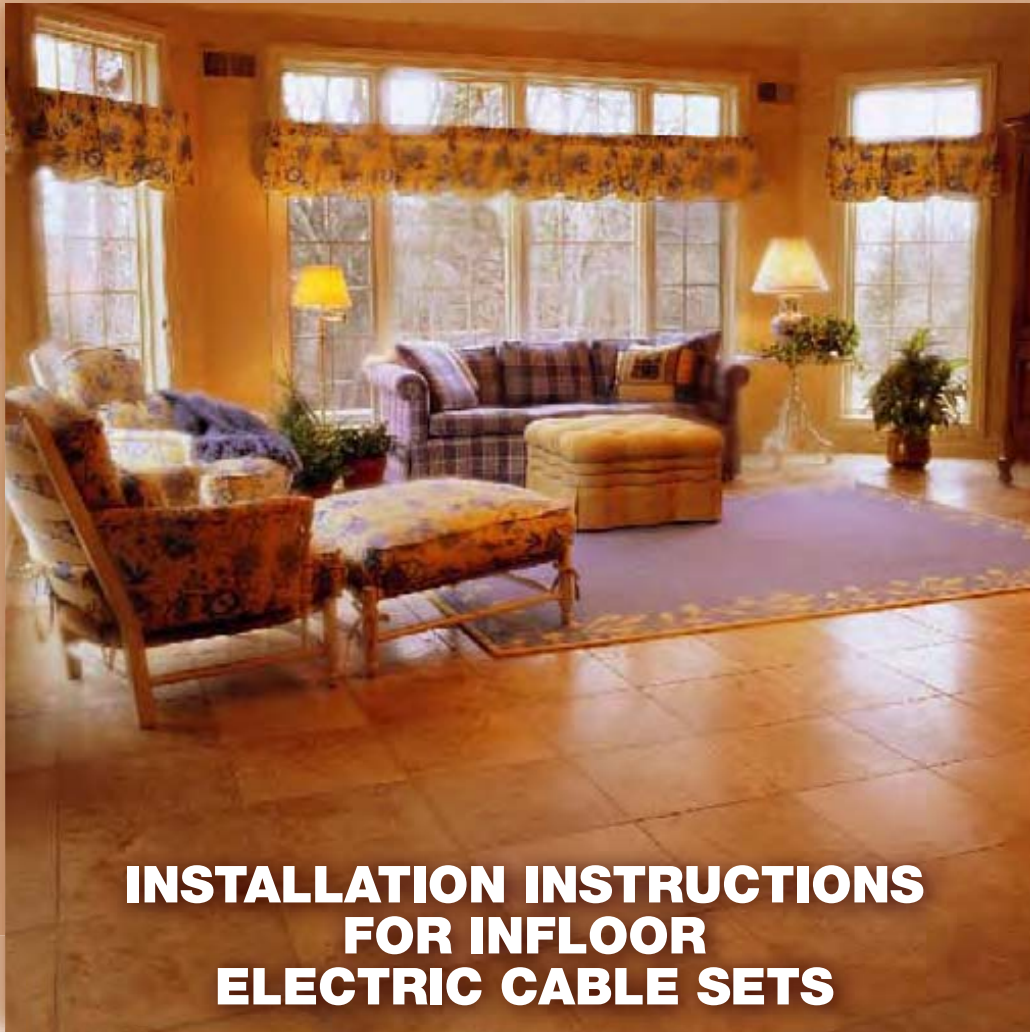


INFLOOR[®]

HEATING SYSTEMS



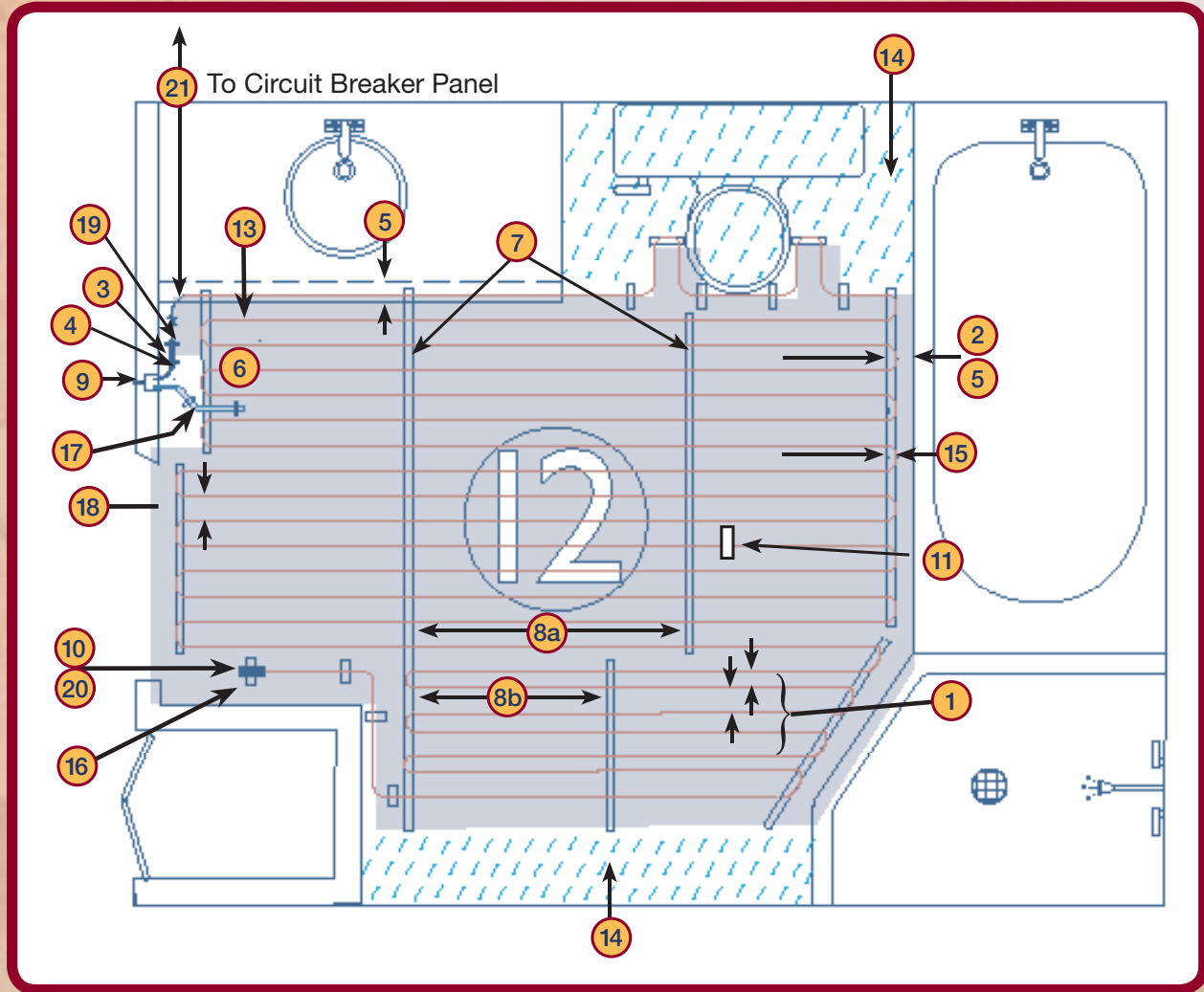
INSTALLATION INSTRUCTIONS FOR INFLOOR ELECTRIC CABLE SETS



(120/240 VAC)

HEATING CABLE SYSTEM KEY

The Infloor Electric Cable Guide and Electric Cable Installation Instructions introduce terminology to identify and explain key Electric Cable Kit components and how they are installed. These terms are italicized each time they appear and are graphically illustrated and explained in the following Heating Cable System Terminology and Key.



HEATING CABLE SYSTEM TERMINOLOGY



The following terms may appear frequently throughout these instructions in italicized text. Each is graphically illustrated in the key illustration on the previous page.

- 1 **ALTERNATING HEATING CABLE SPACING** The Heating Cable configuration used for floors above unheated areas and concrete slabs. Cable is laced through the strapping at repeating spacing intervals of 1½"-3"-1½"-3", etc. using the pre-dimensioned holes of the Infloor Cable Strapping (see also Standard Heating Cable Spacing).
- 2 **BORDER DIMENSION** Space between the outside perimeter of the Heating Cable and the surrounding room walls; may be set to 1½" to 6" as required, to slightly alter the Heated Area and enable a proper fit with the selected Electric Cable (Steps 3 and 7).
- 3 **COLD LEAD SPLICE** Factory connection between the Cold Lead and Heating Cable; must be recessed ¼" into the sub-floor, due to its slightly larger diameter (Step 5).
- 4 **COLD LEAD** Non-heated section of cable that transports current to the Heating Cable section; has a black outer jacket, covering a copper braid and two inner color-coded conductors (black/white for 120V cables or red/black for 240V cables), and is slightly larger in diameter than the Heating Cable section.
- 5 **DIMENSION 1½"** Minimum distance permitted between sections of Heating Cable or between Heating Cable and walls, vanity kick plates and fixtures (Steps 3 and 7).
- 6 **DIMENSION 6"** Minimum distance the sensor wire should extend between two adjacent runs of heating cable, measured from the arc of the Return Loop (Step 8).
- 7 **"INFLOOR" CABLE STRAPPING** Coiled plastic strapping used to harness the Heating Cable to the floor; may be cut to length as needed.
- 8 **"INFLOOR" CABLE STRAPPING SPACING** Distance between parallel rows of the Infloor Cable Strapping. To prevent contact between adjacent runs of Heating Cable, a minimum separation must be maintained. For Standard Heating Cable Spacing (see 8a in the key) the minimum separation is 30". For Alternating Heating Cable Spacing (see 8b in the Key) the minimum separation is 18". (Step 4).
- 9 **ELECTRICAL CONNECTION BOX (ECB)** Customer-supplied electrical enclosure that houses the heating controller for the heating cable system (Step 1). Cold Lead is pulled through the wall cavity and into the ECB using the fish cords (Step 5).
- 10 **END-OF-RUN** Location where the Tail Splice is secured to the sub-floor (Step 8). With Infloor Electric Cable there is no need to route the End-of-Run back to the Electrical Connection Box.
- 11 **"HALF OF CABLE" MARKER** Label attached to the Heating Cable at its mid-point, which should appear during installation at the 'Half-of-Heated Area' line drawn on the floor (Step 3). Serves as a useful mid-installation check as to whether or not there will be a cable surplus or shortage at the End-of-Run (Step 7).
- 12 **HEATED AREA** Area physically covered by the Heating Cable; typically much smaller than the total room area since it does not include vanities, fixtures and Low Traffic Areas (Step 2).
- 13 **HEATING CABLE** Section of cable that warms the floor; has clear outer covering with visible underlying copper braid.
- 14 **LOW TRAFFIC AREAS** Sections of the floor that are seldom walked upon and do not require Heating Cable coverage unless it is necessary to use up surplus cable (Step 7).
- 15 **RETURN LOOP** Location where the Heating Cable turns 180° through the Infloor Cable Strapping, forming a loop that extends ¾" (1" maximum) beyond the strapping cable slots (Step 6).
- 16 **RIBBON STRAPPING** Plastic strips, 1" wide and 12" long; may be cut to length and stapled, to fasten to the Cold Lead Splice (Step 5) and Tail Splice (Step 8) to the floor.
- 17 **SENSOR TUBE** If a floor temperature-sensing heating controller will be used, it is necessary to install a sensor tube at the same time as the cable system (Steps 5 and 8). The sensor tube will allow for the sensor wire to be installed during thermostat installation.
- 18 **STANDARD HEATING CABLE SPACING** The Heating Cable configuration normally used on wood sub-floors located above heated areas. Cable is laced through the Infloor Cable Strapping at a constant spacing interval of 3" between adjacent cable runs (see also Alternating Heating Cable Spacing).
- 19 **START-OF-RUN** Location of the Cold Lead Splice; where the heated section of cable begins (Step 5).
- 20 **TAIL SPLICE** Factory connection between the Heating Cable conductors located at the End-of-Run (uncoiled from the spool last). See Step 8.
- 21 **POWER SUPPLY WIRING** The 120V or 240V customer-supplied power cable; terminated in the circuit breaker panel and pulled into the ECB for connection to the heating controller (Step 11).



READ BEFORE ATTEMPTING INSTALLATION. FAILURE TO COMPLY WITH THESE WARNINGS OR FOLLOW THE INSTALLATION INSTRUCTIONS PROVIDED WILL VOID THE WARRANTY AND MAY RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK OR FIRE. IT MAY ALSO RESULT IN CABLE FAILURE OR IMPROPER SYSTEM OPERATION.

1. Heating Cable must not touch, cross or overlap itself at any point. This could cause the cable to overheat, requiring replacement.
2. Do not energize coiled heating cable.
3. Do not install heating cable directly under carpet, vinyl composition or linoleum type floors, solid hardwood flooring or any type of nailed-down wood flooring. Floor nailing will irreparably damage the cable, void warranty and may result in physical injury or risk of fire. Do not use this system for other types of applications; contact Infloor for professional advice.
4. Electrical inspection may be required before, during and/or after installation of the Infloor electric system. Contact your local electrical inspection authority for more information.
5. Do not alter the length of the heating cable to suit a floor area larger or smaller than the recommended range for that cable. Physical injury or fire may result if altered and will void the warranty. Only the Cold Lead (black cable connected to the heating cable) may be cut to suit the location of the Electrical Connection Box (ECB).
6. The entire heating cable, the Cold Lead Splice and Tail Splice must be embedded in a cement-based underlayment.
7. In cases where the floor is routinely expected to be wet, such as tiled showers, it is recommended that a Ground Fault Circuit Interrupter (GFCI), or equivalent, be installed, in addition to a suitable water impermeable covering. Consult your local electrical and/or building authorities for more information.
8. If the system is connected to a GFCI (or equivalent) which trips during normal operation, and cannot be reset, there is likely a fault in the heating cable. No attempt should be made to re-energize the system. Under no circumstances should the GFCI be bypassed — contact Infloor for advice.
9. These instructions have been prepared for use with standard North American building construction practices. If your building construction differs, consult an appropriate electrical professional.
10. Do not bend the heating cable at right angles; minimum bending radius is $\frac{3}{4}$ ".
11. Do not use staples to affix cold lead, heating cables or thermostat sensor wire, as this could puncture the heating cable and cause a system failure. Use only the "Infloor" Cable Strapping, Ribbon Strapping and plastic clips provided, and only staple according to the method described in Steps 4, 5 and 8.
12. Do not place more than six consecutive/adjacent runs of heating cable at $1\frac{1}{2}$ " spacing; doing so will cause the floor area to become too hot and use in this manner is not permitted by electrical codes.

CONNECT POWER SUPPLY WIRING

4

CONNECT POWER SUPPLY WIRING and COLD LEAD CONDUCTORS TO HEATING CONTROLLER

Installation of any heating controller and associated wiring must be in accordance with the manufacturer's instructions and all applicable national and local electrical codes and ordinances.

Prepare for power supply wiring connections as follows:

- Ensure the power supply branch circuit has been disconnected and de-energized.
- Prepare the Cold Lead for connection to the heating controller: carefully remove 6" of the black outer jacket. **AVOID DAMAGING THE UNDERLYING COPPER BRAID!** Separate braid wires from the cold lead conductors and tightly twist braid strands together into a single stranded conductor (Figure 11a). Connect the ground wire to the ECB.
- Strip ½" of insulation from each of the cold lead conductors.
- Trim excess length from the power supply wiring as necessary, allowing minimum of 6" to project from the ECB. Remove ½" of insulation from each of the power supply conductors. Figure 11b shows a 120V application. In 240V applications, the cold lead has red and black insulated conductors.
- Connect Power Supply Wiring to the heating controller following the associated manufacturer's instructions.
- Do not energize the system until the mortar/grout materials of the finished floor have fully cured. This will ensure that the setting of the mortar/grout will not be compromised by the heat from the cables – refer to the mortar/grout manufacturers' instructions for cure times.

NOTE: Your system installation may require an electrical inspection at this time. Consult your local electrical and/or building inspection authorities. When you are ready to energize your system, consult the operating instructions associated with the specific heating controller.

FIGURE 11a



FIGURE 11b



The Electric Cable Guide offers some useful hints on how to configure your system to operate with optimal comfort and efficiency (refer to the section entitled, "Operating Tips").

APPLY SCRATCH COAT

3.2

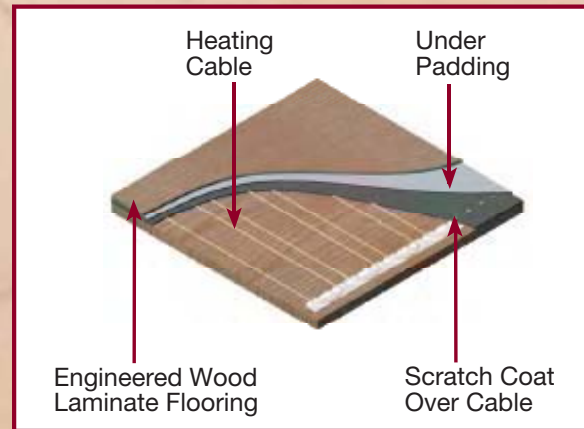
APPLY SCRATCH COAT OF MORTAR and COMPLETE FLOORING LAMINATE

- Once the cables have been installed on the floor, apply a scratch coat of cement-based mortar uniformly over the entire floor area, such that the heating cables are completely embedded. Self-leveling cement based mortar compounds may be most appropriate for this procedure, but consult with your flooring supplier for advice.
- Follow the compound manufacturer's instructions for preparing the mix.
- After the mortar is dry, the tile can be set in the usual manner. Floors with heating cables installed are typically $\frac{3}{16}$ " higher than those without heating cables. Figure 10b illustrates each of the sub-layers of a finished floor when tile and laminate/engineered wood are used as the floor finishing materials.

FIGURE 10b



FIGURE 10b



APPLY SCRATCH COAT

3.1

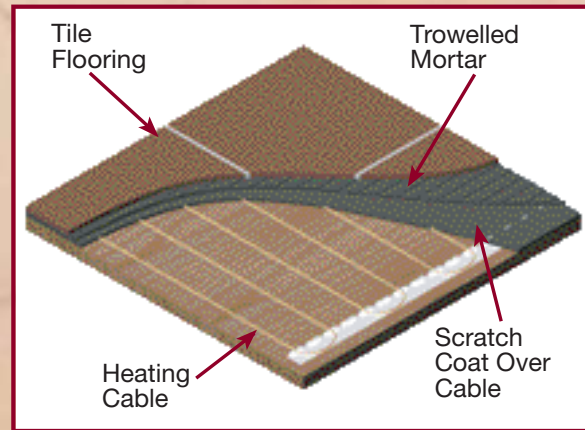
APPLY SCRATCH COAT OF MORTAR and COMPLETE FLOORING TILE

- Once the cables have been installed on the floor, apply a scratch coat of cement-based mortar uniformly over the entire floor area, such that the heating cables are completely embedded. Self-leveling cement-based mortar compounds may be most appropriate for this procedure, but consult with your flooring supplier for advice.
- Follow the compound manufacturer's instructions for preparing the mix.
- Using a straight edge trowel, cover the entire floor area, including areas without cable, to maintain a uniform floor height. Only apply mortar in the direction of the straight cable runs to minimize lateral movement between adjacent cable runs (Figure 10a).

FIGURE 10a



FIGURE 10a



VERIFY RESISTANCE

2.8

VERIFY RESISTANCE OF HEATING CABLE and SENSOR WIRE

- Before proceeding with final floor finishing, measure the resistance of the Heating Cable and optional Sensor Wire to ensure that no damage has occurred to either cable during installation. To measure heating cable resistance, connect the two ohm meter leads to each of the Cold Lead conductors (Figure 8a). The resistance will be between 10 and 250 ohms. To measure sensor resistance, again connect the two ohm meter leads to each of the sensor wire conductors (Figure 8b). The resistance will be between 7 and 14 k-ohms.
- If the resistance of either cable does not fall within the specified range, please contact Infloor Radiant Heating toll free at (800-588-4470) and DO NOT energize the heating cables.
- If each resistance reading is within the specified range, you may be ready to proceed with floor finishing.
NOTE: Your system installation may require an electrical inspection at this time (prior to proceeding with floor finishing). Consult with your local electrical and/or building inspection authorities.

FIGURE 8a



FIGURE 8b



SECURE SENSOR TUBE

2.7

SECURE SENSOR TUBE*, TAIL SPLICE AND ANY LOOSE HEATING CABLE

- If a floor temperature sensor will be used, position the Sensor Tube midway between two adjacent Heating Cable runs that are spaced 3" apart. The end of the sensor tube should extend at least 6" in from the Return Loop and lay not closer than 1½" to a heating cable.
- Due to the slightly larger diameter of the Tail Splice and the sensor tube, remove approximately ¼" of sub-floor material below the splice connection and sensor bulb and secure with Ribbon Strapping and/or plastic clips in the same manner described in Step 5 for the Cold Lead Splice. Remove all debris after this step to avoid cable damage (Figure 8).
- Secure heating cable near the End-of-Run with the clips provided or by stapling 2" lengths of Infloor Cable Strapping to the floor.

ENSURE THAT STAPLES DO NOT PENETRATE THE CABLE OR SENSOR WIRE!

FIGURE 8



*Sensor tube is supplied with thermostat

“HALF OF CABLE” MARKER

2.6

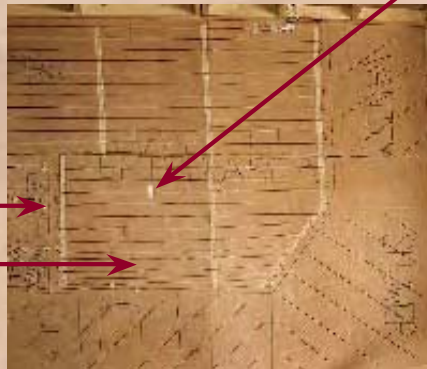
IF “HALF OF CABLE” MARKER DOES NOT MEET AT “HALF HEATED AREA”

When you reach the “Half of Cable” Marker, pause to evaluate the remaining area.

- If the Half of Cable Marker appears **BEFORE** the Half-of-Area-Line previously marked on the floor, there will likely be a cable shortage at the planned end of run, the amount of which depends on how far before the line the marker appears.
- For a cable shortage, consider the low traffic areas and Border Dimension. Cable can be conserved by avoiding placement in low traffic areas or by increasing the border dimension. The border may be increase to a maximum of 6". To do this, carefully unlace the cable from the strapping and move the strapping away, but no further than 6" from the wall; this will reduce cable usage. (Figure 7b). Re-lace the cable according to the method outlined in Step 6. DO NOT increase cable spacing by more than 3" as this may result in a cold floor area!
- Once the cable layout is complete, close ALL remaining locking clips on the strapping to ensure maximum wire holding strength and to prevent interference during mortar troweling.
- If the “Half of Cable” Marker appears **AFTER** the Half-of-Heated-Area-Line previously marked on the floor, there will likely be a cable surplus at the planned End of Run, the amount of which depends on how far past the line the marker appears.
- Surplus cable may be used up by routing it into Low Traffic Areas. You may also reduce the cable spacing to 1½" between adjacent runs, provided there are not more than 6 consecutive runs at this compressed spacing (Figure 7a). Both methods will help to consume the surplus cable.
- Once the cable layout is complete, close ALL remaining locking clips on the strapping to ensure maximum wire holding strength and to prevent interference during mortar troweling.



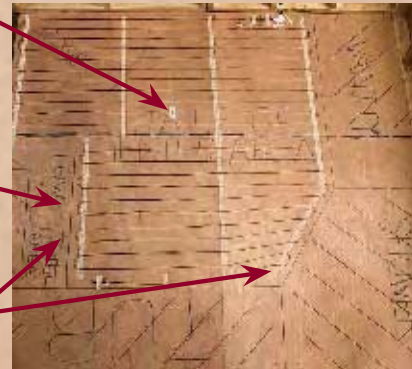
FIGURE 7a



Cable routed into low traffic areas

Cable spacing compressed (not more than 6 consecutive runs)

FIGURE 7b



Cable NOT routed into low traffic areas

Border dimension increased to 6" (maximum)

LACE CABLE THROUGH STRAPPING

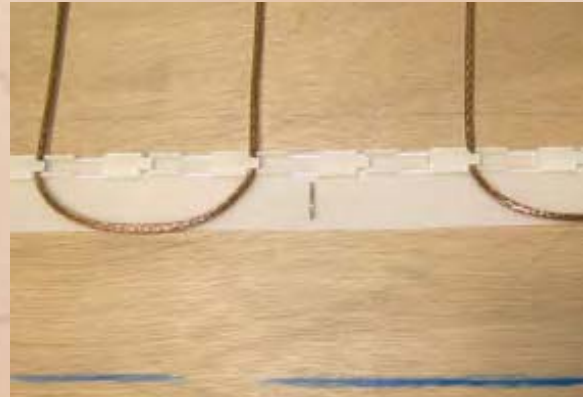
2.5

- Snap Heating Cable (section with clear outer covering and visible underlying copper braid) into the cable strapping holes at appropriate intervals (at 3" or every second hole for Standard Heating Cable Spacing, and every 3"– 1½"– 3"– 1½" alternating hole for Alternating Heating Cable Spacing), and proceed with cable installation following the layout outlined on the floor earlier.
- Carefully pull the Return Loops into the hairpin turn ensuring that the cable does not pop out of the slot on either side of the loop. Pulling too firmly or suddenly may cause the cables to disengage from the strapping (Figure 6a). The loop should not extend beyond the outside edge of the strapping.
- **NOTE: HEATING CABLE MUST BE LACED THROUGH THE STRAPPING IN THE MANNER DESCRIBED. FAILURE TO DO SO MAY RESULT IN IMPROPER SYSTEM OPERATION.**
- It is recommended to install the cable without closing the clips until you reach the End of Run of the cable layout. If any adjustment in cable spacing is required, it is easier done without having to unlock each of the locking clips. Once the cable layout is complete, close all of the hinged clips. When you hear the locking feature "click", the cable will be firmly held under the positive locking system (Figure 6b).

FIGURE 6a



FIGURE 6b



PULL COLD LEAD & OPTIONAL SENSOR TUBE INTO ECB

2.4

Pull cold lead and optional sensor tube into ECB: secure the Cold Lead Splice

- It is important to properly de-coil the cable to prevent twisting. Insert a rod (such as a broom handle) through the cable spool hub and support on a ladder or equivalent (Figure 5a).
- Pull the Cold Lead from the spool, and using fish cords, pull it through the $\frac{3}{4}$ " hole in the sill plate, up through the wall cavity and into the ECB. The cable should be pulled until the factory Cold Lead Splice on the floor is approximately 12" from the sill plate hole. Allow at least 6" of cold lead to project from the ECB (Figure 5b).
- If you are using a floor temperature controller, such as Infloor's Digital Programmable or Duel Sensing, use the fish cords to pull the Sensor Tube through the $\frac{3}{4}$ " sill plate hole, up the wall cavity and into the ECB.
- Due to the larger cable diameter of the cold lead splice and sensor tube, remove approximately $\frac{1}{4}$ " of sub-floor material where the splice will be fastened, to eliminate any possible interference with the tile. For wood sub-floors use a utility knife or chisel; for concrete, use an appropriate masonry chisel (Figure 5c). Remove all debris after this step to avoid cable damage.
- Secure the cold lead splice and cold lead to the floor using 2" lengths of flat Ribbon Strapping. Place the ribbon directly over splice and cold lead and staple it to the floor (Figure 5d). ENSURE THAT STAPLES DO NOT PENETRATE THE CABLE!
- Secure any loose Heating Cable between the Start of Run and location where heating cable is first laced through strapping, using the the clips provided or by stapling 2" lengths of the "Infloor" Cable Strapping to the floor.

FIGURE 5a



FIGURE 5b



FIGURE 5c



FIGURE 5d



INSTALL PLASTIC STRAPPING

2.3

- Each cable kit contains a suitable number of rolls of cable strapping, the unique cable strapping system for enabling fast, problem-free heating cable installation.
- Install the cable strapping at 30" to 36" intervals for Standard Heating Cable Spacing or at 18" to 24" intervals for Alternating Heating Cable Spacing (Figure 4a).
- Staple the strapping to the floor such that the hinged clips will close toward the outside of the cable hairpin turns. The clips should remain open initially, facing upwards at 90° to the floor (Figure 4b).
- On wood sub-floors strapping may be fastened with 3/8" staples (serrated type is preferred), applied at 6" (maximum) intervals. Slide the stapler along the length of the strapping taking care to position staples mid-way between the cable slots in the strapping. Avoid placing staples directly in-line of the cable slots to reduce the possibility of cable contact with a raised or damaged staple.
- On concrete surfaces the plastic strapping may be attached by means of self-tapping concrete anchors or equivalent (Figure 4c). Please Contact Infloor Radiant Heating (800-588-4470) for more information.

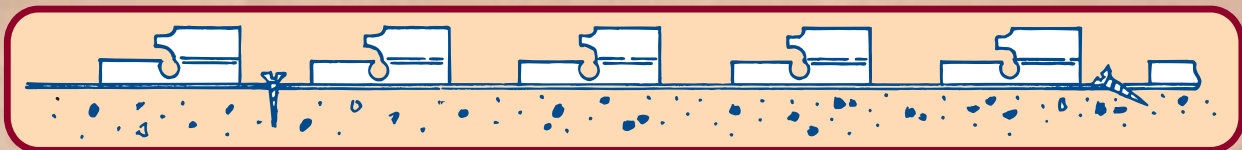
FIGURE 4a
30" distance between adjacent rows of strapping



FIGURE 4b



FIGURE 4c



PLAN CABLE ROUTING

2.2

- Before installing cable, ensure that all surfaces on which the Heating Cable will lie are free of any sharp edges, debris or other restrictions that may cut or otherwise damage the heating cable.
- Carefully measure and locate the mid-point of the Heated Area (NOTE: This may differ from the linear mid-point from one end of the room to the other). This will be a useful reference line later, as it should coincide with the "Half of Cable Marker". Using a chalk line or a heavy-tip marker, straight edge and square, mark the 'half of heated area' line. (Figure 3a)
- Plan the cable layout on the floor. It may be helpful to outline the cable path on the sub-floor using a suitable marker. (Figure 3b)
- Carefully consider the location of Low Traffic Areas.
- Allow sufficient space along walls and cabinets for the heating cable Start of Run. Heating cable should be within 1 1/2" of any vanity kick plate. The Border Dimension may vary between 1 1/2" to 6" depending on the cable coverage range and the size of your room (refer to the section, "Considerations for Installation", in the Electric Cable Guide.
- To simplify mortar trowelling later, consider installing cable runs parallel to the longest wall in the room.

FIGURE 3a



FIGURE 3b



VERIFY SIZE OF HEATED AREA

2.1

FIGURE 2



Drywall, fixtures and vanities removed for illustrative purposes

- Confirm the cable selected will provide the correct coverage by measuring your room floor and determining the square footage to be heated. This is your Heated Area. Areas under cabinets or fixtures (toilets, sinks, tubs, etc.) should NOT be included (Figure 2). Heating cables may be installed under tiled shower surfaces provided the cables are embedded in a cement-based underlayment and covered by an approved water impermeable membrane. Consult your local electrical and/or building inspection authorities for more information.
- Using the heated area, supply voltage (120V or 240V) and the choice of Standard or Alternating Heating Cable Spacing, verify that you have the recommended cable set for your application using Figures 1 and 2 of the Infloor Electric Cable Guide.

ELECTRICAL ROUGH-IN: REMODELING PROJECT

1.2

For a remodeling project, complete the electrical rough-in as follows:

- Determine the appropriate location and height for the Electrical Connection Box* (ECB). Consider proximity to other outlet boxes, ease of routing Cold Lead to the Heated Area, and accessibility to a planned heating controller. The cold lead should enter the same wall cavity in which the ECB is located. Contact your local electrical inspection authority.
- Remove base moldings, and drywall only as required, in areas where fish holes are to be drilled, exposing upper edge of sill plate.
- Drill a horizontal $\frac{3}{4}$ " diameter hole through the sill plate approximately $1\frac{1}{2}$ " deep. If installation is planned for two heating cables, a second fish hole should be drilled a minimum of 4" from the first, but within the same cavity (Figure 1e).
- Use a chisel to completely notch wood from the sill plate above each hole. Clear fish holes of wood chips and install cable guards (drywall ledge at top, facing out) over the holes (Figure 1f).
- Use ECB as template to mark outline on wall. Carefully cut out the minimum possible amount of drywall to prevent the need for wall repair after heating controller has been installed (Figure 1g).
- Install a fish cord through the sill plate, pull through the wall cavity and secure in the ECB. ONE ADDITIONAL FISH CORD WILL BE REQUIRED IF THE INSTALLATION WILL INCLUDE A FLOOR TEMPERATURE SENSOR.
- Install Power Supply Wiring in the ECB, but do NOT energize or connect to the heating controller. Install conduit, if required (consult with your local electrical inspection authority).
- Typically requires a 15 cubic inch box for single cable installations. Multiple cables may require larger boxes. Consult your local electrical authority.

FIGURE 1e



FIGURE 1f



FIGURE 1g



ELECTRICAL ROUGH-IN: NEW CONSTRUCTION

1.1

For new construction it is recommended that rough-in be completed before drywalling begins.

- Determine the appropriate location and height for the Electrical Connection Box* (ECB). Consider proximity to other outlet boxes, ease of routing Cold Lead to the Heated Area, and accessibility of the heating controller during normal use. Typically the cold lead enters the same wall cavity in which the ECB is located.
- Install the ECB, adjusting box projection to suit expected wall covering (Figure 1a).
- Prepare a fish hole, first by drilling a horizontal $\frac{3}{4}$ " diameter hole through the sill plate approximately $1\frac{1}{2}$ " deep.
- Drill a second $\frac{3}{4}$ " diameter hole vertically through the sill plate connecting to the first hole (Figure 1b). If installation will require two cables, a second fish hole should be drilled a minimum of 4" from the first but within the same wall cavity.
- Clear fish holes of wood chips and install cable guards over holes (drywall ledge at top, facing out) over the holes (Figure 1c).
- Install a fish cord through the sill plate, pull through the wall cavity, and secure in the ECB. ONE ADDITIONAL FISH CORD WILL BE REQUIRED IF THE INSTALLATION WILL INCLUDE A FLOOR TEMPERATURE SENSOR.
- Fasten "Do Not Remove" tags to fish cords at the sill plate holes.
- Install Power Supply Wiring, but do NOT energize or connect to the heating controller until the finished flooring has been installed. Install conduit if required (consult with your local inspection authority).
- Drywall installation can now be completed and heating cable can be installed later.

FIGURE 1a



Drywall, fixtures and vanities removed for illustrative purposes

FIGURE 1b



FIGURE 1c



FIGURE 1d



conduit

Typically requires a 15 cubic inch box for single cable installations. Multiple cable sets may require larger boxes. Consult your local electrical authority. Drywall, fixtures and vanities removed for illustrative purposes.

INFLOOR[®]

HEATING SYSTEMS



FLOOR WARMING • SNOW MELTING

Should you have further questions, comments or concerns regarding Infloor[®] Electric Cable, please call Infloor's Technical Department toll-free at

800-588-4470