area. Ground rods of over 200 in. are not uncommon in dry, rocky ground. The more ground rods driven, the more capacitance is added to the system. This could cause a "flashback" of power to the cutting machine in the event of a catastrophic electrical failure.

Make all of the machine connections in parallel, not in series. If the earth grounds are in series, the noise from each conductor will be transmitted to the next connection point and then dissipated into that device. Note that in the Star Ground setup, all connections are in parallel, which also reduces the chances of encountering ground loops.

Be sure to test each rod and record initial readings. Ground rods should be tested periodically to make sure that they are still able to function properly. If it is discovered that the conductive properties of the ground rod have decreased over time, a material called bentonite (available from any well drilling company) can be mixed with water and poured down the hole of the ground. This will reestablish the connection between the rod and earth. DO NOT USE SALT, as it can corrode any ground rod material and cause a complete grounding failure.

If correct readings cannot be obtained by a single ground rod, move at least 25 in. from the original ground rod and drive another. Link these two rods with 4/0 cable. Again, test each rod and record its progress. However, there should never be more than two ground rods for any PAC system.

### Noise grounding recommendations

High Frequency (RHF) enclosure to either the Star Ground bus strip or to the ground rod directly. Wire gauge should be 4-10 AWG stranded copper wire. Run a separate wire from the machine beam, each rail, and torch carriage to either the Star Ground bus strip or ground rod. Again, use 4-10 AWG stranded copper wire. Use braided metal shielding to cover the torch leads. The shielding should go from the back of the torch mounting tube to the power supply cabinet, which is grounded. This shielding is very important for noise control.

When noise problems occur, first verify the earth ground is good and check all noise ground connections for looseness or corrosion. PAC systems use water tables in their process, and often the terminal strip for a Star Ground setup is in an area that is exposed to moisture and heat. Corrosion on these terminals may prevent good conductivity. One loose connection may cause the cutting machine to act possessed.

Posted on 12/29/2015

Posted by **Hypertherm**

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