Hypertherm®

H401/H601

Power Factor and Snubber Capacitor Removal

(For systems manufactured for Hypertherm by HDR)

Field Service Bulletin
(P/N 804430)

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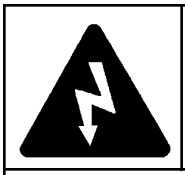
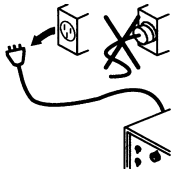
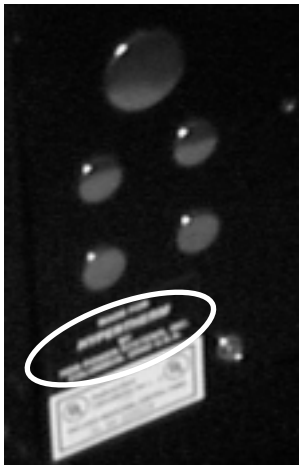



WARNING
ELECTRIC SHOCK CAN KILL



Disconnect electrical power before performing any maintenance.
All work requiring removal of the power supply cover must be performed by a qualified technician.
See *Section 1* of the Instruction Manual for more safety precautions.

NOTE: To tell if the unit was manufactured by HDR, look for the sticker on the left side of the power supply. It is located by the primary input power knockouts. See picture below.



Why Capacitors Were Incorporated in the H401/H601 Design

Adding **Power Factor** capacitors was considered appropriate because the electrical load for the H401 and H601 power supplies is inductive. An inductive load draws more current than required so the reactive power demand is satisfied. Adding the capacitors diverts some of the reactive power from the line causing a reduction in line current and an improvement in the power factor.

The **Snubber Capacitors** were incorporated in the original design of the SCR bridge. Testing has shown that snubber capacitors are not required. In some cases the capacitors can cause arcing to occur. They should be removed.

Reasons for Removing Power Factor Capacitors

1 – The power factor improvement shown is less than .5% at rated load with the capacitors.

2 – Capacitors cause a deterioration of about 25% in the quality of line current as well as a deterioration in voltage, due to the introduction of harmonics.

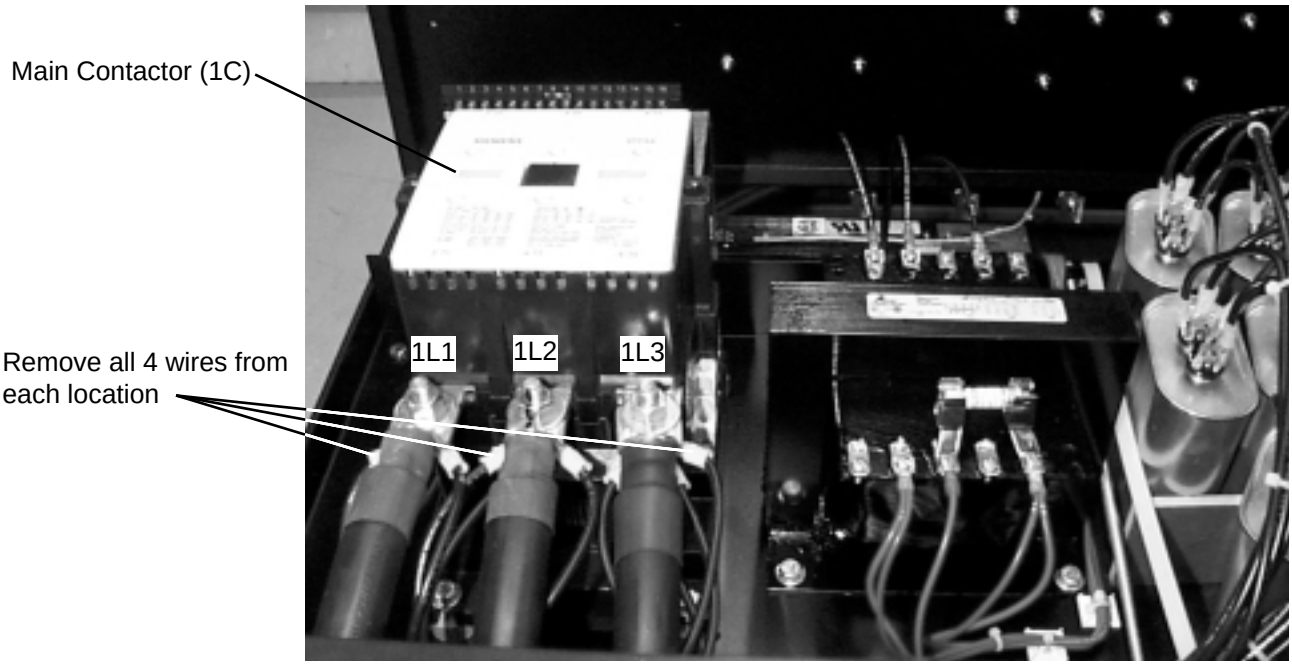
3 – The line-side harmonic currents have been observed to cause over-heating and failure of the capacitors in some cases.

Note: For a more detailed technical explanation of the power factor capacitors, see page 4.

Power Factor Capacitors Procedure

1 – Disconnect power from H401/H601.

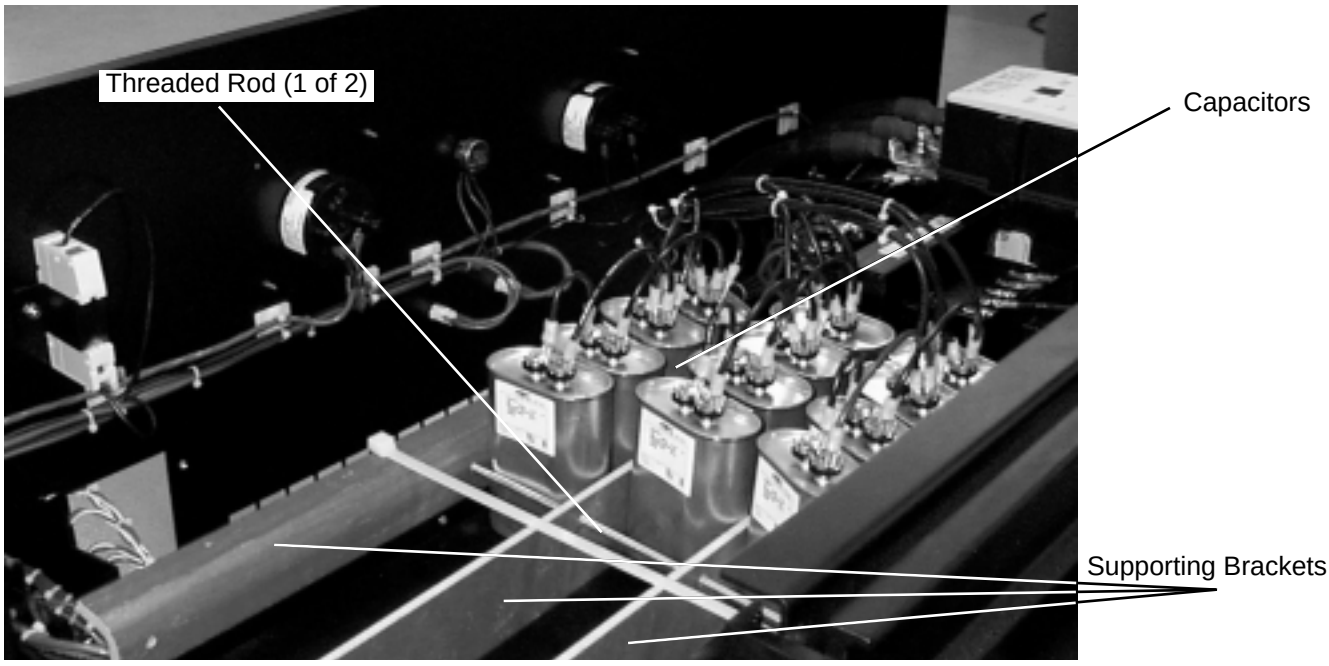
2 – Remove top cover of power supply and locate the main contactor (1C). Remove the 12 ga. wires from the secondary side of 1C numbered 1L1, 1L2, and 1L3 (there are four at each location). See figure below.



3 – Loosen and remove the threaded rods at both ends of the capacitor banks. See figure below.

4 – Remove capacitors and supporting brackets from the machine.

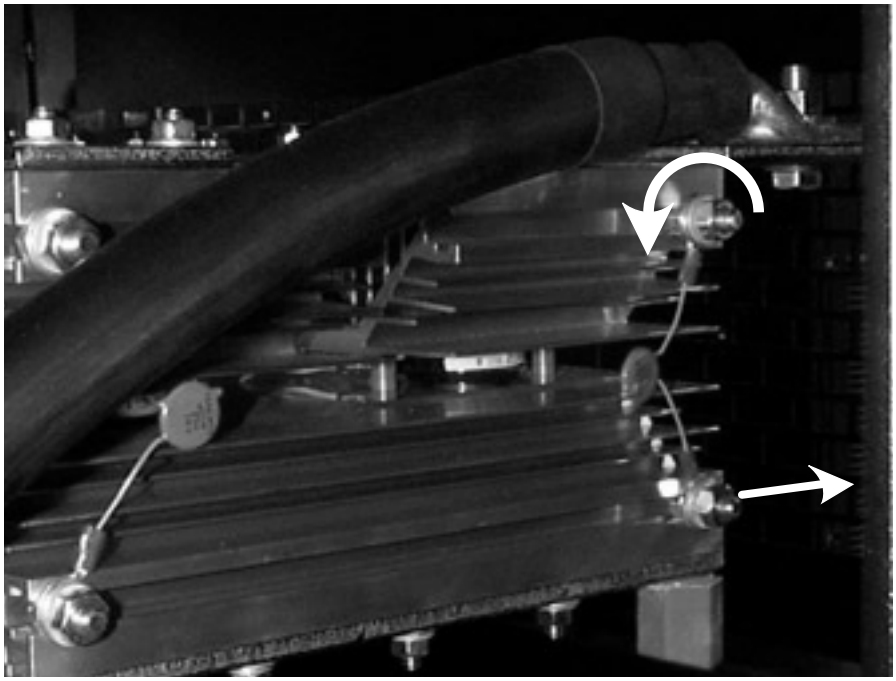
5 – Replace top cover and turn power back on.



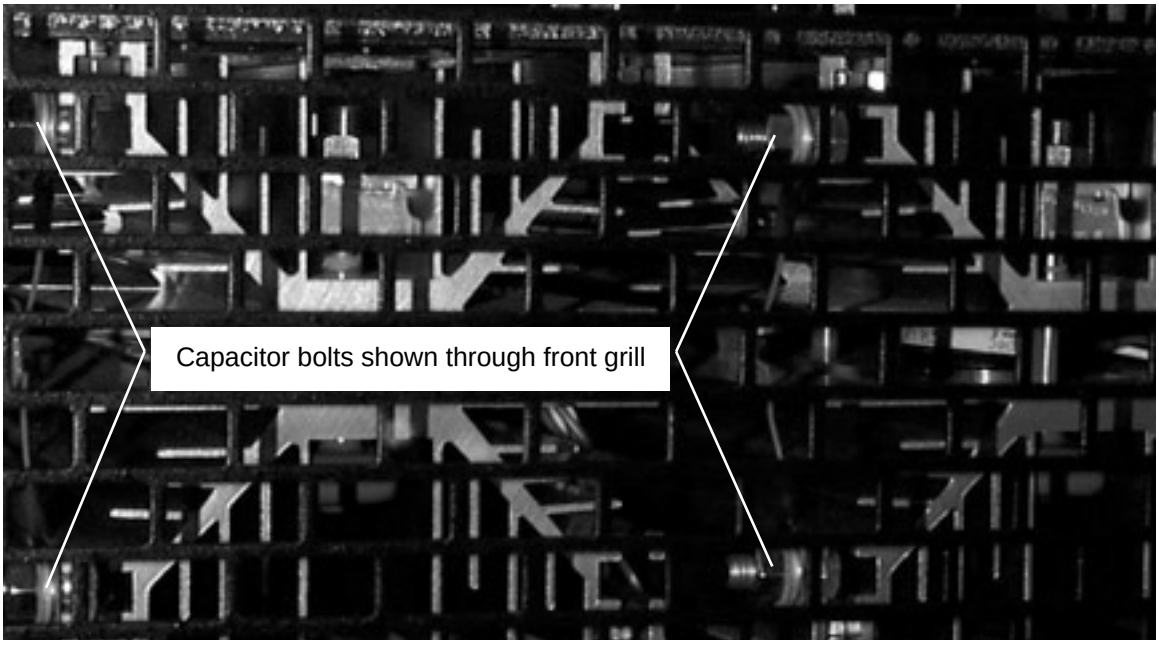
Snubber Capacitors Procedure

There are 6 snubber capacitors to remove from the SCR bridge.

1 – Disconnect power from H401/H601.
2 – Remove left side panel.
3 – Loosen nuts (2) for each capacitor and slide bolt out of slot. See figure below.



Note: The 2 capacitors at the front of the machine are difficult to reach. Reach in through left side of power supply, underneath SCR bridge. DO NOT cut wires to capacitor and leave bolts in place.



Removal of Power Factor Capacitors in the H401 & H601

Need for Power Factor Capacitors in the H601 power supply:

Generally, a typical electrical load (e.g. an induction motor) is inductive in nature. An inductive load draws more current from the line than required since it draws an additional (reactive) current component to satisfy its reactive power demand. It is well known that adding power factor capacitors in conjunction with inductive loads helps reduce the line current. This is because a capacitor has the ability to source reactive current. Adding capacitors across an already existing inductive load helps divert some of the reactive current demand from the line. This causes a reduction in the line current and improvement in the power factor in the process.

The H601 power supply, being an inductive load (power factor ~0.5-0.7), it was considered appropriate to install power factor capacitors for the reason mentioned above. Currently the per-phase capacitance is 40uf.

Proposal to remove Power Factor Capacitors from the H601 power supply:

This proposal has been brought up for the following reasons:

1 – It has been found that the value of 40uf provides an insignificant amount of reactive power to the power supply. The improvement in power factor due to the presence of these capacitors is less than 0.5 % at rated load.

2 – The presence of these capacitors has been observed to cause a deterioration in the quality of line current as well as voltage. This is due to the introduction of harmonics (both voltage and current) into the power system. The switching of the thyristors present in the H601 provides the stimulus for harmonic current generation. This stimulus causes the capacitors to resonate with the incoming feeder transformer leakage impedance as well as neighboring inductive loads, resulting in line current harmonics. It has been observed that the quality of line current as well as voltage (given by the term Total Harmonic Distortion) deteriorates typically by about 25% due to the presence of these capacitors.

3 – The resulting harmonic currents have been found to cause over-heating and failure of these capacitors in some cases. Given the dependence of harmonic current generation on external factors such as feeder transformer leakage impedance and neighboring loads, it is impossible to consider all possible load scenarios for reasonably estimating the capacitor current rating. For instance, it has been observed that the capacitor current increases by about 50% in the event there are two H601s running in tandem as compared to the situation when only one H601 is in operation.

Based on these reasons, it is proposed that the power factor capacitors currently installed in the H601 Power Supply be removed.