WarmlyYours
Be Connected.
Be Warm. Be Radiant.

Resistance Heating Floor Fault Location
Thermal Camera Method

WARNING! This troubleshooting method uses tools that use VERY HIGH VOLTAGE. We recommend that only licensed electricians use these high voltage tools. Please note: When energizing the heating wire, be advised that the heating wire may retain dangerous high voltage for a few minutes after the tools have been disconnected. Do not plug Hi-Pot into a GFCI protected circuit.

Tools needed:

1. 1KV adjustable Hi Pot device
2. Thermal Imaging Camera
3. 16 AWG extension cord with 8"-12" of the outer insulation removed to expose the hot, neutral and ground wires for clamp meter testing of amperage- plug on one end and exposed wire on other end.
4. 16 AWG (or larger) extension cord with intact ground
5. Digital clamp amp meter
6. Variac Transformer

Method 1: HEATING A SHORT

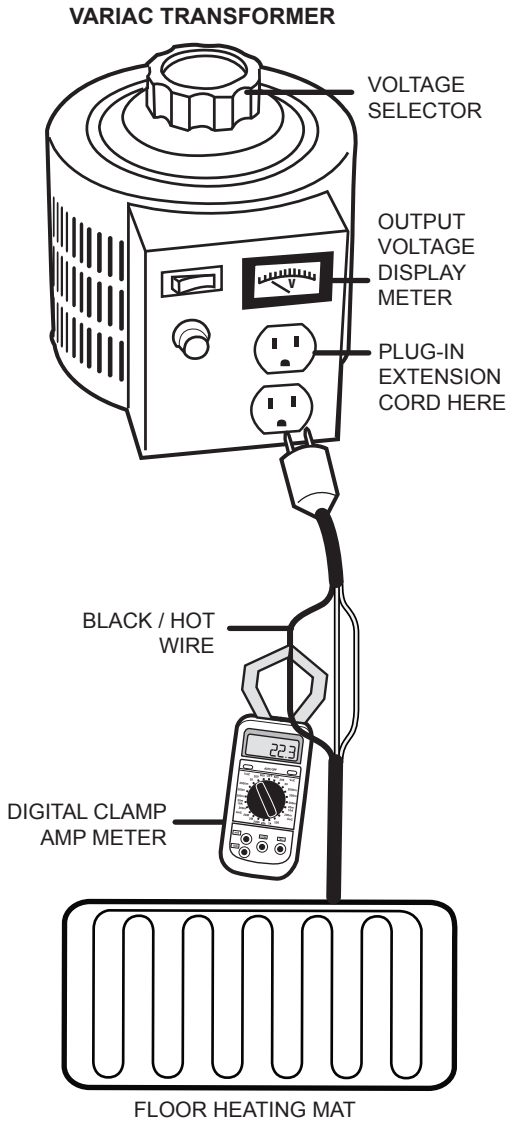
Take ohms readings of cores and grounds, and across core to ground. See diagrams on Page 2. Record these readings for reference. Ideally, there will be Ohms (resistance) between one or both of the core/s and the ground shield. This will indicate there is a complete circuit present between the core and ground, and the variac may be used. If there are no Ohms between the core and ground of either wire, please skip to Method 2. You may need to return to this step after Method 2 is completed and Ohms between core & ground is established.

With the Variac turned off, start by plugging in the extension cord into the outlet on the device. The exposed end will be attached to the heating wire with the Ohms reading between its core and ground. In the instance both wires have Ohms to their respective ground shields, choose the wire with the lower resistance value.

It is always a good idea to know in advance the original ohms value and voltage of the system that is being diagnosed. If there is an ohm reading across a core wire and the ground, what is it? What percentage is that number compared to the factory value? If it is 50% of the factory value, the absolute maximum voltage to use during troubleshooting is 50% of the voltage normally used with the heating wire. That maximum voltage would be 60 volts for a 120v system and 120v for a 240v system. Never start at this voltage! Always start at zero volts and use the dial at the top of the variac to slowly increase the voltage being sent to the wires. If the maximum voltage is 50-60 volts, excellent results will be visible with a thermal camera at 20-30 volts. Do NOT increase voltage to speed up this process! Using too high a voltage will burn out the circuit that was just made. If there is no information on the size or ohm values of the wire, use the following tips, or contact WarmlyYours Technical Support at 800-875-5285.

Attach the exposed black wire from the extension cord to the inner-conductor wire from the heating system and the white wire can then be attached to the ground shield of the same wire. The green (ground) wire from the extension cord should be capped off,as it will not be used. Affix the amp probe clamp around the extension cord's black wire and set the dial to measure amperage. Turn the Variac on. Slowly turn the dial up from zero. The amp probe should begin to display an amperage reading. 6 volts should be sufficient to achieve an amperage draw on most heating systems. For 120 volt mats, no more than 12 volts should be used. Do NOT try to use more voltage to expedite the process. The Variac may need to run low voltage through this circuit for up to 15 to 20 minutes, or longer, to achieve results. This process will heat the wire right up to the point of the failure and the precise location of the failure can be seen with the thermal imaging camera. Because this "weld" can be very delicate, it is very important to continue to monitor amp draw until the fault location is identified.

Mark the location of the failure with tape or a grease pencil. This location will need to have the flooring/-covering surface removed and thinset chipped away to expose the wire for the necessary repair.



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Method 2: CREATING A SHORT BY ZAPPING CORE TO GROUND

If there are no Ohms between the core wires, and no Ohms between the core and ground at both ends, the core is likely broken or vaporized. If no reading is present across the ground shields, the wire has been severed. The Hi-Pot device is used to establish Ohms between the core wires, or from the core wire to its respective ground shield by "fusing" the wire together sufficient enough so that it may carry the low voltage current of the Variac transformer illustrated in Step 1 of this process.

ATTENTION! DO NOT APPLY CURRENT TO THE WIRE FOR MORE THAN 2-3 SECONDS AT A TIME! DOING SO WILL PERMANENTLY DAMAGE THE HI-POT DEVICE. If the Hi-Pot is returned to WarmlyYours in a non-functional state, up to $1500 dollars will be deducted from your deposit refund.

NOTE: After zapping the wires, the cores and grounds may still be carrying HIGH VOLTAGE. Before testing for ohms, turn Hi-Pot OFF. Next, using the unpowered Hi-Pot probe and clamp, press the core wires against the ground to eliminate residual voltage in the wires. If this is not done, you can get shocked or the digital volt meter may sustain damage.

Turn hi-pot on with the output voltage selector set to zero, press reset to activate the device. Attach the black probe from the Hi-Pot device to the ground shield of the heating system heat. Touch the red probe to the core wire. Turn the dial slowly to increase the voltage. This voltage is displayed in the Output Voltage Display as shown in the diagram below. When the needle is at ".5" on the display meter, that represents 500 Volts. When the needle is at "1", that represents 1000 Volts. Use 200-400 volts across the core and ground wires to see if the voltage will jump through the inner insulation. If the current jumps, the unit will need to be reset using the button on the front of the Hi-Pot. If it doesn't jump, causing the Hi-Pot to click, try moving the voltage selector on the Hi-Pot up another 50 volts. Repeat up to approximately 500-600 volts. If the Hi-Pot resets, it means the electricity is jumping the gap in the insulation between the core and the ground. Once the unit resets, hold the RESET button on the front of the Hi-Pot down with a finger, continuing to hit the wires with 2-3 second bursts of electricity. This process actually will begin to heat at the failed area. Use the thermal camera to try to locate the area of failure. It may be necessary to increase the voltage output in 50v increments or so up to 500-600 volts. Continue to apply voltage in 2 to 3 second bursts as before. During the zapping process, check for ohms across these wires every 5 minutes or so, as a "weld" in the wire may have been created. Be careful, the cores and grounds may still be carrying HIGH VOLTAGE. Before testing for ohms, turn Hi-Pot OFF and use the unpowered Hi-Pot probe and clamp to press the core wires against the ground to eliminate residual voltage in the wires. This will allow you to proceed to Method 1 and follow the steps detailed there to heat a portion of the heating system up to the short.

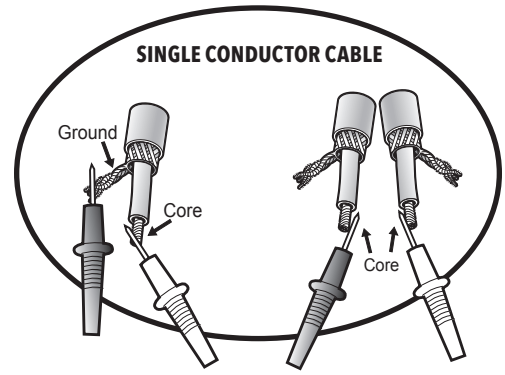
If there is no response across these wires, repeat until the Ground and Core melt together. This process may need to be repeated for 10-15 minutes, or more. After this amount of time, this failure will most likely be warmer than the surrounding area and be visible to a thermal camera. Scan the entire area of the where the system is installed with the thermal camera. If there is a warm spot present, mark the location of the failure with tape or a permanent marker. This location will need to have the flooring or top surface removed and thinset chipped away to expose the wire for the necessary repair.

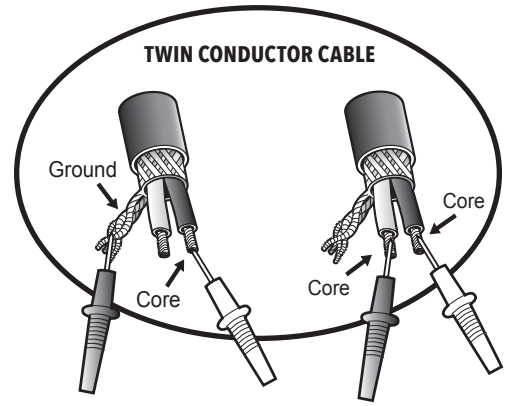
If the warm spot is not visible, it may be under a cabinet or other fixture. If this process does not reveal the fault area, move to the core wire process detailed in Method 3, or use the included ShortStop device to help find this location. Please see the ShortStop Instructions.

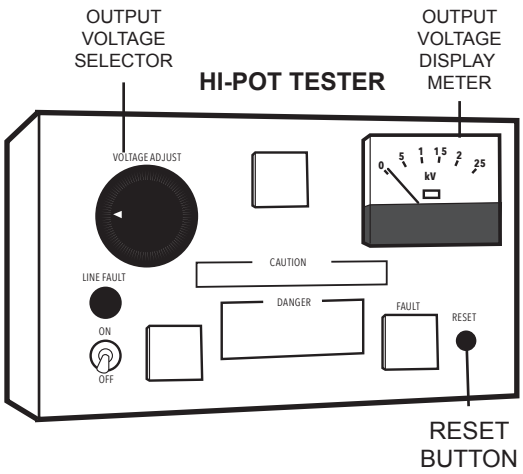
Method 3: ZAPPING CORE TO CORE

Attach the black probe to one of the core wires, the red probe will be attached to the opposite core wire of the heating system. This step requires sending 200-600 volts down the core wires to see if the voltage will jump through the gap in the core wire. If the unit resets during this operation, that is good. Always use the minimum amount of voltage necessary to cause the Hi-Pot to reset. Sometimes the cores will melt together. If this happens, hold the button on the front of the Hi-Pot down with a finger, continuing to hit the wires with 2-3 second bursts of electricity. This process actually will begin to heat at the failed area. Use the thermal camera to try to locate the area of failure. It may be necessary to increase the voltage output in 50v increments or so up to 500-600 volts. Continue to apply voltage in 2 to 3 second bursts as before.

If the failure is found at the factory splice, remove the splice and a couple of inches of cold lead on each side of the splice. Do NOT open the splice or apply voltage to the splice! Send this splice to WarmlyYours for testing. If the splice is defective, WarmlyYours will reimburse repair/replacement costs. Contact WarmlyYours Tech Support for instructions on removing and returning the splice for testing.







Do not plug Hi-Pot into a GFCI protected circuit. If the Hi-Pot will not reset, and the fault light is illuminated, the circuit that the Hi-Pot is attached to is not wired correctly. Find another available circuit to use. The Hi-Pot will not function without a proper ground. If using an extension cord to power the Hi-Pot, verify proper ground path with a meter. If the extension cord's ground lug is broken off, you must use a different extension cord.