## Power Lead ("Cold Lead") Splice Repair Guidelines

The following instructions are guidelines only for repairing the “Cold Lead Splice” connection on a Watts Radiant electric floor warming mat or cable. These guidelines are provided only to assist in the repair of a product. Watts Radiant does not in any way warranty the repair or ensure proper function of the product following the repair. Only a qualified electrician or technician should make these repairs. Approval must be gained from Watts Radiant before doing this repair. Improper use of these guidelines may result in serious damage to property and persons or failure of the splice. Never repair a mat or cable that has been shortened from its factory length by more than 1 foot of floor warming cable without prior approval from Watts Radiant technical support. If you need additional assistance, please contact Watts Radiant for technical support.

Step 1 The factory produced Cold Lead Splice is located between the cold lead cable and the beginning of the floor warming cable. Begin by cutting out the entire damaged factory splice section covered by the black shrink tubing. You must remove any visibly damaged cable, but don’t remove any “extra” good heating cable.

Step 2 For a heating cable with an outer jacket: Strip off approximately 2.5 inches of the outer jacket. DO NOT USE standard wire strippers! The out of round character of the cable makes it very difficult to strip with a common wire stripper tool, using one could damage the cable. Some of our products have an “XLPE” jacket that is a somewhat hard material that can be lightly “scored” with a sharp blade and bent to break through it, then pull off the slug. If the jacket is a softer “TPU” material, you’ll need to use the tip of a soldering pencil to melt a narrow ring around the outer jacket of the cable, then pull the slug off. The TPU jacket has a lower melt point, but be very careful to avoid overheating the heating elements inside the braided ground shield. With either type of jacket, if it doesn’t easily pull off you may need to use your heat gun to gently warm the slug for a few seconds, which should soften and loosen it for you.

Step 3 Loosen the braided ground shield wires by pushing back on the braid and sliding it up the heating wires about ½” or more, which will cause the braid to expand and the heating elements to be visible between the braided ground wires.

Step 4 Gently bend the cable back onto itself at least 2 inches from the cut end, but don’t pinch or fold the wires.

Step 5 Use a very small screwdriver, paperclip, tweezers or similar small blunt object to pry between the ground shield wires at least 2 inches from the ends of the wires, making an opening through which to pull the heating wires. Gently pull each insulated wire through the braid.

Step 6 Pull the ground braid out straight to make it into a pigtail lead, it will be used in the ground wire splice connection.

Step 7 The easiest way to strip the insulation from the heating elements is with thermal wire strippers (available in our Heating cable repair tools kit, Order Number 81007201). When thermal strippers are not available the heated tip of a soldering pencil is the best alternative tool option. The heating element insulation needs to be melted about 5/8” from the end of each element, all the way around the wire at that point. It should be fairly easy to pull the slug of insulation off with your fingertips. If your heating cable has a fiber strand in with the heating elements, it will not be necessary to remove it, the fibers will not interfere with the soldering process.

Step 8 Use a digital ohmmeter for two tests of the heating circuit before proceeding. First; test the resistance value from heating element to heating element, it must be within the factory resistance range for this specific size and type of cable. If you are not sure what the reading should be for your cable, call for technical support. Second; test the cable to verify it does not have a short to the ground shield. The ohmmeter should show infinite resistance from each heating element to the ground shield wires. If you have any questions about the readings you see, call for technical support.

Step 9 Use a standard wire stripping tool to remove ½” of insulation from the ends of each Cold Lead wire. Use a small screwdriver or similar blunt tool to comb out about 2 inches of the braided ground surrounding the three power lead wires and trim the braid wires off. You may be able to simply push back the ground braid wires and use a piece of tape to hold the braid out of the way if needed.

Step 10 Slide the large black shrink tube over the section of cable that will more easily accommodate its length, and position it far enough away from the splice to avoid heating it by accident which could start shrinking it too soon.

Step 11 Position the cold lead wires and heating cable wires to ensure that you will be able to fully overlap the stripped ends, and verify you can overlap the ends of the ground wire and the ground shield wires of the floor warming cable.

Step 12 Slide a solder tube over one of the insulated heating element wires, smaller end first, and far enough down the wire to leave the stripped end easily accessible.

Step 13 Slide a 2” black shrink tube over the corresponding cold lead wire and position it at least 2 inches away from the stripped end of the cold lead wire to keep it away from the heat of the soldering process, or shield it from the heat.

Step 14 Pull the cold lead wire and the heating element wire together to overlap the stripped ends. Gently wrap the heating element around the cold lead wire, producing a linear assembly with maximum contact between the heating element and the cold lead wire. Make sure none of the wire ends are pointed out, which might penetrate the insulation

Step 15 Slide the solder tube over the wire splice connection. The solder ring in the middle should be centered over the area where the heating element is wrapped around the stripped end of the cold lead wire.

Step 16 Use a hot air gun set to a temperature of about 900°F, with a narrow air output nozzle if that accessory is available. First, concentrate the heat directly over the solder ring in the center of the tube. IMPORTANT! When the solder completely melts and flows into the wires, continue heating for another 3 seconds. If the heat is removed too soon, an incomplete solder connection can result, which may cause connection failure later. NOTE: If your hot air gun does not have the accessory nozzle to narrow the heat coming out of the gun, you can make one with something like an empty soup can with a pair of tin snips. If needed, a hose clamp can be used to attach it to the heat gun. It is also possible to shield the ends of the solder tube and portions of the wires that you don't want to heat with a wet cotton rag.

Step 17 After the connection has been soldered, begin moving the hot air gun back and forth to finish shrinking the rest of the tubing. After the rest of the tube has completely shrunk, stop heating it. Additional heating time will not help and may cause scorching of the insulation outside of the shrink tube, or eventual splice failure. Allow the solder tube to cool for one minute before moving it.

Step 18 Test the soldered splice connection by very gently pulling on the wires to determine if they are truly bonded together. If the wires did not solder together properly, you'll have to go back to Step 13 and repeat process with a new solder tube.

Step 19 Position the 2" black shrink tube directly over the solder filled shrink tube. Use hot air gun to shrink the black insulator in that position. It should shrink quickly, don't overheat it.

Step 20 Repeat steps 12 through 19 with the other heating element and cold lead wire. Be careful not to re-heat the first splice connection while assembling the second.

Step 21 Slide the crimp connector over the ground braid of the heating cable, and use a standard crimp connector tool to securely lock it in place. You need to capture all of the braided ground shield wires with the crimp connector.

Step 22 Slide the end of the cold lead ground wire into the other end of the crimp connector and use the crimping tool to lock the wire securely in place.

Step 23 The connection should now be complete and ready for initial tests. First, very gently tug on each wire splice to make sure they do not easily pull apart.

Step 24 Use a digital ohmmeter to measure the resistance of the heating circuit. The measurement between the power lead wires should fall within the resistance range specified for this floor warming cable. The reading between each power lead and the ground wire should be "infinite resistance", or the same reading you see when you are holding the test probe tips apart in the air. If assistance is needed with these tests, follow the steps shown in the installation manual for the floor warming cable, or call Watts Radiant for technical support. Only continue if the cable passes these tests.

Step 25 Carefully slide the larger black shrink tube over the cold lead splice connections. Position the larger tube so it covers all three spliced wire connections and the point where the insulated heating elements wires separate from the ground shield of the floor warming cable. Use a hot air gun to shrink the large tube in this position, attempting to leave it in a relatively straight and flat configuration as it cools. Start at one end and work your way toward the other end to avoid trapping air. The large tube should shrink rapidly, don't overheat it.

Step 26 Properly connect the repaired floor warming cable to the power source through a GFCI, such as a Watts Radiant thermostat control. Operate the system for a few days, or at least ten to fifteen 5-minute heating cycles. If the GFCI trips or the cable does not warm up, the cable will need to be checked for additional damage, or the Cold Lead Splice repair connections may have failed to carry current. If this is the case, take a new set of ohmmeter readings and call Watts Radiant for technical support.

Step 27 Make sure the splice is protected and lays flat on the floor. The complete splice must be embedded in mortar at least 1.5" from the wall, and at least 2" away from the nearest floor warming cable. If necessary, use a chisel to carefully carve a channel into the sub-floor under the splice. You may need to put a small bead of hot glue in the channel and quickly press the new cold lead splice into the adhesive to hold it neatly in the channel.

Step 28 If floor coverings are not immediately being installed, temporarily cover the splice with a loose tile, or similar hard material to protect the cables against damage.

Step 29 After mortar or thin set is applied to fully embed all splices and cables, and floor covering material has been replaced, the new mortar needs at least 2 weeks of curing time before turning the system on. If there is still moisture in the mortar bed and/or inside the splices when power is applied, it can result in a GFCI trip. Follow the guidelines of the mortar manufacturer to know how long their product needs to cure before energizing the floor warming system.