# Recommended Grounding and Shielding Practices

## Field Service Bulletin

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Hypertherm®

*The world leader in plasma cutting technology*

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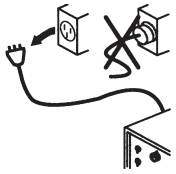
**WARNING**
**ELECTRIC SHOCK CAN KILL**



**Disconnect electrical power before performing any maintenance. All work requiring the removal of the power supply cover must be performed by a qualified technician.**

**See *Section 1* of the plasma system instruction manual for more safety precautions.**

## Introduction

This document describes the grounding and shielding necessary to protect a plasma cutting system installation against radio frequency interference (RFI) and electromagnetic interference (EMI) noise. It addresses the 3 grounding systems described below. There is diagram on page 5 for reference.

Note: These procedures and practices are not known to succeed in every case to eliminate RFI/EMI noise issues. The practices listed here have been used on many installations with excellent results, and we recommend that these practices be a routine part of the installation process. The actual methods used to implement these practices may vary from system to system but should remain as consistent as possible across the product line.

### Types of grounding

A. The safety (PE) or service ground is shown in green on the diagram on page 5. This is the grounding system that applies to the incoming line voltage. It prevents a shock hazard to any personnel from any of the equipment, or the work table. It includes the service ground coming into the plasma power supply and other systems such as the CNC controller and the motor drivers, as well as the supplemental ground rod connected to the work table. In the plasma circuits, the ground is carried from the plasma power supply chassis to the chassis of each separate console through the interconnecting cables.

B. The DC power or cutting current ground is shown in red on the diagram on page 5. This is the grounding system that completes the path of the cutting current from the torch back to the power supply. It requires that the positive lead from the power supply be firmly connected to the work table ground bus with a properly sized cable. It also requires that the slats make good contact with the table and the workpiece.

C. RFI and EMI grounding and shielding is shown in blue on the diagram on page 5. This is the grounding system that limits the amount of electrical “noise” emitted by the plasma and motor drive systems. It also limits the amount of “noise” that is received by the CNC and other control and measurement circuits. This grounding/shielding process is the main target of this document.

## Steps to take

1. Unless noted, use only AWG #6 (16 $mm^2$) welding cable (Hypertherm part no. 047040) for the EMI ground cables shown on the diagram (blue).

2. The cutting table is used for the common, or star, EMI ground point and should have threaded studs welded to the table with a copper bus bar mounted on them. A separate bus bar(s) should be mounted on the gantry as close to the drive motor(s) as possible. If there are drive motors at each end of the gantry, run a separate EMI ground wire from the far drive motor to the gantry bus bar. The gantry bus bar should have a separate heavy EMI ground wire (AWG #4 part no. 047031) to the table bus bar. The EMI ground wires for the torch lifter and the RHF box must each run separately to the table ground bus.

3. A ground rod that meets all applicable local and national electrical codes must be installed within 6m (20 feet) of the table. This is a PE ground and should be connected to the ground bus on the cutting table with AWG #6 green/yellow grounding wire (Hypertherm part number 047121) or equivalent. All PE grounds are shown on the diagram in green.

4. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, power supply-to-power supply multi-drop connections, and interconnections between all parts of the Hypertherm system.

5. All hardware used in the ground system must be brass or copper. The only exception is that the studs welded to the table for mounting the ground bus can be steel. Under no circumstances should aluminum or steel hardware be used.

6. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.

7. The positive, negative, and pilot arc leads should be bundled together for as long a distance as possible. The torch lead, work lead and the pilot arc (nozzle) leads may only be run parallel to other wires or cables if they are separated by at least 150 mm (6"). If possible, run power and signal wires in separate cable tracks.

8. The ignition console should be mounted as close as possible to the torch, and must have a separate ground wire to the bus bar on the cutting table.

9. Each Hypertherm component, as well as any other CNC or motor-drive cabinet or enclosure, must have a separate ground cable to the common (star) point on the table. This includes the ignition console, even if it is bolted to the power supply or to the cutting machine.

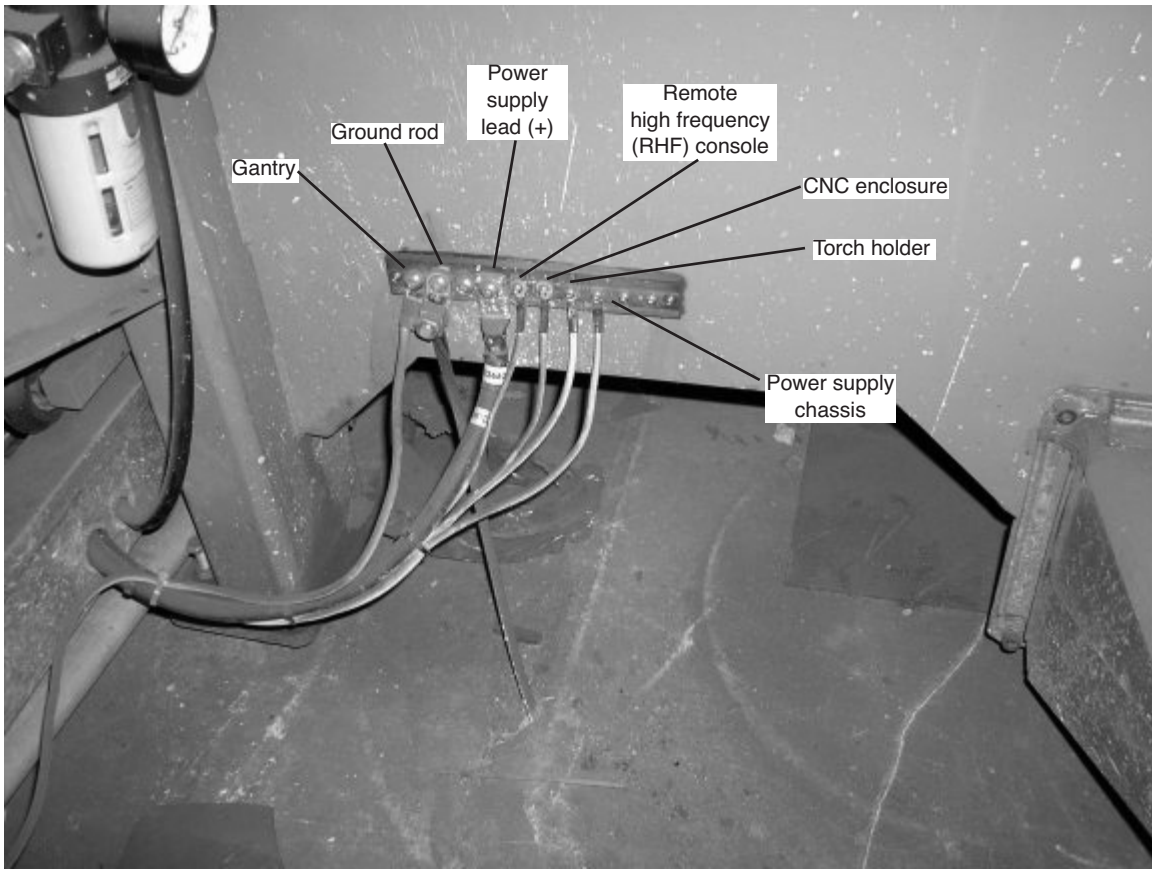
10. The metal braided shield on the torch leads must be connected firmly to the ignition console and to the torch. It must be electrically insulated from any metal and from any contact with the floor or building.

11. The torch holder and the torch break-away mechanism – the part mounted to the lifter, not the part mounted on the torch– must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (1/2") wide. A separate wire must run from the lifter to the bus bar on the gantry. The valve assembly should also have a separate connection to the gantry bus bar.

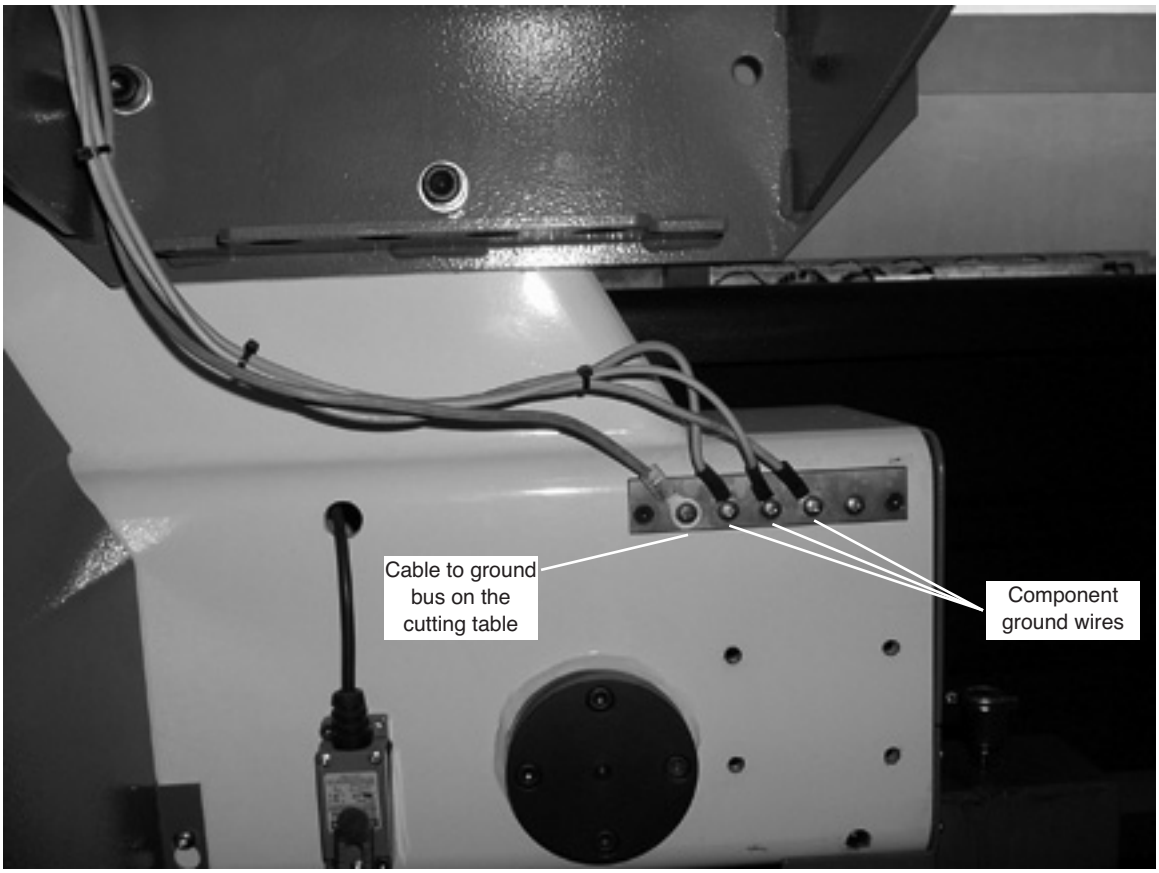
12. If the gantry runs on rails that are not welded to the table, then the rails need to be connected with a ground wire from each end of both rails to the table. This need not go to the common (star) point, but could take the shortest path to the table.

13. If the OEM is installing a voltage divider to process arc voltage for use in the control system, the voltage divider board should be mounted as close as possible to the point where the arc voltage is sampled. One acceptable location is in the plasma power supply. If the Hypertherm voltage divider board is used, the output signal is isolated from all other circuits. The processed signal should be run in twisted, shielded cable (Belden type 1800F or equivalent). The cable used must have a braided shield, not a foil shield. The shield should be connected to the chassis of the power supply and left unconnected at the other end.

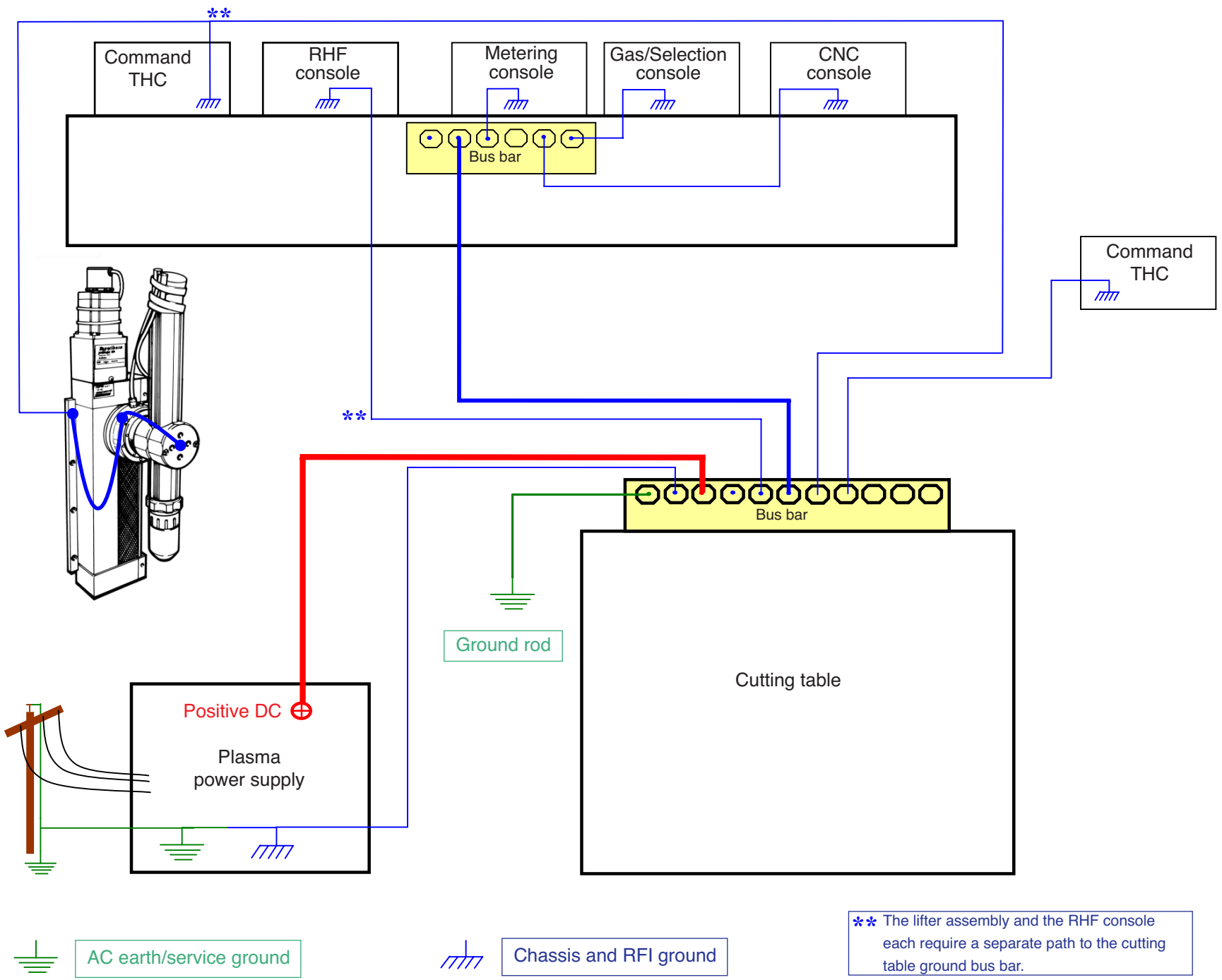
14. All other signals (analog, digital, serial, encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing and the shield, not the drain, should be connected to the metal housing of the connectors at each end of the cable. Never run the shield or the drain through the connector on any of the pins.




Example of a good cutting table ground bus. The picture above shows the connection from the gantry ground bus, the connection from the ground rod, the power supply positive lead, the RHF console, the CNC enclosure, the torch holder, and the power supply chassis.




Example of a good gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground wires from the components mounted on the gantry go to the bus except those from the RHF module and the torch holder. A single heavy cable then goes from the gantry ground bus to the ground bus bolted to the table.


**
Command THC
RHF console
Metering console
Gas/Selection console
CNC console
Bus bar
Command THC
**
Bus bar
Ground rod
Cutting table
Positive DC
Plasma power supply
AC earth/service ground
Chassis and RFI ground
** The lifter assembly and the RHF console each require a separate path to the cutting table ground bus bar.