

Electric Cable

Installation Manual



**Series 386
& 387**

Assembled in the



If you have any questions, please call 1-800-608-0562

www.infloor.com

⚠ WARNING

Please be aware local codes may require this product and/or the thermostatic control to be installed or connected by an electrician.

⚠ WARNING



**THINK
SAFETY
FIRST**

Read this Manual BEFORE using this equipment.

Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.

Keep this Manual for future reference.

Infloor Electric Cable is a simple, economical way to warm any floor, and provide years of lasting comfort. This instruction manual provides complete details, suggestions, and safety precautions for installing this floor-warming system.

Fasten the cables to the floor. Then, depending on the floor coverings to be used, put down a layer of thin-set, thick-set, or self-leveling mortar on top of the cables. Finally, install the floor coverings. It's that simple!

Specifications for Infloor Electric Cable:

Infloor Electric Cable is a complete heating cable consisting of a series resistance heating cable and a power lead for connection to the electric power supply. The heating cable cannot be cut to fit.

Voltages: 120 VAC, 240 VAC, 1-phase

Watts: 10 W/sqft (34 Btu/h/sqft) when spaced 3-1/2" inches on center, up to 15 W/sqft (51 Btu/h/sqft) when spaced 2-1/2" inches on center (see Table 2)

Maximum circuit load: 15 amps

Maximum circuit overload protection: 20 amp breaker

GFCI: (Ground Fault Circuit Interrupter) required for each circuit (included in the Infloor control)

Listing: UL Listed for U.S. and Canada under UL 1673 and CAN/CSA C22.2 No. 130.2-93, File No. E185866

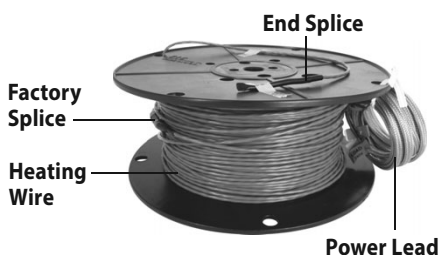
Application: Indoor floor heating only (-X on the nameplate label indicates CUL Listing for this application). Suitable for installation in a shower area (see Step 3.19 for restrictions) (-W on the nameplate label indicates CUL Listing for Wet Location in Canada per Canadian Electrical Code, Part I (CEC)).

Embedded in polymer-modified cement based mortar only (see Appendix 1).

Minimum bend radius: 1 inch

Maximum exposure temperature:
(continuous and storage) 194°F (90°C)

Minimum installation temperature: 50°F (10°C)



⚠ WARNING

Installation must be performed by qualified persons, in accordance with local codes, ANSI/NFPA 70 (NEC Article 424) and CEC Part 1 Section 62 where applicable. Prior to installation, please consult the local codes in order to understand what is acceptable. To the extent this information is not consistent with local codes, the local codes should be followed. However, electrical wiring is required from a circuit breaker or other electrical circuit to the control. It is recommended that an electrician perform these installation steps. Please be aware local codes may require this product and/or the control to be installed by an electrician.

Expected floor temperature

Heating performance is never guaranteed. The floor temperature attainable is dependent on how well the floor is insulated, the temperature of the floor before start up, and the overall thermal drain of the floor mass. Insulation is required for best performance. Refer to Phase 6 for important design considerations.

These are the three most common installations:

- 1. Wood framing:** With the cable installed on a well-insulated wood subfloor, and thin-set mortar and tile on top, most floors can be heated up to 20°F warmer than they would otherwise be.
- 2. Insulated concrete slab:** With the cables installed on an insulated concrete slab, and thin-set mortar and tile on top, most floors can be heated up to perhaps 15°F warmer than they would otherwise be.
- 3. Uninsulated concrete slab:** With the cables installed on an uninsulated concrete slab, and thin-set mortar and tile on top, most floors can be heated up to perhaps 10°–15°F warmer than they would otherwise be.

Please consult a designer or the factory if questions remain about the surface temperature that can be expected from the cables in any particular construction. Please see “Phase 7: Install Insulation” on page 20.

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Important Safety Information



This is a safety-alert symbol. The safety alert symbol is shown alone or used with a signal word (DANGER, WARNING, or CAUTION), a pictorial and/or a safety message to identify hazards.



When you see this symbol alone or with a signal word on your equipment or in this Manual, be alert to the potential for death or serious personal injury.

This pictorial alerts you to electricity, electrocution, and shock hazards.

⚠ WARNING

This symbol identifies hazards which, if not avoided, could result in death or serious injury.

⚠ CAUTION

This symbol identifies hazards which, if not avoided, could result in minor or moderate injury.

NOTICE

This symbol identifies practices, actions, or failure to act which could result in property damage or damage to the equipment.

Table 1

⚠ WARNING



As with any electrical product, care should be taken to guard against the potential risk of fire, electric shock, and injury to persons. The following cautions must be observed:

NEVER install Infloor Electric Cable under carpet, wood, vinyl, or other non-masonry flooring without embedding it in thin-set, thick-set, or self-leveling mortar.

NEVER install Infloor Electric Cable in adhesives or glues intended for vinyl tile or other laminate flooring, or in pre-mix mortars. It must be embedded in polymer modified, cement based mortar.

NEVER cut the heating wire. Doing so will cause dangerous overheating and will void the warranty. The power lead may be cut shorter if necessary, but never remove completely from the heating wire.

NEVER bang a trowel or other tool on the heating wire. Be careful not to nick, cut, or pinch the wire causing it to be damaged.

NEVER use nails, staples, or similar to fasten the heating wire to the floor.

NEVER attempt to repair a damaged heating wire, splice, or power lead using unauthorized parts. Use only factory authorized repair parts and methods.

NEVER splice one heating wire to another heating wire to make it longer. Multiple Infloor Electric Cable power leads must be connected in parallel in a junction box or to the thermostat.

NEVER install one wire on top of another or overlap the heating wire on itself. This will cause dangerous overheating.

NEVER forget to install the floor sensor included with the thermostat.

NEVER install Infloor Electric Cable in any walls, or over walls or partitions that extend to the ceiling.

NEVER install wires under cabinets or other built-ins having no floor clearance, or in small closets. Excessive heat will build up in these confined spaces, and the wire can be damaged by fasteners (nails, screws, etc.) used to install built-ins.

NEVER remove the nameplate label from the power leads. Make sure it is viewable for inspection later.

NEVER extend the heating wire beyond the room or area in which it originates.

NEVER allow a power lead or sensor wire to cross over or under a heating cable. Damage could result.

ALWAYS completely embed the heating wire and factory splices in the floor mortar.

ALWAYS maintain a minimum of 2.5" spacing between heating wires.

ALWAYS pay close attention to voltage and amperage requirements of the breaker, the thermostat, and the Infloor Electric Cable. For instance, do not supply 240 VAC power to 120 VAC Infloor Electric Cable as damage will result.



NEVER bang a trowel or other tool on the heating cable.



ALWAYS completely embed the factory splice and all heating wire in mortar. **NEVER** bend the splice or place any part of it in the wall or through the floor.



ALWAYS test the wire before and after installation.

ALWAYS make sure all electrical work is done by qualified persons in accordance with local building and electrical codes, Section 62 of the Canadian Electrical Code (CEC) Part I, and the National Electrical Code (NEC), especially Article 424.

ALWAYS use copper only as supply conductors to the thermostat. Do not use aluminum.

ALWAYS seek help if a problem arises. If ever in doubt about the correct installation procedure to follow, or if the product appears to be damaged, the factory must be called before proceeding with the installation.

WARNING

Installation must be performed by qualified personnel, in accordance with local codes and standards. A licensed electrician is recommended.

Phase 1 - Preparations

Before installing Infloor Electric Cable, make sure to fully inspect the products and carefully plan the site.

Items Needed

Materials:

- Infloor Electric Cable system
- Wire Strap (provided with the cable)
- Infloor thermostat with floor sensor
- Infloor Relay control (if required)
- Control electrical box (UL Listed, extra deep, see control instructions for size and type required)
- Infloor Sensor Tube p/n 29011
- Junction electrical box (if required, see Step 2.2)
- Wire nuts (if a junction electric box is required, see Step 2.2, must be UL Listed and proper size)
- Flexible or rigid conduit (if required, see Step 2.4, must be UL Listed and proper size)
- 12-gauge or 14-gauge electrical wiring cable (UL Listed, see Step 2.1)
- Nail plate

Tools:

- Digital multi-meter (for ohms testing; must read up to 20,000 ohms (Ω) to measure sensor)
- Drill with 1/2" and 3/4" bits
- Hammer and chisel
- Hot glue gun and hot glue (craft grade)
- Wire strippers
- Phillips screwdriver
- Fish tape
- Hole saw
- Floor covering installation tools



Floor sensor is included in the thermostat packaging. This must be installed in the floor with the cable.

Table 2 - Cable sizes

Please check the product label for exact ratings. This table is for reference only.

120 VAC

Model Number	Total Sq. ft. 2.5" Spacing 14.4 watts/ft ²	Total Sq. ft. 3" Spacing 12 watts/ft ²	Total Sq. ft. 3.5" Spacing 10.3 watts/ft ²	Wire Length (ft.)	Amp Draw	Resistance (ohms)
38630	8	10	12	39	1.0	108 - 134
38631	13	15	18	59	1.5	72 - 89
38632	17	20	24	78	2.0	53 - 66
38633	21	25	30	98	2.5	42 - 52
38634	25	30	36	117	3.0	33 - 42
38635	29	35	42	137	3.5	29 - 37
38636	34	40	48	157	4.0	25 - 32
38637	38	45	54	176	4.5	22 - 28
38638	42	50	60	196	5.0	20 - 26
38639	51	60	72	235	6.0	16 - 21
38640	59	70	84	274	7.0	14 - 19
38641	67	80	96	313	8.0	12 - 16
38642	76	90	108	352	9.0	11 - 14
38643	84	100	120	391	10.0	10 - 13

240 VAC

Model Number	Total Sq. ft. 2.5" Spacing 15 watts/ft ²	Total Sq. ft. 3" Spacing 12 watts/ft ²	Total Sq. ft. 3.5" Spacing 10 watts/ft ²	Wire Length (ft.)	Amp Draw	Resistance (ohms)
38730	17	20	24	78	1.0	217 - 267
38731	25	30	36	117	1.5	143 - 176
38732	34	40	48	157	2.0	107 - 132
38733	42	50	60	196	2.5	84 - 104
38734	51	60	72	235	3.0	67 - 83
38735	59	70	84	274	3.5	59 - 73
38736	67	80	96	313	4.0	50 - 63
38737	76	90	108	352	4.5	45 - 56
38738	84	100	120	391	5.0	40 - 50
38739	101	120	144	470	6.0	33 - 42
38740	118	140	168	548	7.0	29 - 37
38741	135	160	192	626	8.0	24 - 31
38742	151	180	216	704	9.0	22 - 28
38743	168	200	240	783	10.0	20 - 26

NOTICE

It is important to select the proper size cable for the given area. Infloor Electric Cable cannot be cut shorter in order to fit a given area. Doing so will damage the heating wire and prevent the system from working.

⚠ WARNING



To prevent the risk of personal injury and/or death, make sure power is not applied to the product until it is fully installed and ready for final testing. All work must be done with power turned off to the circuit being worked on.

STEP 1.1

Remove the Infloor Electric Cable, Infloor thermostat, and Infloor sensor from their packages. Inspect them for any visible damage. Verify everything is the correct size and type according to the plan and the order. Do not attempt to install a damaged product.

STEP 1.2

Record the product information. There is a factory-applied nameplate label on the power leads. Do not remove this label. Record the cable serial number, model number, voltage, and cable resistance range in the Cable and Sensor Resistance Log (Table 4). If installing more than one cable, do this for each of them.

STEP 1.3

Use a digital multi-meter set to the 200Ω or 2000Ω (2kΩ) range to measure the resistance between the conductors of the cable power leads. Record these resistances in **Table 4** under “Out of the box before installation”. The resistance should measure within the resistance range on the nameplate label. If it is a little high or low, it may be due to air temperatures or meter calibration. Consult the factory if in doubt.

Measure the resistance between either of the white or black leads and ground lead. This measurement should be “open”, usually indicated by an “OL” or a “1”. This is the same as displayed when the test leads are not touching anything.

If there is any change in the reading, record this information and contact the factory before continuing. This could indicate damage, test lead problems, or a number of other issues. Try “pinning” the test leads to the cable lead wires against a hard non-metal surface if the readings continue to fluctuate.

Change the meter to the 20,000 ohms (20 kΩ) range. Measure between the lead wires of the Infloor sensor. This resistance varies according to the temperature sensed. **Table 3** provides approximate resistance-to-temperature values for reference.

Table 3 - Floor Sensor Resistance Values

Temperature	Typical Values
55°F (13°C)	17,000 ohms
65°F (18°C)	13,000 ohms
75°F (24°C)	10,000 ohms
85°F (29°C)	8,000 ohms

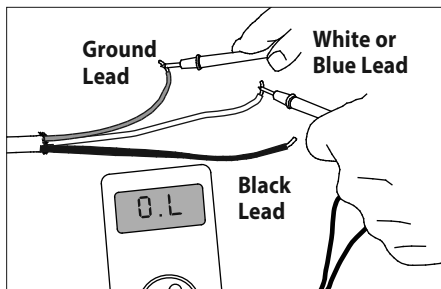
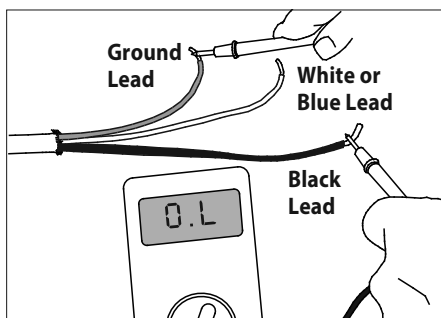
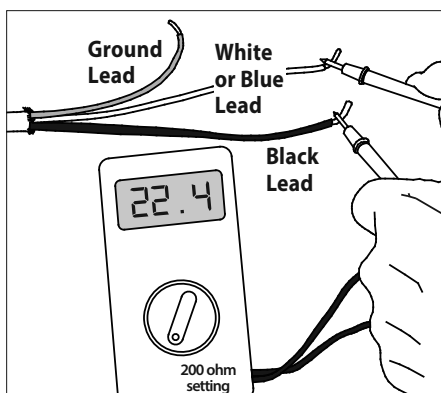


Table 4 - Cable and Sensor Resistance Log

	Cable 1	Cable 2	Cable 3
Cable serial number			
Cable model			
Cable voltage			
Factory cable resistance range			
OUT OF THE BOX BEFORE INSTALLATION (OHMS)			
Cable black to white (black to blue for 240VAC)			
Cable black to ground			
Cable white to ground (blue to ground for 240VAC)			
Sensor wire			
AFTER CABLE AND SENSOR ARE FASTENED TO FLOOR (OHMS)			
Cable black to white (black to blue for 240VAC)			
Cable black to ground			
Cable white to ground (blue to ground for 240VAC)			
Sensor wire			
AFTER FLOOR COVERINGS ARE INSTALLED (OHMS)			
Cable black to white (black to blue for 240VAC)			
Cable black to ground			
Cable white to ground (blue to ground for 240VAC)			
Sensor wire			
Retain this log to retain the warranty! Do not discard!			

INSTALLATION NOTES

Phase 2 - Electrical Rough-in

WARNING

To prevent the risk of personal injury and/or death, make sure power is not applied to the product until it is fully installed and ready for final testing. All work must be done with power turned off to the circuit being worked on.

STEP 2.1:

Circuit Breaker (Overcurrent Protection)

Infloor Electric Cable must be protected against overload by a circuit breaker. GFCI type (ground fault circuit interrupter) or AFCI type (arc-fault circuit interrupter) breakers may be used if desired, but are not necessary when using Infloor controls with integral GFCI.

The rating of the breaker (see Table 5) is determined by the amp draw of the heating cables. Add the amp ratings of all cables to be connected to the Infloor control (see Table 2 or the Nameplate Label on the cable). If the total is less than 12 amps, use a 15 or 20 Amp breaker (preference is 15 A). If the total is between 12 and 15 amps, use a 20 Amp breaker. If the total is over 15 A, another circuit will be required with its own breaker and Infloor control.

It may be possible to tap into an existing circuit as long as there is adequate capacity for the cables(s) and any additional appliance, such as a hair dryer or vacuum cleaner. Avoid circuits which have lighting, motors, exhaust fans, or hot tub pumps due to possible interference.

Table 5

Circuit Breakers and Supply Wire					
Cable(s)		Supply Wire		Breaker	
VAC	total amps	(AWG)*	qty	type**	rating
120	up to 12 amps	14	1	SP	15 or 20 A
120	up to 15 amps	12	1	SP	20 A
240	up to 12 amps	14	1	DP	15 or 20 A
240	up to 15 amps	12	1	DP	20 A

* Recommended only. Follow local codes for wire gauge size.

** SP= single-pole, DP=double-pole

STEP 2.2:

Install Electrical Boxes

Infloor Thermostat:

Install an extra-deep electrical box for the Infloor Thermostat. Follow the instructions included with the thermostat for complete information on location and wiring.

Infloor Relay:

Install an extra-deep electrical box for any Infloor Relay(s). The Infloor Relay is used when more than 15 amps must be controlled by one Infloor Thermostat. Follow the instructions included with the Infloor Relay for complete information on location and wiring.

Junction Boxes:

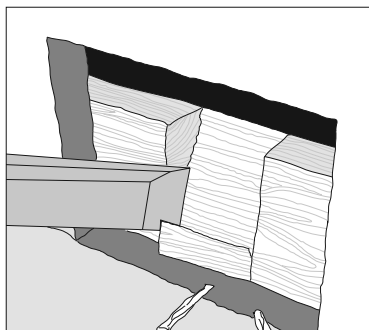
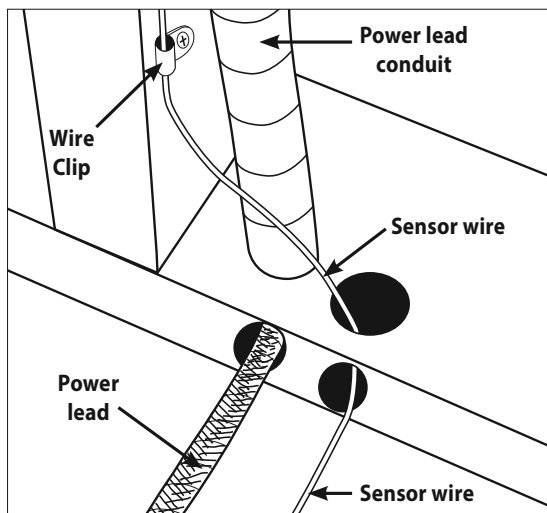
If a cable is to be located so its power lead is not long enough to reach the Infloor thermostat or Infloor Relay directly, a junction box must be installed. Do not attempt to make a connection to other wiring without a junction box. Use a standard junction box with a cover, mounting it below the subfloor, in the attic, in the wall, or in another location easily accessible after all coverings are complete. If the Infloor sensor wire is not long enough to reach the Infloor thermostat directly, it may be extended. A junction box may be required by local code to make this connection. Follow the installation instructions included with the Infloor control for details.

For construction with an existing wall or where the wall is covered, cut the necessary openings to mount the electrical boxes listed above. Wait to install the boxes until all wiring is fed into these locations to make it easier to pull the wire.

STEP 2.3:

Bottom Plate Work

Drill or chisel holes at the bottom plate as indicated. One hole is for routing the power lead conduit and the other is for the thermostat sensor. These holes should be directly below the electrical box(es).



If going in to an existing wall, cut out dry wall and chisel out bottom plate to route wires to control.

STEP 2.4:

Install Power Lead Conduit and Thermostat Sensor

Power Lead Conduit:

The shielded power lead can be installed with or without electrical conduit (recommended for added protection against nails or screws) depending on code requirements. Remove one of the knock-outs in the electrical box to route the power lead. If electrical conduit is not required by code, install a wire collar to secure the power leads where they enter the box. If conduit is required by code, install 1/2" (minimum) conduit from the bottom plate up to the electrical box. For multiple power leads (multiple cables) install 3/4" conduit.

Infloor Thermostat Sensor:

The Infloor sensor should be installed in a plastic sensor tube (P/N 29011) or electrical conduit. Sensor tube or conduit is recommended for added protection against nails or screws. Do not place the sensor in the same conduit as the power leads to avoid possible interference. Open a separate knock-out in the bottom of the thermostat box. Feed the sensor tube or conduit through the knock-out, down through the cut-out in the bottom plate, and out into the floor where the heating cable will be installed. Feed the thermostat sensor down the sensor tube.

STEP 2.5:

Rough-in Wiring:

Install appropriate 12 or 14 AWG electrical wire from the circuit breaker or branch circuit source to the Infloor Thermostat electrical box (and Infloor Relay box(es) if needed) following all codes, see **Table 5**.

If Infloor Relay(s) are used, feed appropriate wire (see Infloor Relay installation manual for size and type) between the Infloor Relay(s) and the Infloor thermostat.

See Infloor Relay instructions for details of wire size and type.

Phase 3 - Install the Cables

STEP 3.1:

Floor Cleaning

The floor must be completely swept of all debris including all nails, dirt, wood, and other construction debris. Make absolutely sure there are no objects on the floor which might damage the wire.

Wet mop the floor at least twice to ensure there is no dirt or dust. This will allow proper bonding of the mortar and proper stick of any adhesives or double-sided tape used later.

STEP 3.2:

Outline the Heated Area

Use a marker to outline the area where the heating cable will be installed. This includes any cabinet base or fixture not already installed, across doorways, next to toilets, etc.

Cabinet vanities: Draw the border right up to the toe-kick.

Tubs and shower entries: Draw the border about 3" from the edge of the tub or shower.

Walls: Draw the border about 3" from the wall. If required to help the cable fit better, it may be drawn 4" to 6" from the wall since people do not generally stand this close to a wall anyway. It may also be drawn closer, but be careful that the cable will not be placed under any trimwork.

WARNING

- Keep the cable at least 6" from wax toilet rings.
- Do not run the cable under cabinets or fixtures that have no clearance under them.
- Avoid running the cable into a small closet or pantry. The heat cannot escape and things can be laid on the floor, blocking the heat and potentially overheating and causing a fire hazard.

STEP 3.3

Make Sure the Cable Fits

Check the cable size to ensure it will fit inside the Heated Area at the selected wire spacing.

WARNING

Remember the heating cable length CANNOT be cut to fit. It must be kept its original length and fully embedded in the mortar in the floor. Any modification or mis-use of the heating cable will void the warranty and cause potential shock or fire hazard.

STEP 3.4

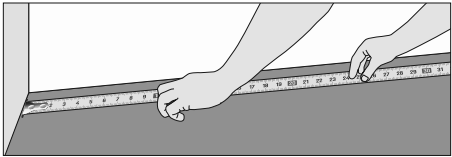
Decide the Layout

Decide which direction the cables will run on the floor for the easiest coverage. Refer to the sample layouts in this manual for assistance. Depending on the shape of the area, it may help to think of it in terms of several smaller areas.

Install Wire Strap

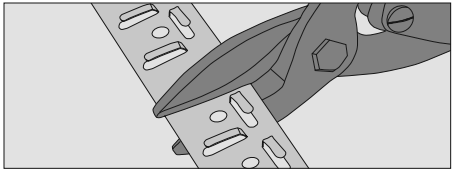
STEP 3.5

Measure the edge of the Heated Area where Wire Strap will be installed.



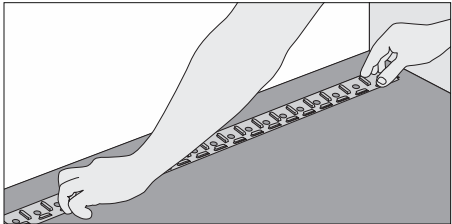
STEP 3.6

Cut the Wire Strap to length using metal shears.

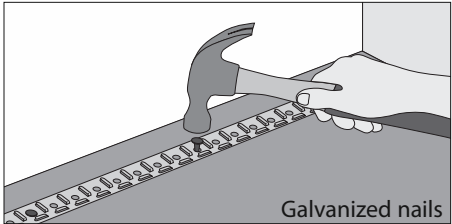


STEP 3.7

Secure the strap to the floor. Depending on the floor type, different methods may be used.

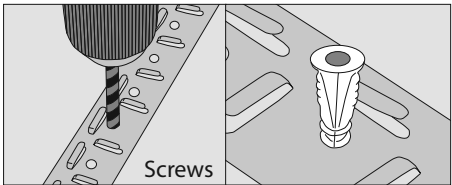


Plywood, cement board, or similar: Galvanized nails or screws may be used to secure the strap every 6" to 10".



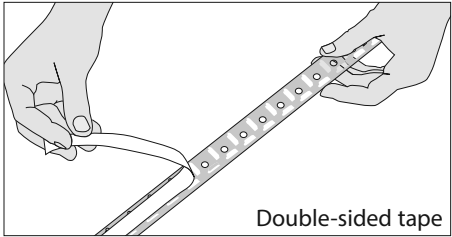
Galvanized nails

OR



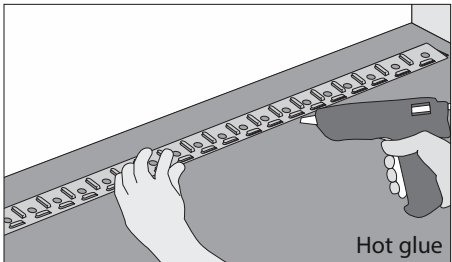
Screws

Concrete, self-level, or similar: Double-sided tape (if included with your cable), hot glue, or strong spray adhesive may be used if the floor is well cleaned and the strap is wiped free of any oils. However, it is highly recommended to also place screws at each end of the strap, and every 4 to 5 feet, to ensure it does not come loose. If using a strong spray adhesive, apply to both the back of the strap and the floor where it will be placed, and carefully follow all spray manufacturer's instructions and cautions.



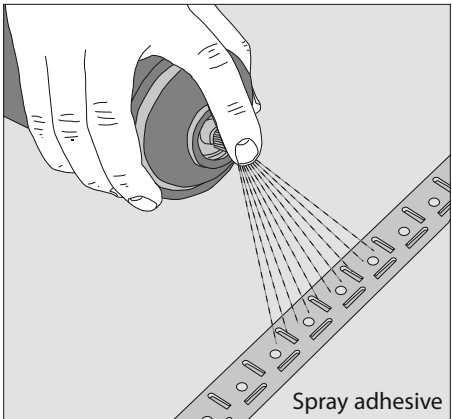
Double-sided tape

OR



Hot glue

OR



Spray adhesive

STEP 3.8

Cut another piece of strap for the other end of the area and secure to the floor.

⚠ CAUTION

Completely embed the Factory Splice and heating cable in the floor mortar. Never bend the factory splice. Never allow any part of the Factory Splice or heating cable to enter a wall or cabinet or drop through the subfloor. Damage to the product will result.

STEP 3.9

Position the Power Leads

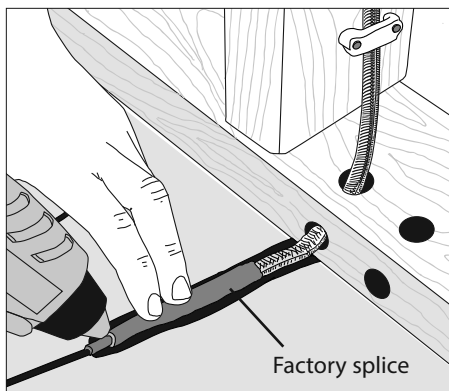
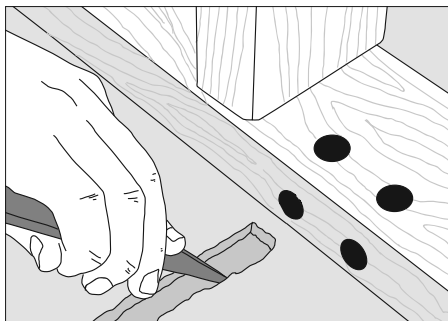
Carefully cut the tie binding the power lead coil. Do not nick the braid covering the power lead.

Locate the Factory Splice to ensure the power lead will reach the Infloor control electrical box or junction box location. It is acceptable to run the power leads several feet in the floor area embedded in mortar if needed.

STEP 3.10

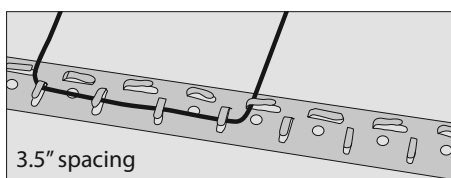
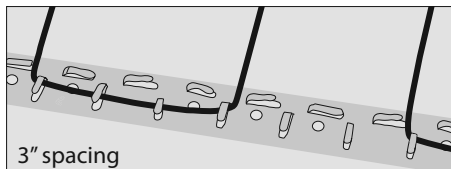
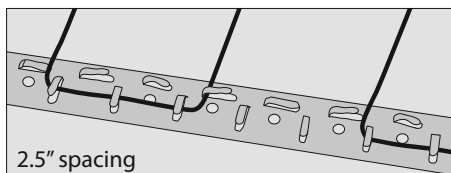
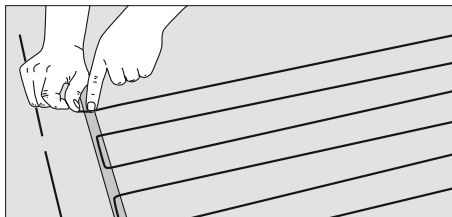
Set the Factory Splice

Draw an outline around the Factory Splice and move it aside. Chisel a shallow channel to allow the Factory Splice to lay flat with the rest of the heating cable in the channel. Add hot glue in the channel and set the Factory Splice in place.



STEP 3.11

Weave the cable back and forth across the area at the desired spacing until the other side of the room has been reached. Once this area is completed, press down all the tabs. NEVER space the cables less than 2.5" apart.



STEP 3.12

If there are additional areas to cover with cable, cut the lengths of strap necessary, attach them to the floor, and begin weaving the cable into that area.

STEP 3.13

To secure long lengths of heating cable, place additional, short lengths of the strap at 3–4-ft. intervals. Spray the back of the strap with a high-tack adhesive, and slide the strap, upside down, under the cables. Turn the strap

over when it is positioned and adhere to the floor. Press the tabs down over the cables. If a spray adhesive was not used, carefully secure these short lengths of strap to the floor without damaging the cable.

STEP 3.14

If a second cable is to be installed in the area, all power leads must come back to the control, or to a junction box and then to the control. NEVER run power leads across heating cables, under baseboard areas, or other potentially damaging areas. Never join two cables in series.

Other Installations

Because many different room shapes and floor obstructions may be encountered in any given installation, additional layouts are provided below to assist in determining the best way to complete installations in odd-shaped areas.

Corner shower or vanity

STEP 3.15

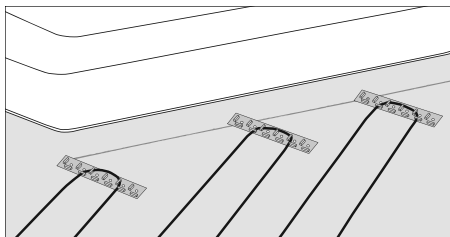
For an angled area, such as a corner shower, it may be possible to lay Wire Strap at an angle and adjust tab spacing to keep the wire spacing consistent. However, if this is too difficult to accomplish, or undesirable, you can first cut several pieces of strap a little longer than the cable spacing being used.

STEP 3.16

Attach each piece of strap to the floor so that the cable does not get any closer to the corner shower than 3".

STEP 3.17

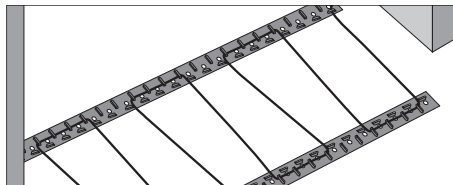
Fill in the section with cable. Make sure that the cables are spaced evenly and parallel to one another.



Door entryway

STEP 3.18

For an entryway or other small area where warmth is required, begin by cutting two lengths of strap a little shorter than the length of the entry opening. Then secure the two straps parallel to each other.



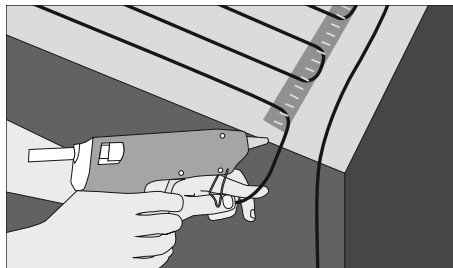
STEP 3.19

Fill in with cable, adjusting spacing as necessary to fill in as much of the area as possible.

Bench Seat

STEP 3.20

If covering a bench seat or step area (not in a shower area), place a single run of cable up the riser. Use straps to secure the cable to the seat area at the desired spacing, then install a single run down the riser. Use an "s-shaped" curve to avoid sharp bends in the cable at corners and help the cable to lay flat. Again, the cable on the riser and seat area MUST be fully embedded in mortar and have approved floor coverings. Use hot glue where necessary to secure the cable flat against the riser.



Shower area installation

NOTICE

This application into a shower area must be verified by the local inspector or the authority having jurisdiction (AHJ).

STEP 3.21

Cables only with (-W) on the nameplate label may be installed into a floor or bench seat located in a shower area. It must never be installed into walls. In general, the cable should be completely embedded into mortar directly below the surface coverings of tile or stone. Other types of coverings are not recommended. It may be installed into a mortar layer lower than this and beneath the waterproof system, however performance will be reduced.

See the Appendix for an example of this type installation.

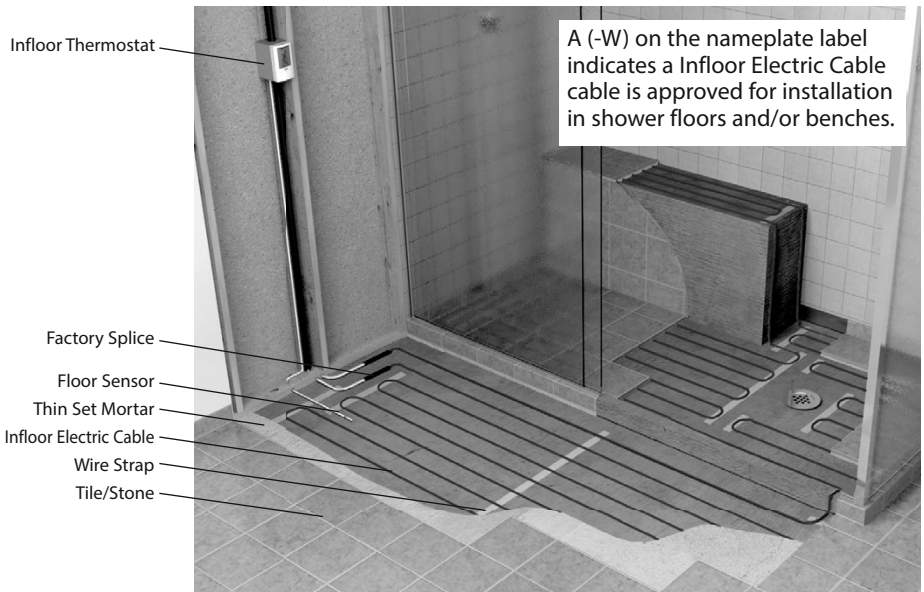
It is recommended that a dedicated cable be installed in the shower area separate from the rest of the bath floor. In case there is ever a problem with the shower installation, this cable could be disconnected without loss of heat to the rest of the floor.

STEP 3.22

Make sure the power lead factory splice (the connection between the power leads and the heating cable) is located outside the shower area and at least 1' away from shower openings and other similar areas normally exposed to water. Make sure the control is located at least 4' away from shower openings such that it cannot be exposed to water or touched by a person in the shower area.

STEP 3.23

If the heating cable must enter the shower area over a curb, secure the cable at the edges in an "s-shaped" curve to ensure the cable is not bent sharply or pinched when surface coverings are installed. Do not damage any waterproofing components, and do not run the heating cable through a non-masonry curb, causing it to overheat.



STEP 3.24

If covering a shower floor, cut lengths of strap and secure to the floor with adhesives. Do not use fasteners that penetrate any waterproofing membrane or waterproofing system. Fill in the floor area with cable. Around the drain leave at least 2" spacing from the edge of the flange. Make sure cable is not placed where door hardware, handrails, or other items may mount to the floor.

STEP 3.25

If covering a bench seat in the shower, cut lengths of strap and secure to the top surface of the seat with adhesives. Do not use fasteners that penetrate any waterproofing membrane or waterproofing system. Use hot glue to secure a single run of cable up the side of the bench riser. Fill in the seat area with cable. Then secure a single run of cable down the riser if needed. Use an "s-shaped" curve to avoid sharp bends in the cable at corners and help the cable to lay flat.

STEP 3.26

If the cable cannot exit the shower area, the end of the cable has a waterproof splice that may be located in the shower area, fully embedded into the mortar like the heating cable.

STEP 3.27

If any part of the heating cable entering a shower area is damaged during installation, **do not attempt to repair it**. A field repair or modification of the cable may result in serious shock hazard.

Final Steps

STEP 3.28

After the cable installation is completed, inspect the work. Make sure all tabs are pressed down, cable spacings are correct, no cables cross over each other, all the cables are undamaged, and all areas to be heated are covered with cable.

STEP 3.29

Take resistance readings of the cable again to make sure it has not been damaged during the installation. This is very important to do. Record these readings in the Cable and Sensor Resistance Log (Table 4).

STEP 3.30

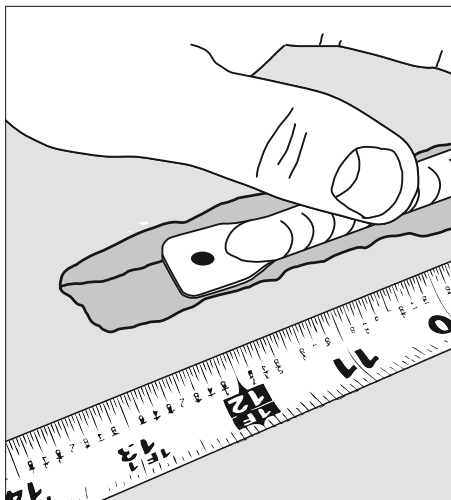
Lay cardboard, carpet, or similar material over the cables to protect them from damage until the floor covering is installed.

STEP 4.1

Feed the power leads from the cable up through the hole drilled in the baseplate, or up into the conduit to the control electrical box (or junction box if one was used).

STEP 4.2

Below the control, or wherever the floor sensor tube is to be located, measure at least 1 ft. into the heated area. Mark the spot where the sensor tube will be attached to the floor. Be sure to locate the sensor tube exactly between two of the heating cables.

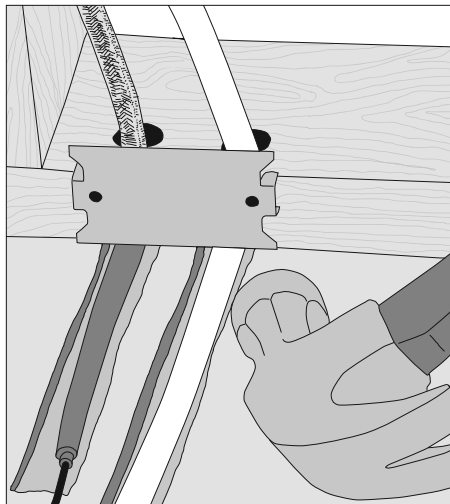


STEP 4.3

To make sure the sensor tube does not create a high spot in the floor, it may be necessary to chisel a channel into the floor and lay the sensor tube into the channel. Hot glue the tube into place.

STEP 4.4

Feed the sensor tube up to the control box. Feed the thermostat sensor down the sensor tube. Finish by securing a steel nail plate over the power lead(s) and sensor tube to protect them against baseboard nails later.



STEP 4.5

If it was necessary to end a power lead at a junction box, feed 14- or 12-gauge electrical wire from this box to the control box.

Tip: If more than one cable was installed, label the ends of the power leads with a brief description as to which area they supply power. Use tape to label them "Cable 1," "Cable 2," "Kitchen," "Bath," or similar. This will make it easier to identify the leads later on. Take photos of the installation. This will provide a useful record for any future needs.

Phase 5 - Control Installation

STEP 5.1:

If it has not already been done, install an electrical box for the Infloor thermostat and Infloor Relay. See Step 2.2 for details.

STEP 5.2

Refer to the wiring diagrams in the Appendix of this manual for typical configurations.

STEP 5.3

Read and follow the instructions included with the Infloor thermostat and Infloor Relay for complete connection instructions, requirements, and mounting.

STEP 5.4

Make any final connections to the circuit breaker or branch circuit source.

STEP 5.5

System Start Up

After all controls are installed, do not energize the system, except to briefly test operation of all components (no longer than 10 minutes). **Do not put the system into full operation until the tile or flooring installer verifies all cement materials are fully cured (typically two to four weeks).** See mortar manufacturer's instructions for recommended curing time.

Refer to the installation sheets provided with the controls for proper setting. The system should now operate as designed. **Please leave this instruction manual, Infloor Control instructions, and copies of photos of the installed heating system with the end user.**

NOTICE

Most laminate and wood floor manufacturers specify their flooring should not be subjected to temperatures over 82° to 84°F (27° to 28°C). Check with the flooring dealer or manufacturer and set the thermostat Floor Limit temperature appropriately.

Phase 6 - Install the Floor Coverings

It is recommended to consult with professional flooring installers to make sure proper materials are used and proper installation techniques are followed. Please note, this installation manual is not a structural or a floor covering installation manual and is intended only for general guidance as it applies to the Infloor Electric Cable product.

When installing tile or stone, the Tile Council of North America (TCNA) guidelines or ANSI specifications should be followed as a minimum standard.

A latex-modified thin-set cement-based mortar and grout is recommended instead of water-based multi-purpose materials when installing a radiant product. Do not use solvent based adhesives or pre-mix mortars because they are not as heat resistant and do not conduct heat well.

Select the proper size trowel for the installation of tile or stone. We recommend a minimum 3/8" x 1/4" trowel. This trowel works well for most ceramic tile. A thicker thin-set can be used if required. Select the thin-set thickness in accordance with the floor covering requirements.

For additional information on tile installation, please contact TCNA at 864-646-8453 or visit their web site at www.tileusa.com, or contact NTCA at 601-939-2071 or see their web site at www.tile-assn.com.

When installing floor coverings other than tile or stone, follow industry and/or manufacturer's recommendations. Ensure the wire is first covered with a layer of self-leveling cement based mortar, letting it cure fully before applying any surface underlayment, floating wood or laminate flooring, carpet, etc. The combined R-values of all floor coverings over the wire should not exceed R-3. Higher R-values will diminish performance. Consult the floor covering manufacturer to verify compatibility with radiant electric heat. Also, make sure nails, screws, or other fasteners do not penetrate the floor in the heated area. The wire can easily be damaged by fasteners penetrating the floor.

All floor coverings must be in direct contact with the cement-based mortar encasing the wire. Do not elevate the floor above the mortar mass. Do not install 2" x 4" wooden nailers (sleepers) on top of a slab for the purpose of attaching hardwood. Any air gap between the heating wire and the finished floor covering will drastically reduce the overall output of the heated floor.

Care should be taken when laying area rugs, throw rugs, and other surface products on the floor. Most products are okay to use, but if in doubt, consult the product manufacturer for compatibility. Do not use rubber backed products.

When placing furniture make sure an air clearance of at least 1-1/2" is available. Furniture able to trap heat can damage the heating system, the flooring, and the furniture over time.

After floor coverings have been installed, take resistance readings of the cable again to make sure it has not been inadvertently damaged. Record these readings in the Cable and Sensor Resistance Log (Table 4).

Phase 7 - Install Insulation

Insulate under the subfloor for better performance and efficiency of the system. Refer to the Appendix for diagrams and insulation recommendations.

Appendix 1: Types of Construction and Applications

Type of Construction

Mortar Applications:

Thin-set and thick-set (self-leveling) mortar applications are illustrated to the right.

1. If a backer board or plywood sheeting is used to strengthen the floor, or if the heating wire will be placed directly onto the slab, install in the thin-set mortar bond coat above these materials.
2. If a thicker mortar bed, or self-leveling concrete, is used to strengthen the floor, the heating wire can be installed in either the mortar bed (dry-set) or in the mortar bond coat directly below the tile or stone.

The heating wire is generally installed above the self-leveling mortar in a thin-set bond coat. Use plastic lath instead of the typical metal lath when installing in a self-leveling layer.

Self-leveling Mortar Applications:

These are appropriate applications if installing engineered wood, vinyl, laminate, or carpet floor coverings. Attach the Infloor Electric Cable to the subfloor or slab, then pour self-leveling mortar 1/4" to 1/2" thick according to manufacturer's specifications. Install floor covering after the mortar has cured.

Special Precautions

Isolation Membrane: Install the heating wire above the membrane, whenever possible, unless recommended otherwise by the membrane manufacturer.

Insulation: Insulation dramatically enhances the performance and efficiency of floor-warming systems. Do not install rigid insulation directly above or below backer board or mortar.

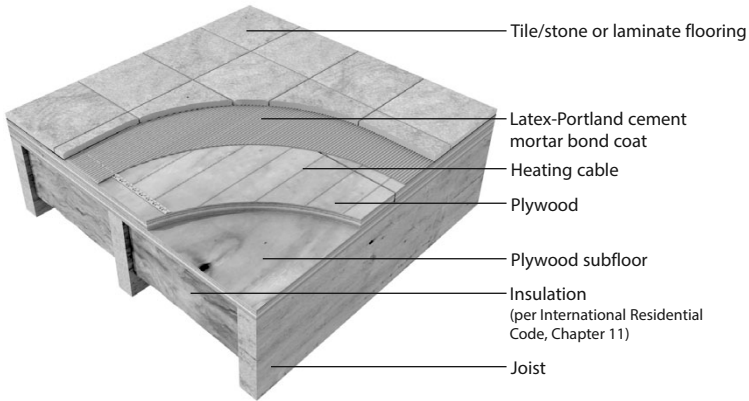
Mosaic Tile: When installing mosaic tile, it is recommended to apply a two-step process. First, embed the heating wire in a thin self-level mortar bed (1/4"-3/8"), then thin-set the mosaic tile according to typical practice.

Expansion Joints: Do not install heating wires through an expansion joint. Install heating wire right up to the joint, if necessary, but not through the joint.

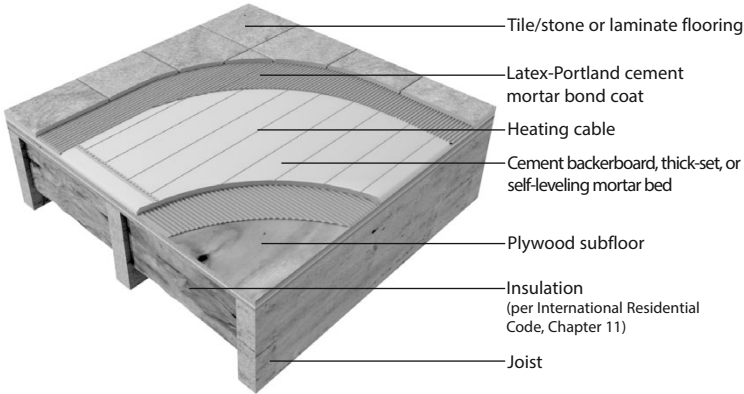
CAUTION

Never bang a trowel on the Heating Wire to remove excess mortar from the trowel. This could damage the heating wire.

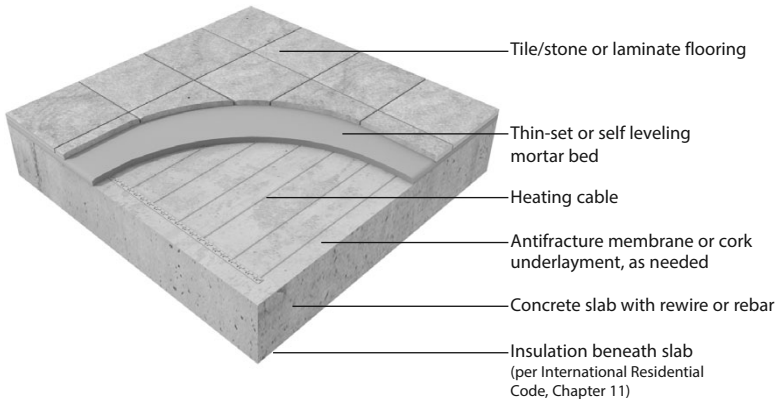
Double-plywood over frame floor



Cement backerboard over frame floor



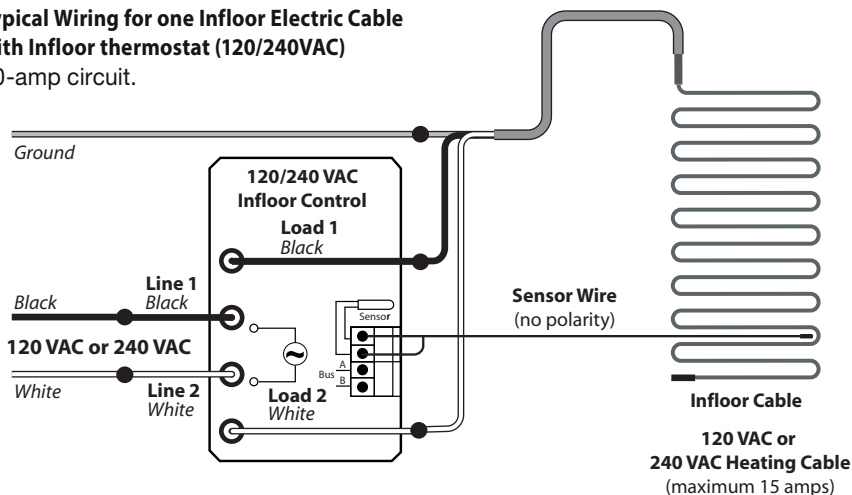
Thin-set over slab on grade



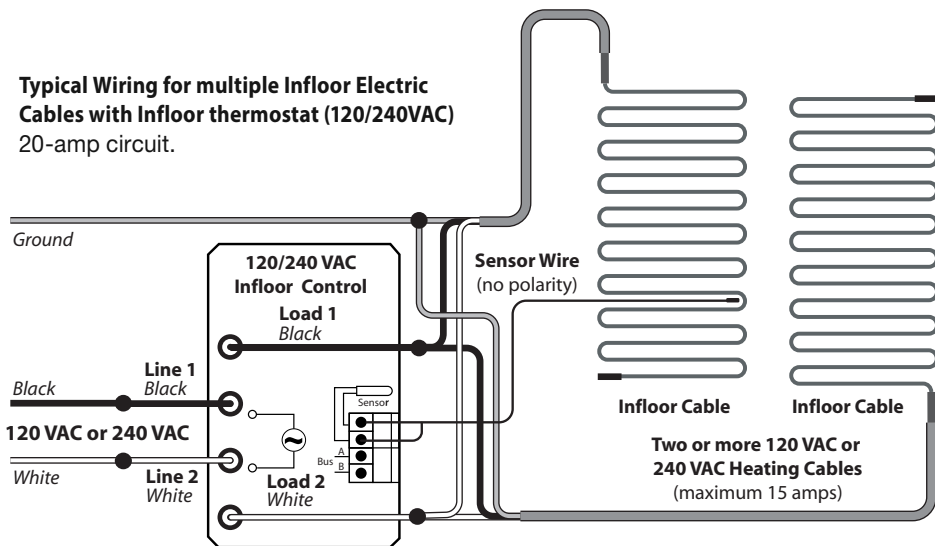
Appendix 2: Wiring Diagrams

120/240VAC Control Wiring Diagrams

Typical Wiring for one Infloor Electric Cable with Infloor thermostat (120/240VAC)
20-amp circuit.



Typical Wiring for multiple Infloor Electric Cables with Infloor thermostat (120/240VAC)
20-amp circuit.



⚠ WARNING

Make sure 120 VAC is supplied to 120 VAC cables and 240 VAC is supplied to 240 VAC cables. Otherwise, dangerous overheating and possible fire hazard can result.

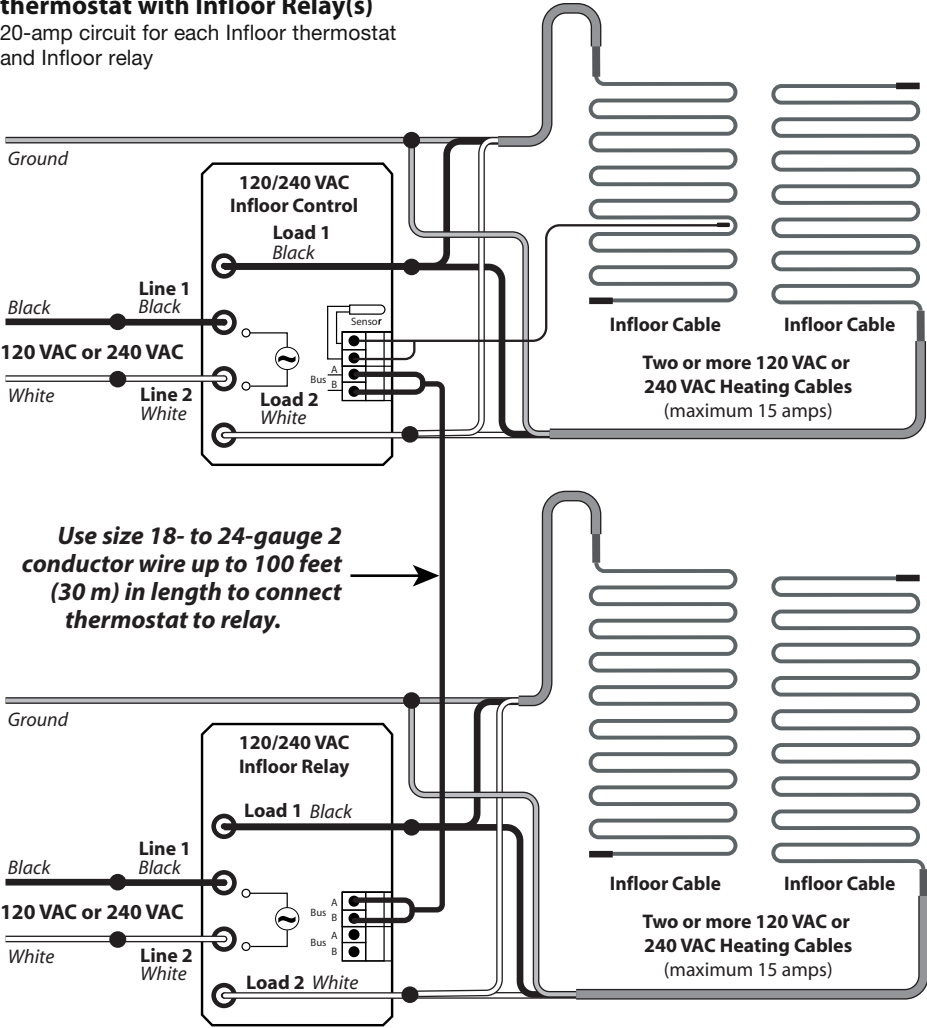
⚠ WARNING

All electrical work must be done by a qualified licensed electrician in accordance with local building and electrical codes, and the National Electrical Code (NEC), especially Article 424 of the NEC, ANSI/NFPA70 and Section 62 of CEC Part 1.

Infloor Relay Connection Diagrams

Typical Wiring for Infloor thermostat with Infloor Relay(s)

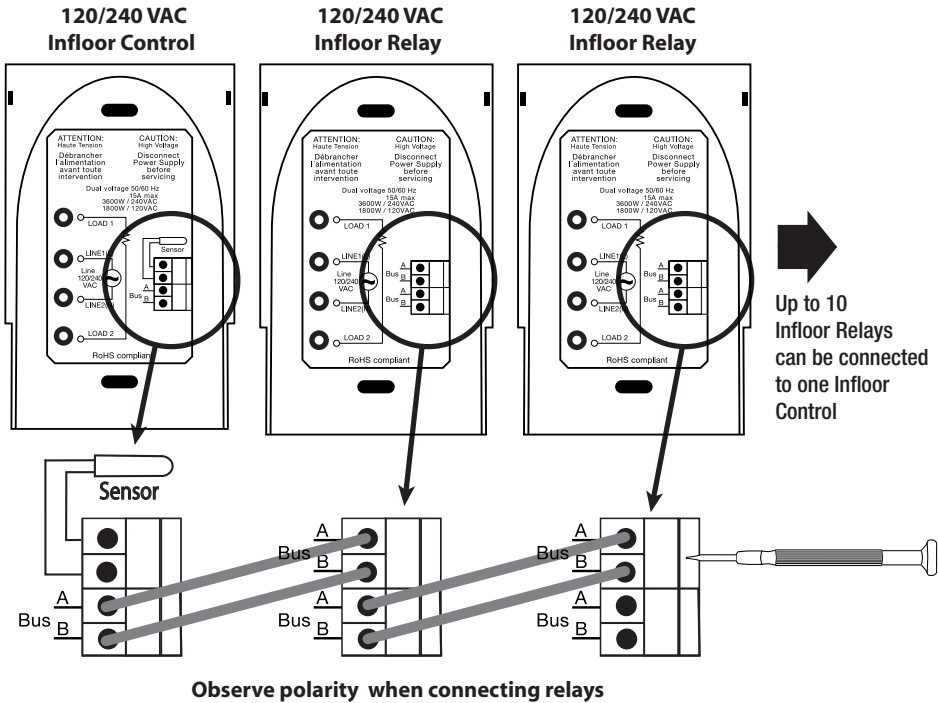
20-amp circuit for each Infloor thermostat and Infloor relay



⚠ WARNING

Make sure 120 VAC is supplied to 120 VAC cables and 240 VAC is supplied to 240 VAC cables. Otherwise, dangerous overheating and possible fire hazard can result.


Diagram for connection of signal wire between Infloor Control and Relays



⚠ WARNING

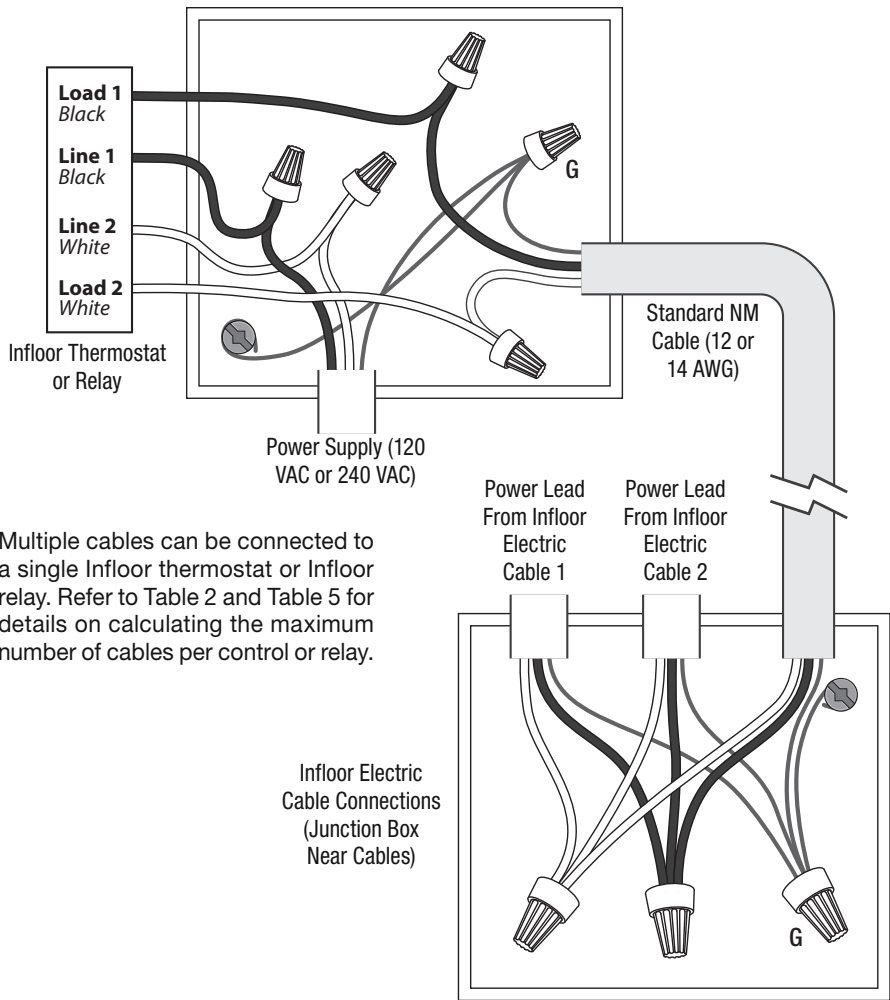
All electrical work must be done by a qualified licensed electrician in accordance with local building and electrical codes, and the National Electrical Code (NEC), especially Article 424 of the NEC, ANSI/NFPA70 and Section 62 of CEC Part 1.

Connecting Multiple Cables


 **WARNING**

To prevent the risk of personal injury and/or death, do not perform any electrical work unless qualified to do so. Work should be done with great care and with power turned off to the circuit being worked on. Follow all local building and electrical codes.

Infloor Thermostat / Relay Connections



Multiple cables can be connected to a single Infloor thermostat or Infloor relay. Refer to Table 2 and Table 5 for details on calculating the maximum number of cables per control or relay.

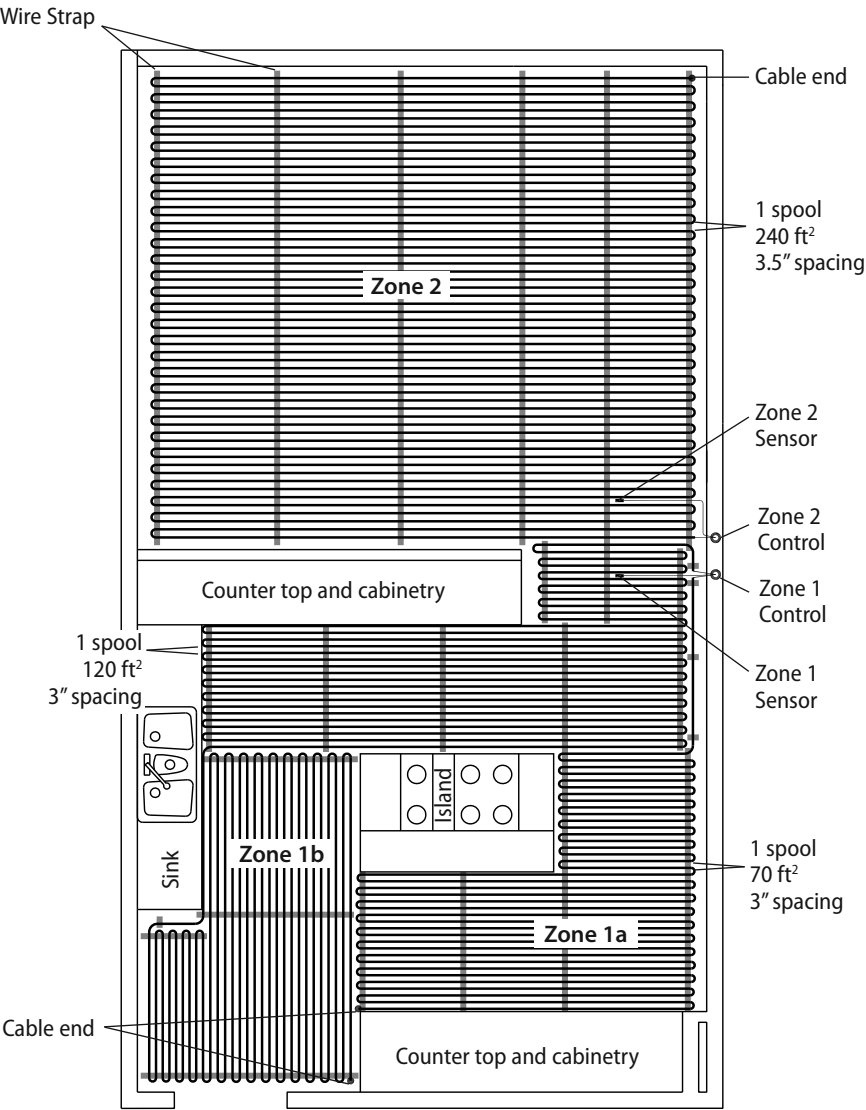
 **WARNING**

The Infloor thermostat is not fully illustrated in these diagrams in order to simplify them. These diagrams are given only as examples of how to properly connect multiple cables. Care must be taken not to overfill a box. Be sure to use wire nuts that are the correct size for the connections being made. Follow all codes for wiring.

All electrical work must be done by a qualified licensed electrician in accordance with local building and electrical codes, and the National Electrical Code (NEC), especially Article 424 of the NEC, ANSI/NFPA70 and Section 62 of CEC Part 1.

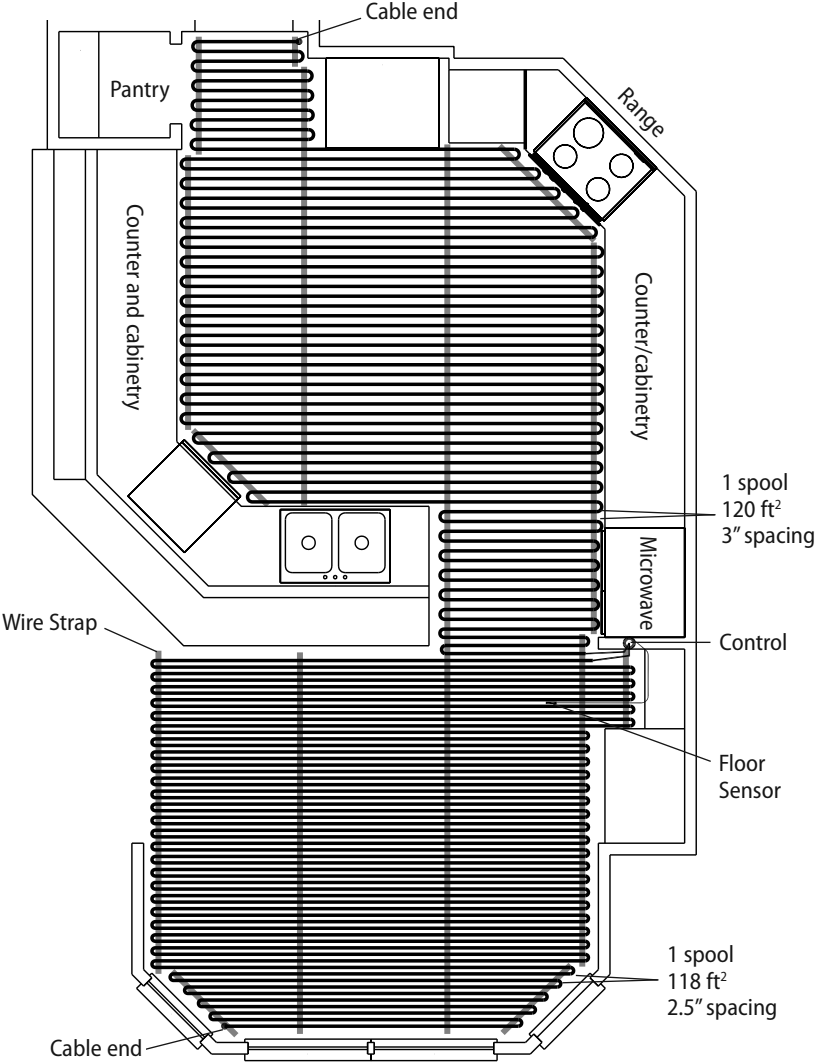
Appendix: Sample Layouts

Kitchen and Family Room (normal heat loss, slab on grade with insulation)
Two zones, 240 volts: Three cables. 190 ft. of Wire Strap, or eight 25-ft. rolls.



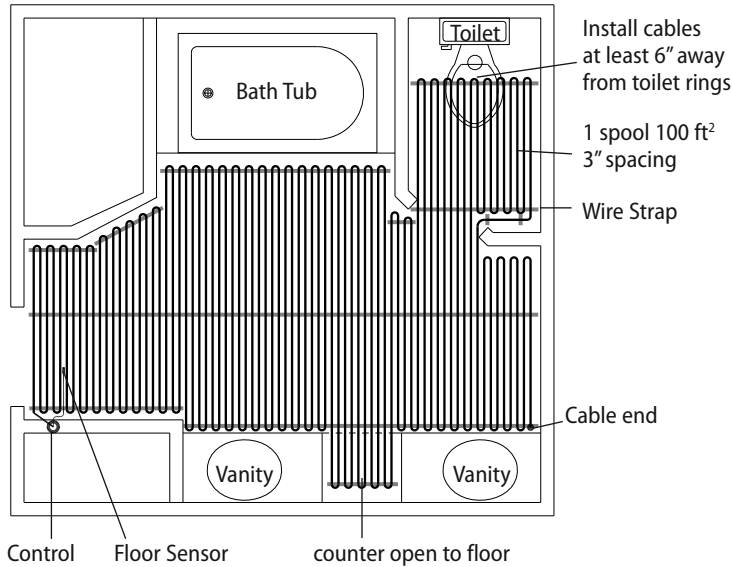
Kitchen and SunRoom (normal and high heat loss, framed floor construction)

One zone, 240 volts: Two cables. 104 ft. of Wire Strap, or five 25-ft. rolls.



Master Bathroom (normal heat loss, framed floor construction)

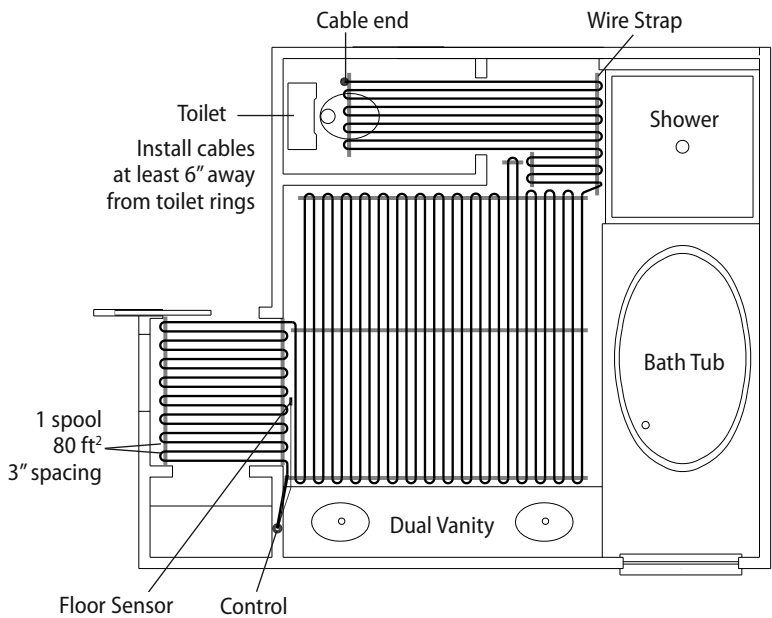
One zone, 120 volts: One cable. 35 ft. of Wire Strap, or two 25-ft. rolls.



Master Bathroom

(normal heat loss, framed floor construction)

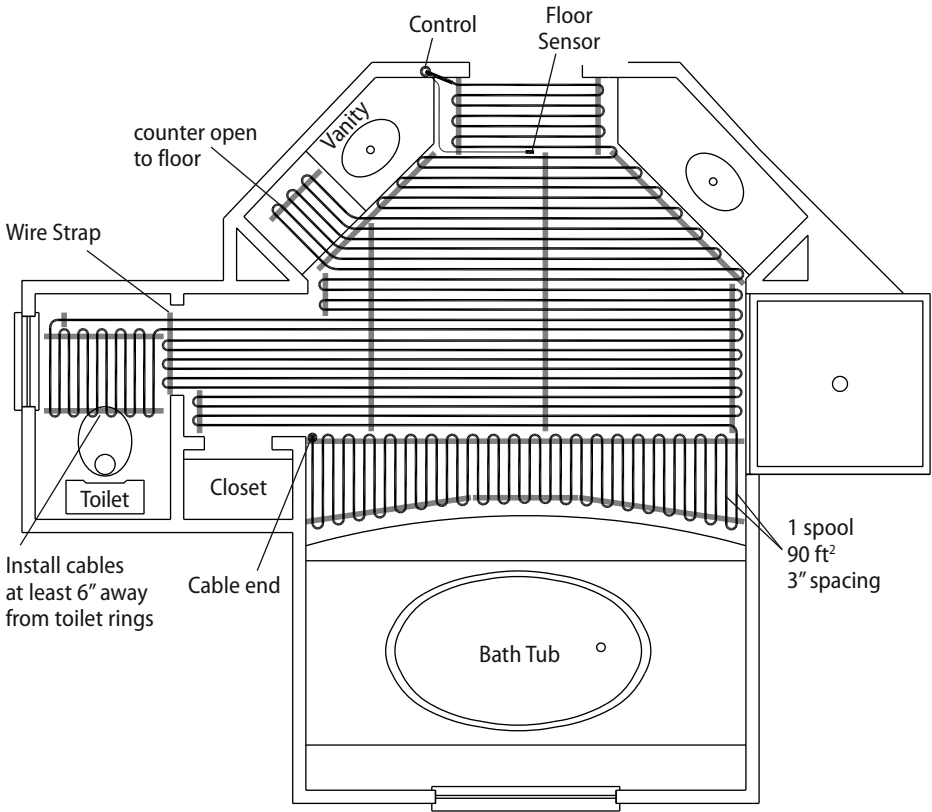
One zone, 120 volts: One cable. 24 ft. of strap, or one 25-ft. roll.



Master Bathroom

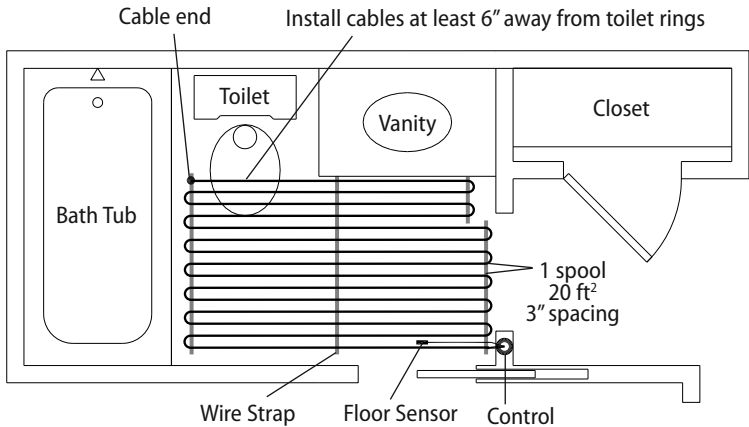
(normal heat loss, framed floor construction)

One zone, 120 volts: One cable. 49 ft. of Wire Strap, or two 25-ft. rolls.

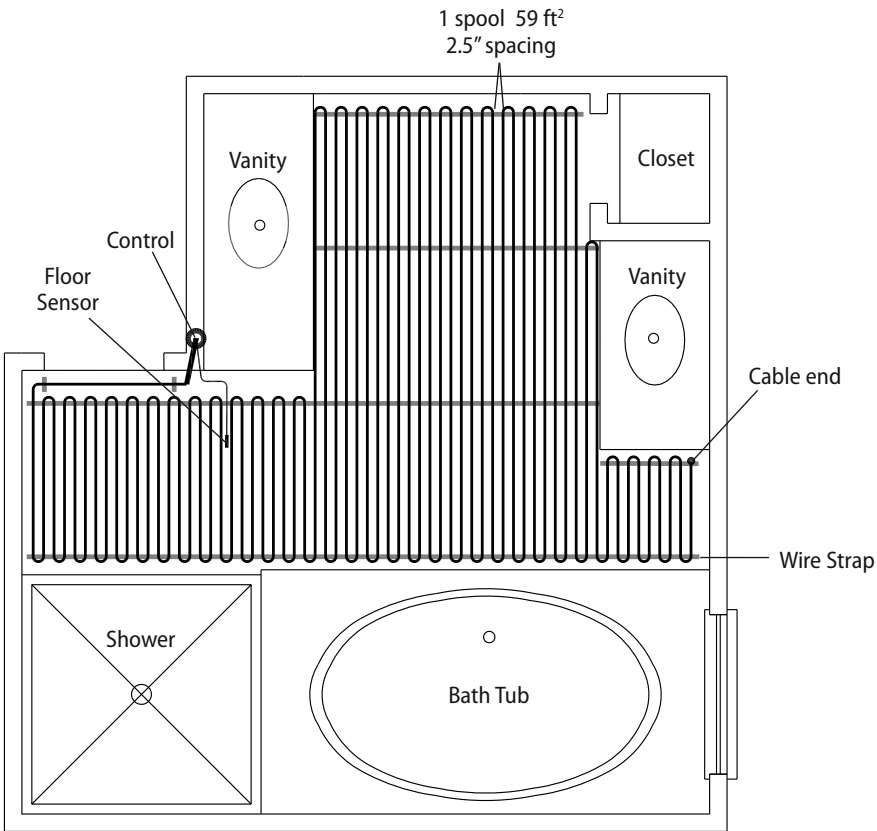


Master Bathroom (normal heat loss, framed floor construction)

One zone, 120 volts: One cable. 11 ft. of Wire Strap, or one 25-ft. roll.

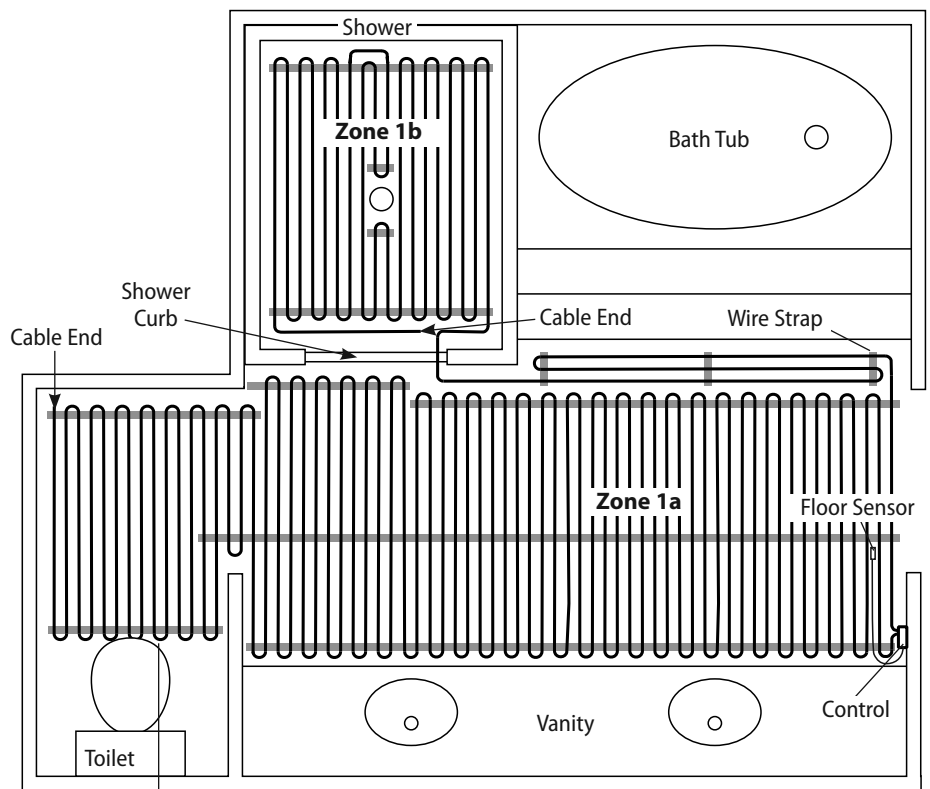


Basement Bathroom (high heat loss, below grade basement slab)
One zone, 120 volts: One cable. 39 ft. of Wire Strap, or two 25-ft. rolls.



Master Bathroom (normal heat loss, framed floor construction)

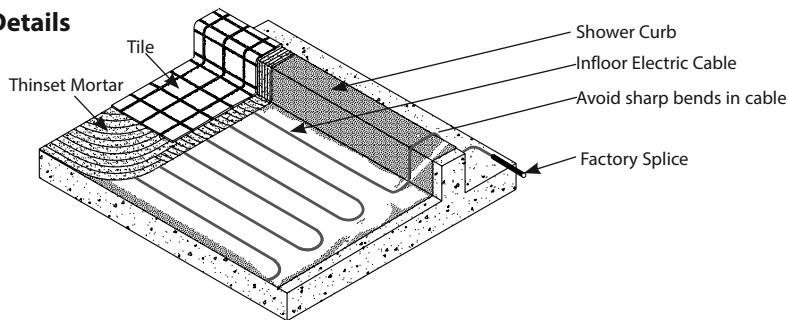
Two zones, 120 volts: Two Cables



Install cables
at least 6" away
from toilet rings

Example of Cables only with (-W) on the nameplate label, where cable is installed in a shower area and enters over the curb.

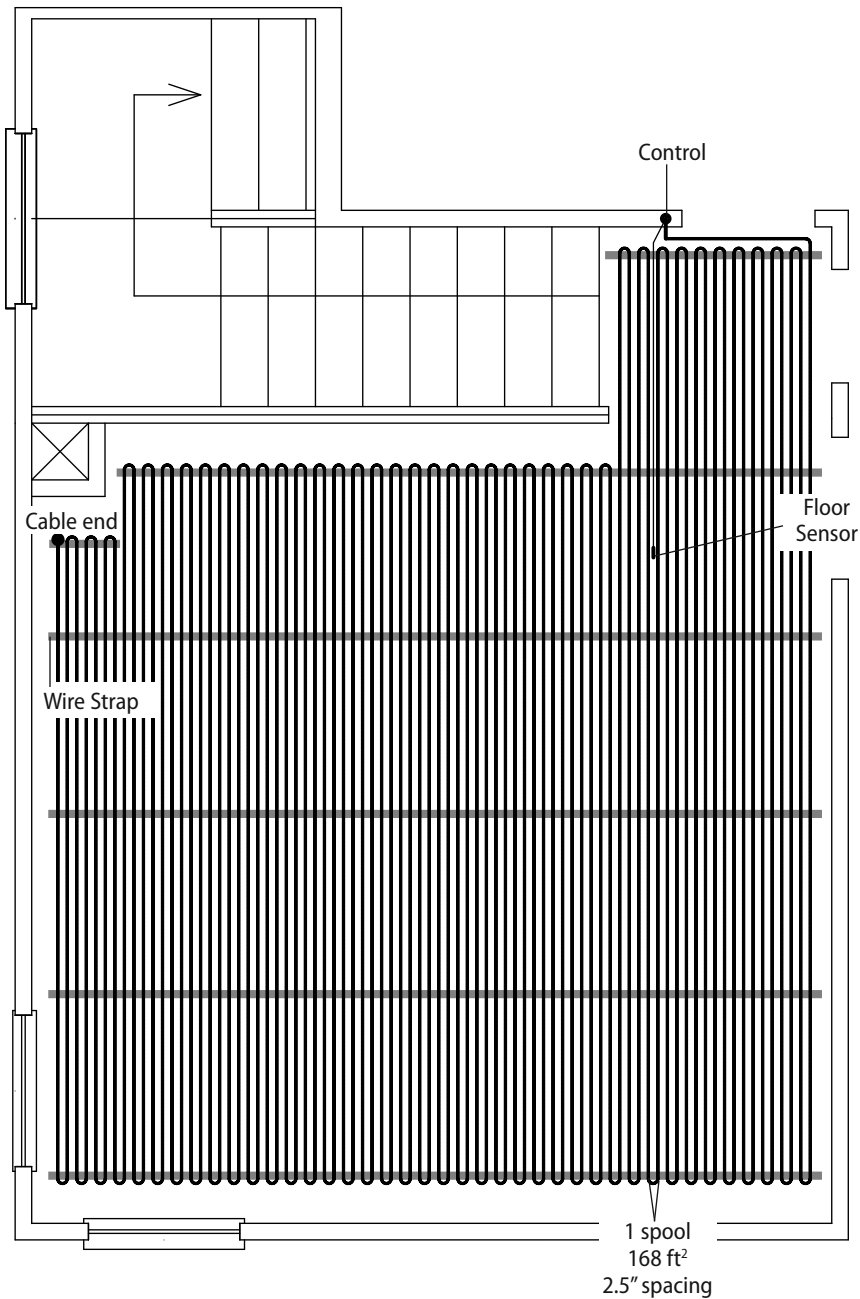
Shower Details



NOTICE

See phase 3 for complete details and Cautions. This application into a shower area must be verified by the local inspector or the authority having jurisdiction.

Recreation Room (high heat loss, below grade basement slab)
One zone, 240 volts: One cable. 69 ft. of Wire Strap, or three 25-ft. rolls.



Troubleshooting Guide

If not qualified to perform electrical installations, it is strongly recommended that a qualified, licensed electrician be hired to install the heating cables and related electrical components. If problems with the system arise, please consult the troubleshooting guide below.

WARNING

Any electrical troubleshooting work should be performed with the power removed from the circuit, unless otherwise noted.

Problem	Possible Cause	Solution
Cable resistance measurement is outside the range printed on the nameplate label.	An analog ohmmeter (using a moving needle) was used to take the reading.	Obtain a digital ohmmeter able to read 0 to 20,000 ohms and remeasure the resistance.
	If measurement shows an open or short circuit, the cable has been damaged.	Record resistances between all wires and contact the manufacturer.
	If measurement is just a little low or high, room temperature has affected the resistance.	Make the room temperature 65°–75°F (18°-24°C), or contact the manufacturer.
	The resistance measurement could be from more than one cable wired in series, or wired in parallel. Either will provide false resistance readings.	Make sure resistance measurements are for only one cable at a time.
	The multi-meter may be set to the wrong scale.	The ohmmeter should typically be set to the 200 (200Ω) scale. For heating wire with resistance range higher than 200 ohms on the nameplate label, set the meter to the 2000 ohm (2kΩ) scale.
Floor does not get warm.	Cable has been damaged.	Measure cable resistance. Check for both “open circuit” and “short circuit” as detailed earlier in this manual. If damaged, record resistances between all wires and contact the manufacturer.
	GFCI has tripped, indicated by a light on the control or “GFCI TRIP”.	Check for loose wire connections. Reset the GFCI on the control or circuit breaker. If it trips again, check for a short circuit in the cable as detailed earlier in this manual. If cable is damaged, record resistances between all wires and contact the manufacturer. If cable is not damaged, replace the GFCI control. Also see “GFCI conflicts” below.
	Incorrect voltage supplied, or mismatched electrical components used.	Measure “line” voltage, 120 VAC cables have black and white leads. 240 VAC cables have black and blue leads.
	Uninsulated concrete slab floor.	Surface temperatures rise slowly on an uninsulated slab and heat is lost to the ground below. If, after 5 to 8 hours of heating, the floor is not warmer to the touch, check for cable damage (see “Cable has been damaged” above). Measure “load” voltage/ amperage to cable.
	Cables are wired in “series” or “daisy chained” (end-to-end).	Multiple cables must be connected in “parallel” (or black-to-black, white-to-white).

Problem	Possible Cause	Solution
Floor heats continuously.	Incorrect wiring. The control was “bypassed” when it was wired to the power supply.	Make sure wiring connections are correct. Consult the wiring diagram on the back of the control, the instructions that came with the control, or the wiring diagrams in Appendix 2.
	Defective control.	Return control to dealer for replacement.
Control is not working correctly.	If a programmable control, the programming may be incorrect.	Carefully read and follow control programming instructions.
	Incorrect voltage supplied, or mismatched components used.	Test voltage, verify parts. See “Incorrect voltage supplied” section
	Floor sensor is not wired properly, or is not working properly.	Make sure only one floor sensor is connected to the control.
	Loose connection(s) on line side and/or load side of control.	Remove and reinstall the wire nuts at each connection. Make sure the wire nuts are tight. Check all connections back to the breaker.
	Defective control.	Return control to dealer for replacement.
Control is not working at all.	No power is supplied.	Check circuit breaker. Measure voltage at the control. Check all connections between breaker and control.
	Floor sensor is not wired properly, or is not working properly.	Make sure only one floor sensor is connected to the control.
	Defective control.	Return control to dealer for replacement.
GFCI conflicts and false-trips.	An electric motor or a ballasted light source is sharing the circuit with the cable(s).	Electric motors and similar electrical devices can cause a GFCI to false-trip. Run a dedicated circuit to the floor-warming system or select a different branch circuit.

Although this troubleshooting guide is provided to assist with problems experienced with a floor-warming system, results are never guaranteed. The company does not assume any liability or responsibility for damage or injury that may occur from using this guide.

If problems with the system persist, call the manufacturer.

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. For more information: www.watts.com/prop65



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