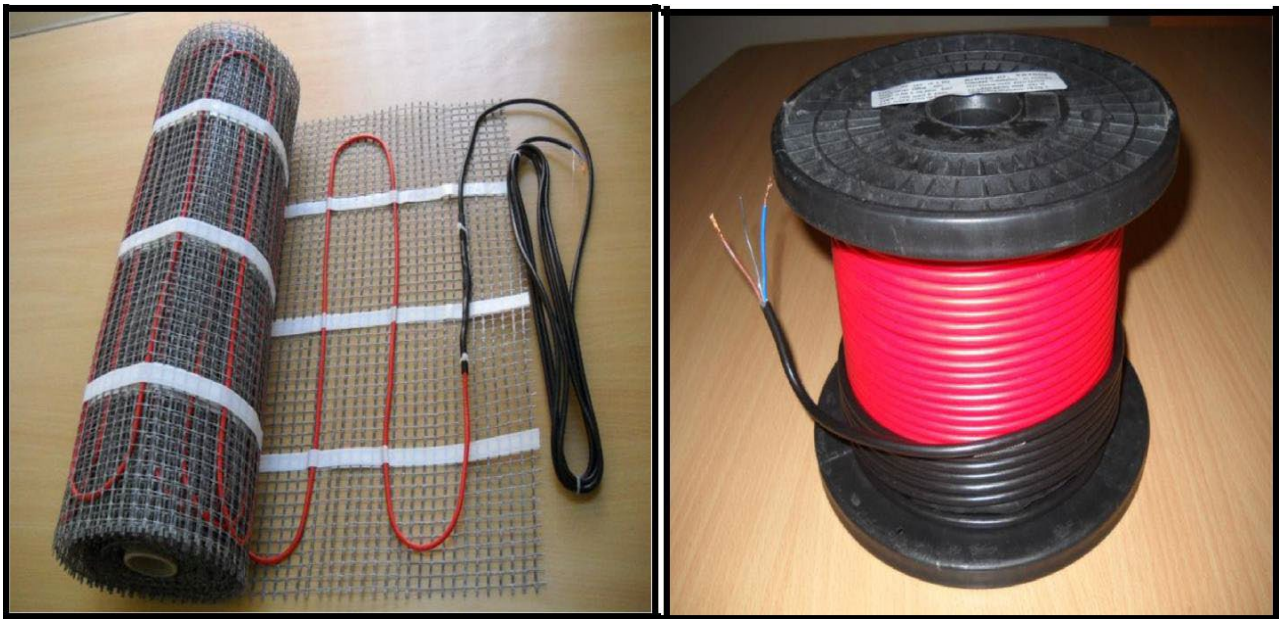
KLIMA by Radiant Electric Heat

ELECTRIC UNDERFLOOR HEATING MAT

and

ELECTRIC UNDERFLOOR HEATING CABLE SYSTEMS



INSTALLATION MANUAL

This installation manual includes factory guideline for installing the KLIMA Floor Heating Systems. These guidelines must be followed to ensure warranty coverage. Contact Radiant Electric Heat for any questions regarding proper installation of the Heating mats and Cables

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TABLE OF CONTENTS Page No.

1. General Information 3
2. Important safeguards and Warnings 3
3. Cable Construction and Specifications 5
4. Product Tables 6
5. Material Requirement 7
6. Pre - installation Check List 7
7. Inspecting and Testing the cable and floor sensor 8
8. Installation–Heating Mats 10
   - 8.1. Floor constructions 10
   - 8.2. Layout planning and product selection 11
   - 8.3. Shower Area 12
   - 8.4. Laying Thermal Insulation 12
   - 8.5. Laying the mat 12
   - 8.6. Adjusting the mat 13
   - 8.7. Joining multiple mats 13
   - 8.8. Installing the floor probe/sensor 14
   - 8.9. Apply the scratch coat (optional) 14
   - 8.10. Completing the Installation 15
9. Installation - Heating Cables 16
   - 9.1. Layout Planning and Product Selection 16
   - 9.2. Cable Spacers 17
   - 9.3. Selecting the Cable Spacing 17
   - 9.4. Thermostat Location and Strapping Layout 18
   - 9.5. Electrical Rough- In (New Construction) 20
   - 9.6. Transfer Layout to floor and plan cable routing 21
   - 9.7. Installing the strapping 21
   - 9.8. Installing the Cable 22
   - 9.9. Lacing the cable through the strapping 23
   - 9.10. Install the floor sensor 23
   - 9.11. Apply Scratch Coat 24
   - 9.12. Complete the installation 24
10. Installing the thermostat 25
11. Switching ON 26
12. Trouble shooting 26
13. Warranty 27

1.0 General Information

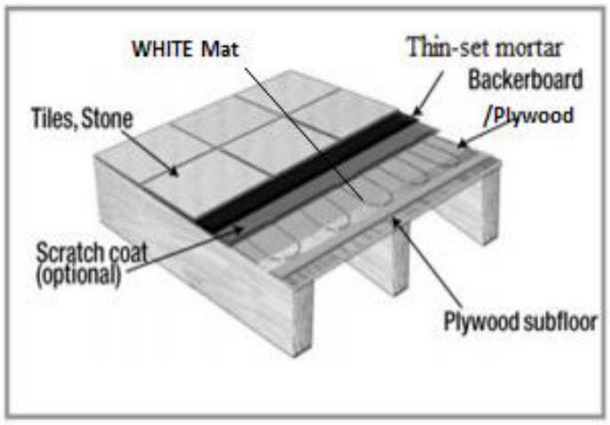
Electric Floor Heating is a simple, economical way to warm any indoor spaces providing years of lasting comfort whether it is used as a supplemental or primary heating source. This heats the room uniformly by the process of Radiant Heating. This installation manual provides guidelines / safety warnings and describes the elements of properly installing the KLIMA floor heating system which are:

1. How to design the proper layout for the room
2. How to select the right product for the application
3. How to properly install the system

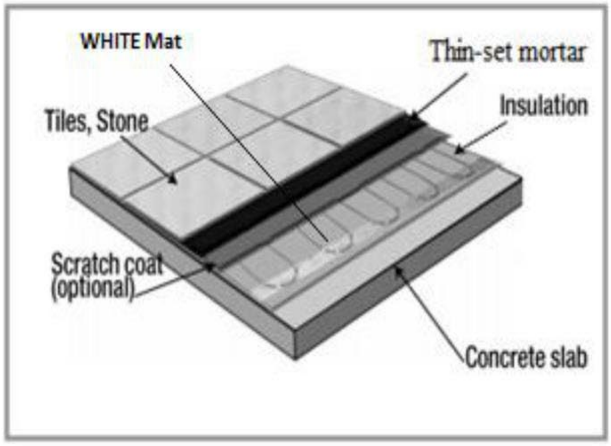
This installation manual DOES NOT provide detailed information regarding thermostat installation.

It is important to thoroughly review the thermostat manual included with the thermostat .It is necessary to install a thermostat (UL listed) with CLASS A GFCI as per instructions given in the thermostat manual.

Typical Installations



Directly on plywood



Directly on concrete

2.0 Important Safeguards and Warnings

READ AND FOLLOW THE WARNINGS AND INSTALLATION INSTRUCTIONS PROVIDED IN THIS MANUAL. FAILURE TO DO SO COULD RESULT IN ANY OF THE FOLLOWING: CABLE FAILURE, IMPROPER SYSTEM OPERATION, PROPERTY DAMAGE, BODILY INJURY OR DEATH. THE WARRANTY IS INVALID IF THE WARNINGS AND SPECIFIC INSTRUCTIONS ARE NOT FOLLOWED.

WARNING: ELECTRIC SHOCK AND FIRE HAZARD

1. The instruction manual follows North American standard building construction conventions.
2. An electrical inspector may be required before, during and after the installation. It is recommended to contact your local building department BEFORE beginning the installation.
3. DO NOT energize the cable before installation as it will cause overheating or damage to the cable.
4. Connect cables to rated voltage only (120 V AC or 240 V AC).
5. This product is approved for indoor use only. Minimum installation temperature is 50˚ F (10˚C).
6. Use only copper supply wires. Be sure to size for conductor properly to carry the rated amperage.

7. DO NOT cut the Red heating cable or attempt to alter the length in any way. The black cold lead can be shortened, but only at the end of cable where the power lead are exposed. DO NOT cut at the splice between the cold lead (black wire) and the heating wire (Red wire).
8. Do NOT install heating cable under any type of floor that requires nailing.
9. The installation must be protected by a Class A GFCI (Ground Fault Circuit Interrupter) for safe operation.
10. DO NOT install the splice and end seal of the cable in shower area.
11. If the GFCI trips during normal condition and cannot be reset, consult an electrician for service. NEVER attempt to bypass or disable the GFCI system.
12. DO NOT drill, nail or cut any floor that have heating cable installed underneath. This could result in contact with live electrical wire causing electrical shock.
13. DO NOT use staples, nails or similar fasteners directly on the cable. Use only the strapping system or Duct tape to attach the cable. The use of any other fastening method will void the warranty.
14. Use a smooth plastic trowel only. NEVER bang or drop a tool on the cable. Care should be taken not to nick or gouge cable.
15. DO NOT install the heating cable under a cabinet or other built in fixtures. This will cause the cable to overheat.
16. DO NOT install the heating cable (Red wire) inside a wall. Only the cold lead can go into a wall stud, when put inside a UL listed conduit.
17. DO NOT extend the heating cable beyond the room or area that it originates. Heating product will not be installed in closets, over walls or partitions that extend to the ceiling, or over cabinets whose clearance from the ceiling is less than the minimum horizontal dimension of the cabinet to the nearest cabinet edge that is open to the room or area. However, the isolated single runs of the cable may pass over partitions where they are embedded.
18. DO NOT attempt to repair damaged cable without a factory splice kit.
19. DO NOT overlap heating cable. Dangerous overheating will occur.
20. DO NOT allow the cold lead or thermostat sensor to cross or overlap the heating cable.
21. All cables must be completely embedded into a cement based mortar including the cold lead, cold lead splice, heating cable tail splice and thermostat sensor with the wire lead.
22. DO NOT bend the cable at sharp right angle. Always maintain a minimum 1” radius.
23. Maintain at least a minimum spacing of 2.6” between heating cable.
24. Test and record the cable resistance at least four times during installation.
25. After installation of the cable, the installer must inspect and remove damaged or defective cables before they are covered or concealed.
26. The installer should mark the appropriate circuit breaker reference label indicating which branch circuit supplies the circuit to those electric space heating cables.
27. These product are to be installed in accordance with ANSI/NFPA 70, National Electrical Code (NEC) and CAN/CSA-C22.1, Canadian Electrical Code, Part I (ECE).
28. Only UL Listed conduit, fitting, and/or other component are to be used.
29. Product are listed for installation with a minimum thermal resistance value of R-0.02
    Typical examples are:
    Granite R-0.05 Ceramic Tiles R-0.028 Marble R -0.09 Cement Mortar R-0.20
    Hard Board 1/2” R-0.34 Engineered wood ¾”R-0.38 Plywood ¾”R-0.93
30. While installing tiles or other stone floor coverings, the installer has to decide if a Permeability Barrier (Water Barrier) is to be applied during installation.

3.0 Cable Construction/ Specification:

The KLIMA Tape Mat is a complete heating mat consisting of a series heating wire and power lead for connection to the electric power supply. The heating wire length cannot be cut to fit.

Controls : KLIMA Tape Mats must be controlled by a floor sensing thermostat (UL Listed)

Voltage : 120 V AC , 240 V AC , 1- Phase (See Table on page 6)

Watts: 14 W / Sqft with 2.6" spacing, Standard 12 W/ Sqft (41 Btu/h / sqft) with 3.0" spacing, 9 W/sqft with 4" spacing

Maximum circuit load : 10 Amp

Maximum Circuit Overload Protection : Circuit Breaker 120 V AC 15 Amp – SP; 240 V AC 15 Amp DP

CLASS A GFCI (Ground Fault Circuit Interrupter) : Required for each circuit (Included in the Thermostat Control)

Application : Type REHM/C . For indoor floor heating application only. Only embedded in Polymer modified cement based mortar / Self leveling Cement.

Minimum bend radius : 1 inch

Maximum exposure temperature : Continuous and storage 194 ˚F (90 ˚C)

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

Skill Level : 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.

This product may be secured in place by an average do-it-yourself person or qualified installer. However, Electrical wiring is required from a circuit breaker or other electrical circuit to the control. So, it is recommended that an electrician perform these installation steps. Please be aware that local codes may require this product and /or the control to be installed by an electrician.

KLIMA - UNDER FLOOR HEATING CABLES/ MATS-REHM/C

CONSTRUCTION:

I) Heating Cond.: Solid/ Multi-strand
(Kanthal - D, SS, CCS, Cu. & Cu. Ni. alloys)

II) Cold Tail Cond. : AWG 18/12/28 TPC (Tin Plated Copper)

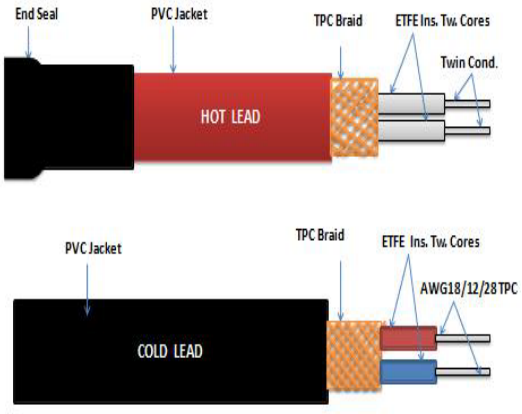
III) Insulation : ETFE, 12 Mil RTI

IV) Shielding : Tin Plated Copper (TPC) Braid, 80% Coverage.

V) Outer Jacket : 32 Mil RTI, High Temp. PVC

VI) Cold Tail : Separate/ Integrated

As per UL 758, UL 1683



CABLE DRAWING

4.0 Product Table : 120 V

120V Model (XX--Watt/ft²)	Watts	Mat Width (Ft)	Element Length (Ft)	Heated area for different Cable spacing (Ft²)						Total Res. (Ohm)	Amps (A)
				14 W/Ft² @2.6`` Spacing		12 W/Ft² @ 3`` Spacing		9 W/Ft² @ 4`` Spacing			
				Mat area (ft²)	Mat Length(ft)	Mat area (ft²)	Mat Length(ft)	Mat area (ft²)	Mat Length(ft)		
REHM/C120-120-XX	120	1.60	40	9	5	10	6	13	8.1	120.00	1.00
REHM/C120-180-XX	180	1.60	60	13	8	15	9	20	12.2	80.00	1.50
REHM/C120-240-XX	240	1.60	80	17	10	20	12	27	16.3	60.00	2.00
REHM/C120-300-XX	300	1.60	100	21	13	25	15	33	20.4	48.00	2.50
REHM/C120-360-XX	360	1.60	120	26	16	30	18	40	24.5	40.00	3.00
REHM/C120-480-XX	480	1.60	160	34	21	40	24	53	32.6	30.00	4.00
REHM/C120-600-XX	600	1.60	200	43	26	50	30	67	40.7	24.00	5.00
REHM/C120-720-XX	720	1.60	240	51	31	60	37	80	48.8	20.00	6.00
REHM/C120-840-XX	840	1.60	280	60	37	70	43	93	56.9	17.14	7.00
REHM/C120-960-XX	960	1.60	320	69	42	80	49	107	65.0	15.00	8.00
REHM/C120-1080XX	1080	1.60	360	77	47	90	55	120	73.2	13.33	9.00
REHM/C120-1200-XX	1200	1.60	400	86	52	100	61	133	81.3	12.00	10.00

240V

240V Model (XX--Watt/ft²)	Watts	Mat Width (Ft)	Element Length (Ft)	Heated area for different Cable spacing (Ft²)						Total Res. (Ohm)	Amps (A)
				14 W/Ft² @ 2.6`` Spacing		12 W/Ft² @ 3`` Spacing		9 W/Ft² @ 4`` Spacing			
				Mat area (ft²)	Mat Length(ft)	Mat area (ft²)	Mat Length(ft)	Mat area (ft²)	Mat Length(ft)		
REHM/C240-120-XX	120	1.60	40	9	5	10	6	13	8	480.00	0.50
REHM/C240-180-XX	180	1.60	60	13	8	15	9	20	12	320.00	0.75
REHM/C240-240-XX	240	1.60	80	17	10	20	12	27	16	240.00	1.00
REHM/C240-300-XX	300	1.60	100	21	13	25	15	33	20	192.00	1.25
REHM/C240-360-XX	360	1.60	120	26	16	30	18	40	24	160.00	1.50
REHM/C240-480-XX	480	1.60	160	34	21	40	24	53	33	120.00	2.00
REHM/C240-600-XX	600	1.60	200	43	26	50	30	67	41	96.00	2.50
REHM/C240-720-XX	720	1.60	240	51	31	60	37	80	49	80.00	3.00
REHM/C240-840-XX	840	1.60	280	60	37	70	43	93	57	68.57	3.50
REHM/C240-960-XX	960	1.60	320	69	42	80	49	107	65	60.00	4.00
REHM/C240-1080-XX	1080	1.60	360	77	47	90	55	120	73	53.33	4.50
REHM/C240-1200-XX	1200	1.60	400	86	52	100	61	133	81	48.00	5.00
REHM/C240-1320-XX	1320	1.60	440	94	57	110	67	147	89	43.64	5.50
REHM/C240-1440-XX	1440	1.60	480	103	63	120	73	160	98	40.00	6.00
REHM/C240-1680-XX	1680	1.60	560	120	73	140	85	187	114	34.29	7.00
REHM/C240-1920-XX	1920	1.60	640	137	84	160	98	213	130	30.00	8.00
REHM/C240-2160-XX	2160	1.60	720	154	94	180	110	240	146	26.67	9.00
REHM/C240-2400-XX	2400	1.60	800	171	105	200	122	267	163	24.00	10.00

Note – The tolerance on resistance is - 5 % to + 10 % at 20 ˚C (68˚F)

5.0 Material Requirement

A . Supplied by KLIMA

1. KLIMA floor heating cable / mat
2. Floor strapping (sold separately)

B. Bought out / Supplied by Installer

3. Thermostat with CLASS A GFCI (UL listed)
4. Temperature sensor (included with thermostat)
5. Electrical box and cable clamps (UL Listed)
6. Wood chisel or router
7. Multi meter or Mega ohm meter
8. Wire nuts of correct size and cable fasteners (UL Listed)
9. Nail plate (Optional)
10. Duct Tape (1'')
11. Stapler
12. Protective glasses
13. Broom
14. Felt Tip Marker
15. Electrician tools
16. Electric drill
17. Plastic trowel
18. Hammer
19. Hot glue gun
20. Tape measure
21. Double backed tape (for concrete slab)
22. Polymer modified thin-set cement base mortar or self-leveling cement
23. Cement Backer board for wooden floor, ¼" thick (R –Min 0.13 and Max 0.15), ¾" plywood (R- 0.93)
24. Expanded Polystyrene Hard Foam Insulation board ¼ "thick (R- Min 4.0 and Max 5.0)
25. AWG 14 copper electrical wiring cable

6.0 Pre - installation Check List :

- The Red heating cable must NOT be cut. Only the cold lead wire (Black Cable) may be shortened as required.
- The installation must be protected by a Class A GFCI (Ground Fault Circuit Interrupter) for safe operation.
- Check that the product identification label on the KLIMA outer packaging and the tag attached to the cold lead of the Cable are an identical match .Also that the cable /mat supplied matches your requirement for the area coverage and heat output by cross referencing on the product table (Page 6) before commencing the installation.
- In case of any discrepancies, you should report these to the manufacturer or supplier and discontinue the installation immediately
- The perimeter of the self-leveling compound area must be separated from the vertical structures by an expansion joint (polystyrene etc. up to 0.5"wide). In case where cables are laid in an area larger than 180 sqft or with a diagonal greater than 23 ft, it is necessary to install an expansion joint .The heating cable should not cross expansion joints. The non-heating connecting cables located at the expansion joints must be laid loosely in a listed conduit to be provided by installer
- Consult the self –leveling compound manufacturer's instructions as to a suitable drying out period before turning on the heating system.
- Use a polymer modified thin –set mortar or self-leveling cement based mortar when tiling over underfloor heating.

- Always wear rubber soled shoes. Do not walk on the cable mat until the cement mortar is completely set and cable is fully protected.
- Before laying the cable/ mat, check the cable resistance with an ohm meter. It should match the rating on the mat label and on the product table (Page 6) with a tolerance of -5 % to + 10 %. You should check the cable mat resistance regularly at all stages of the installation.
- When installing multiple KLIMA cable mats in a single room, the mats should be connected in parallel.
- Consideration should be given to sub – floor thermal insulation before laying the KLIMA mat. A high thermal barrier such as Expanded Polystyrene Hard Foam Insulation Board with R value 4 will significantly slow the process of heat losses into the sub-floor, improve performance and reduce the initial warm up time.
- Install insulation materials onto the concrete subfloor using modified thin-set mortar prior to laying cable / mat and covering with thin-set mortar or self – leveling cement.
- The minimum handling installation temperature for under floor heating is 50˚F (10 ˚C).
- All the Red heating cable must be installed in the floor and covered with thin-set mortar and /or self-leveling cement.
- When using thin-set mortar ensure that the cable is totally encapsulated with no air pockets.

- The heating mat should not be placed in floor areas that will be permanently covered with floor fitted furniture, fitments or appliances (e.g. kitchen cabinets, bathtubs, vanities, toilets, refrigerator etc.).
- Heating product will not be installed in closets, over walls or partitions that extend to the ceiling, or over cabinets whose clearance from the ceiling is less than the minimum horizontal dimension of the cabinet to the nearest cabinet edge that is open to the room or area.
- A minimum clearance of 3” should be left between the heating mat and perimeter walls (4” for combustible surfaces).
- Final electric connection to the main power supply MUST be carried out by a qualified electrician.
- Ensure that you have a listed thermostat with a floor sensor before commencing installation. The floor limit sensor must be installed in the floor when laying the mat.
- Consideration should be given to the load rating of the controlling thermostat. Where the load rating of the thermostat is exceeded, a suitable rated contactor should be installed.
- Only UL and CSA approved thermostat with Class A GFCI must be used. We recommend HONEYWELL digital programmable thermostat with Class A GFCI / EGFPD model TH115-AF-120 S/U-GB and TH115-AF-240 S/U - GB, or equivalent.
- The heating cable /mat must be installed minimum 4” away from any combustible material.

7.0 Inspecting and Testing the cable and floor sensor

7.1 Take the cable/mat out of the packing and inspect it for any physical damage.

7.2 Test the insulation and the resistance of the cable and record data in The MAT/ CABLE TESTING LOG listed on page No10 of this manual.

7.3 The cable /mat and sensor should be tested and recorded a minimum of 4 times during the installation for the warranty to be valid.

7.4 Insulation Test :

Insulation Test

This test ensures that the insulation of the cable is not damaged. A low value on the meter indicates the cable has been damaged and must be replaced. Follow the following steps:

A. Set the multimeter to read ohms

B. Connect the ground wire (braided uninsulated wire) to the black test lead of the multimeter and the red test lead to both the brown and blue wires of the cold lead.

C. The meter should read “OPEN” or “OL”. If you get a different reading, the cable is damaged. Contact manufacturer for support.

D. Record the reading on the cable tag and in the cable test log.

7.5 Resistance Test:

Resistance Test

This test measures the resistance of the mat/ cable which verifies the continuity (no breaks) and that the cable has the proper wattage rating.

A. Set the multimeter to read ohms

B. Connect the meter leads to the brown and blue cold lead wires, DO NOT connect the ground wire.

C. Compare the resistance reading to the value specified in the product selection table (on Page 6), it should read -5 % to +10 %. If the reading is different, contact manufacturer.

D. Record the reading on the cable tag and in the cable test log (on page 10).

7.6 Floor Sensor Test :

Floor Sensor Test

This test measures the resistance of the floor sensor to verify the integrity of the Component.

A. Set the multimeter to read ohms.

B. Connect the multi-meter leads to the floor sensor wires.

C. The meter should give a reading corresponding to the specifications given in the thermostat manual. If the test results are not matching, contact thermostat manufacturer for support.

D. Record the reading on the cable tag and in the cable test log.

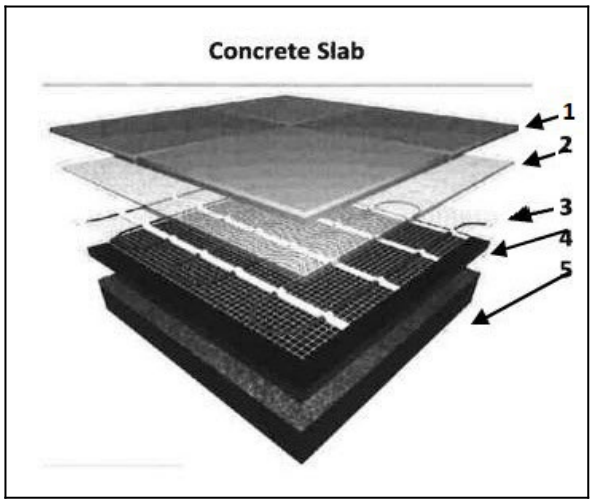
CABLE TEST LOG

Tests must be recorded for warranty	Resistance (-5%+ 10 %)	Insulation Test
Model :		
Volts :		
Factory QC Test		
TEST 1 . Before Installation		
TEST 2 . After Installation but before embedding		
TEST 3 . After Embedding		
TEST 4 . After floor tile		

8.0 Installation - Set Mat

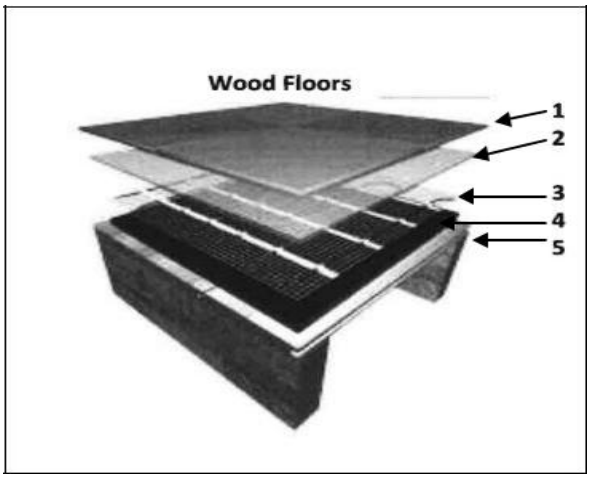
8.1. Floor constructions

Concrete Floors – For optimum performance it is recommended that concrete sub floors be covered by an insulation layer of polystyrene hard foam insulation board with cement coating on both sides (min. R value 4 and max. 6). This will minimize heat loss and ensure quicker heat up time. The KLIMA mat can be laid directly onto an uninsulated concrete floor if it is insulated from below. If not insulated from below, this will increase heat loss and operating costs.



1. Tile / Stone Floor
2. Thin –set mortar and /or self – leveling compound
3. KLIMA mat
4. Insulation
5. Concrete sub- floor

Wood Floors – When installing KLIMA mat on a plywood sub-floor, it is essential that you take the standard precaution to stabilize the sub floor and prevent sub-floor movement , e.g. overboard with a suitable surface for tiling, e.g. with ¾" plywood (R Value 0.93) or Cement Backer Board ¼" (R value 0.13).



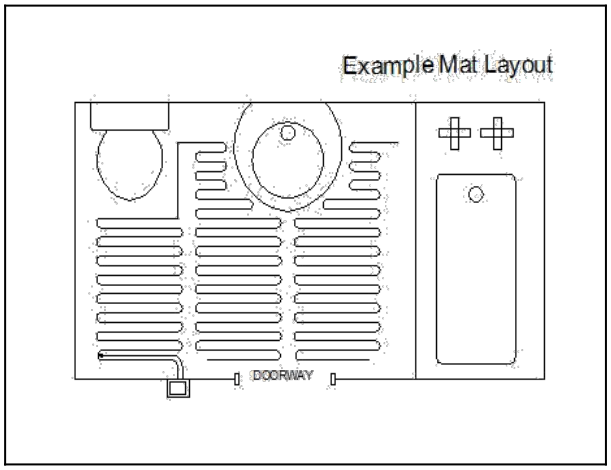
1. Tile / Stone Floor
2. Thin –set mortar and /or self-leveling compound
3. KLIMA mat
4. Backer Board / Plywood
5. Suspended Wood Subfloor

8.2 Layout planning and product selection

It is good practice to plan the installation using a sketch marking your layout pattern and planning the position for floor sensor, connection box and thermostat.

Accurately measure the free floor area to be heated, in square feet, deleting any items of the fixed furniture such as bath, WCs, showers, kitchen cabinets/appliances etc. Use this calculated area (sqft) to select the nearest cable mat size DOWN using the product selection chart (On page 6). NEVER select the nearest mat size up.

If the calculated "heated" floor area is larger than the mat size offered, you can use a combination of mats to achieve the coverage.



Additional mats should be wired in parallel using a suitable junction box. It is important that the correct size of KLIMA matting is used as the cable cannot be shortened.

Example :

Calculated Heated Area (sqft)	Heating Mat Coverage (sqft)	Product Model No.

Note : For hard to reach areas the cable can be removed from the matting and attached to the floor with thin-set mortar/ Duct tape.

8.3 Shower Area

It is preferable to use a separate cUL wet rated mat in the floor of the shower area. It must never be installed into walls. In general, the cable mat should be completely embedded into mortar directly below the surface covering of tile or stone. Other type of coverings are not recommended.

Make sure the power lead factory splice (the connection between the power lead and the heating cable) and the cable end seal, are 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.

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

8.4 Laying Thermal Insulation

Use of cement reinforced extruded hard polystyrene foam insulation board, minimum thickness ¼", with a thermal resistance value of R minimum 4 is recommended.

CONCRETE FLOORS

Ensure the floor is level and dust free. A new concrete screed should be well cured prior to laying insulation board. A bed of polymer – modified thin-set should be applied to the floor using a notched trowel. Lay the boards in a staggered brickwork pattern butting the edges together. Boards should be thoroughly bedded ensuring that no air pockets remain.

A waterproof joint can be made using silicon sealant before butting the board edges together. When the thin-set mortar is dry, board joints can be taped with a fiberglass reinforcing scrim tape.

WOOD FLOORS

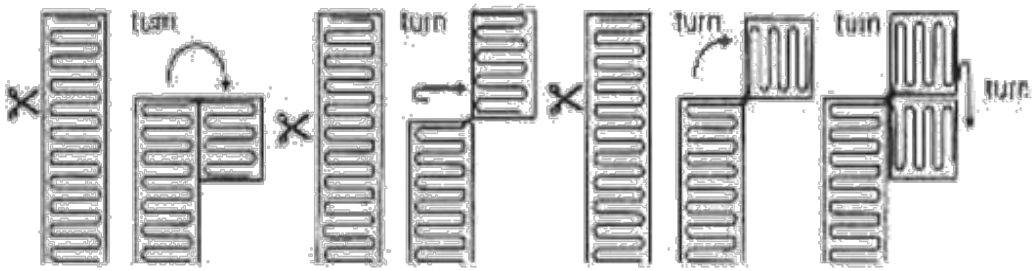
Plywood ¾" thick R 0.93 or Cement Backer Boards ¼" thick R 0.13 can be laid onto a thin – set mortar. A bed of polymer-modified thin-set mortar should be applied to the floor using a notched trowel. Lay the boards in a staggered brickwork pattern butting the edges together. Boards should be thoroughly bedded, ensuring that no air pockets remain. ¾" boards can be mechanically fixed to flat and plywood floors (12" centers) using stainless steel screws with washers under their heads .These should be screwed down until the washers grip the boards. Cementitious surface joints can be taped with a fiberglass reinforcing scrim tape.

8.5 Laying the mat

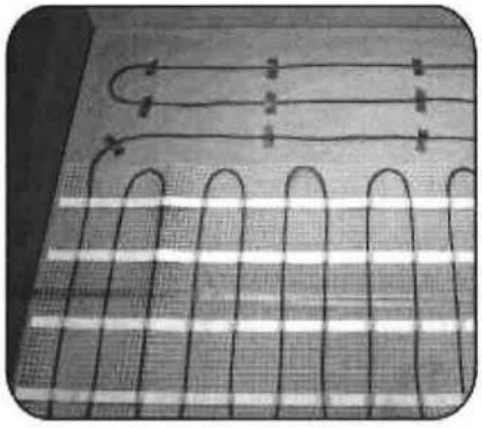
Roll out the mat minimum 3" away from the wall .When you reach end of a run, allow for a distance of minimum 4" from the wall from rolling out the mat, simply cut the backing mesh (NOT the red cable) and turn 180 degrees. The mat is unrolled in the opposite direction ensuring a minimum spacing of 2.6" between the cable loops. When satisfied with the proposed layout, stick the matting to the floor using the integral "peel and stick" tape strips or using 1" Duct tape.

Note : The floor shall be clean from the dust and the sharp objects .

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



8.6 Adjusting the mat :



For areas that will not accommodate the full mat width of 18" the cable can be removed from the matting and attached to the floor uniformly with duct tape. The matting can be further secured to the floor by hot glue gun or duct tape. This is recommended on the outer edges of the matting when using self – leveling compound to prevent the mat lifting. These additional fixing methods should only be used on the matting and NOT on the cable. The looped cables must be spaced about 3" from each other (Minimum 2.6") using 1'' Duct tape.

WARNING : Risk of electrical shock and fire .Damage to supply conductor insulation may occur if the conductors are routed less than 2.6" from this heating product . Refer to above for recommended means of routing supply conductors.

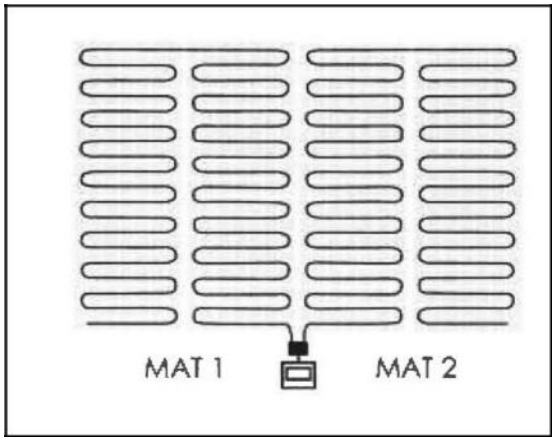
Connections of multiple mats must be done in PARALLEL at the power source / thermostat.

NEVER cut off the end of the heating cable to connect another one in series.

8.7 Joining multiple mats

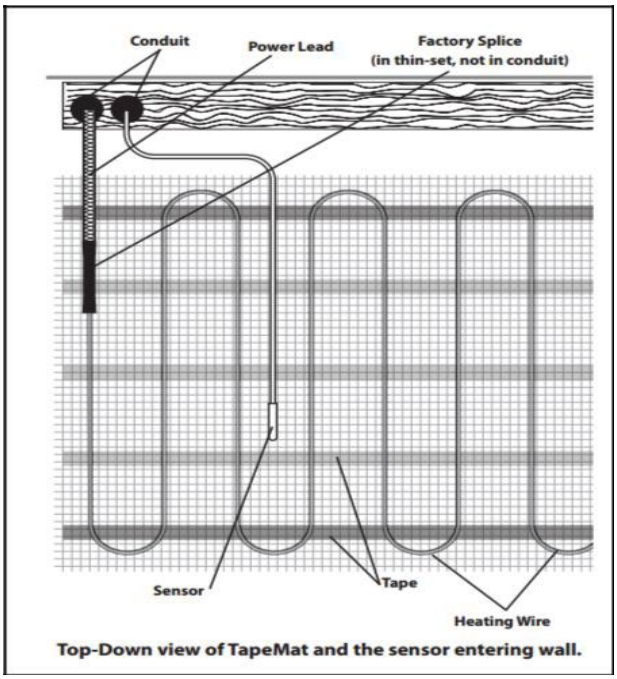
If the area to be heated is larger than the largest available mat size, the mats can be simply wired in parallel.

8.7.1 If the total current drawn by the mats wired in parallel exceeds the rating of the relay limit in the thermostat (typically 16 Amp) then a higher rated contactor must be used with the thermostat.



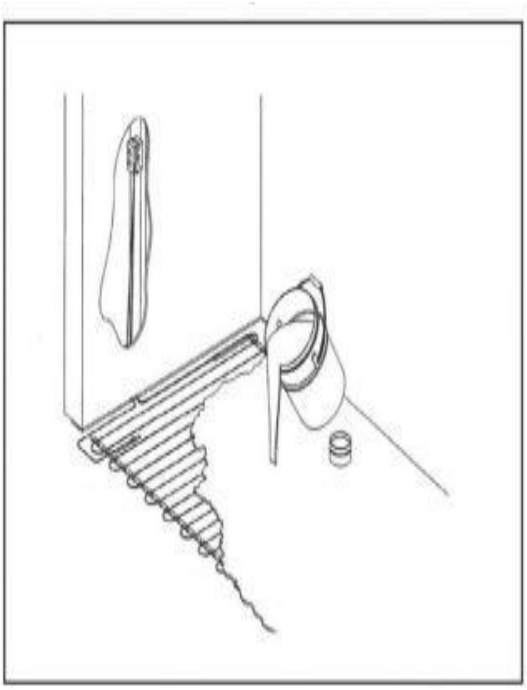
8.8 Installing the floor Probe / Sensor

If necessary, cut a groove in the floor to accommodate the floor sensor for the thermostat. Before laying the sensor check the resistance using an ohm meter .The sensor should be positioned between 2 heating cable loops under the mat approximately 20" from the wall. Additionally, a second back up sensor can be installed as a precaution against future replacement. Bring it to the box, but do not connect the second sensor to the thermostat. The existing floor should be prepared as normal for tiling .The entire floor should be free from any sharp projections. The floor surface should then be primed to accept the tile thin set mortar if required.



Top-Down view of TapeMat and the sensor entering wall.

8.9 Apply the scratch coat (Optional)



8.9.1 Apply a scratch coat of the Polymer modified thin-set or self-leveling cement uniformly over the entire floor area. Make sure the heating cables are completely embedded. Follow the compound manufacturer's instructions.

8.9.2 Use a plastic straight edge trowel and cover the entire areas to maintain uniform height.

8.9.3 Apply the mortar in the same direction of the cable runs to minimize lateral movement.

8.10 Completing the Installation

There are two recommended methods of covering the cable/mat:
Concrete or wood floors using Polymer modified thin-set cement base mortar.

Working with a width of mat at a time, apply Polymer modified thin-set cement base mortar on top of the mat so that the cable and mat both are completely covered ensuring that there are no air pockets. This should be done using a plastic notched trowel or similar, taking care not to damage the cable. Once dry, another layer of thin-set mortar can then be applied carefully using a notched trowel to comb the thin-set mortar before laying the tiles.

Concrete and Wood floors using self – leveling cement :

An alternate method for all but the smallest installation is to cover the cable mat installation with suitable self-leveling cement. This product will find its own level and once dry will provide a suitable flat surface to apply a layer of thin-set mortar before laying the tiles.

Important :

1) The heating cable must NOT be cut or shortened and the joint between the cold lead wire (black) and the heating cable (Red) must not be bent or put under strain. Red heating cables should never cross or touch (2.6” gap min) and must be installed in the floor. To ensure no heating wire enters the wall, leave 6” of lead wire in the floor.
2) Always wear rubber soled shoes. Do not walk on the cable mat until the cement mortar is completely set and cable is fully protected.
3) A fully qualified electrician must now make the final connections to the main power supply and install the thermostat. The thermostat should be installed in the room to be heated. For bathrooms, the thermostat must be placed outside the shower at least 4 ft away. Control of the heated floor in this application is provided by the floor sensor only.
4) Make sure to check that the heater is connected to the proper voltage supply 120V or 240 V AC

Finally the electrician should check for continuity of the floor sensor and retest the resistance of the cable. The installation should be protected by a Class A GFCI for safe operation.

IMPORTANT TEST : TEST THE CABLE RESISTANCE, CABLE INSULATION AND FLOOR SENSOR RESISTANCE TO BE SURE NO DAMAGE OCCURRED. RECORD THE READINGS ON THE CABLE LABEL AND THE DATA LOG ON PAGE 10.

9.0 INSTALLATION - HEATING CABLE

9.1 Layout Planning and Product Selection :

WHITE heating cable is used to warm interior floors. It is not to be used for exterior applications such as snow melting or roof gutter applications. It is not to be used in walls or ceilings. Follow these steps in planning the installation.

9.1.1. Draw the room dimensions on piece of grid paper.

9.1.2. Draw in any fixed obstruction such as a shower, bath tub, vanity or counter. The cable is not to be installed under these type of items. In addition, DO NOT run cable into closets or confined areas where heat could build up.

9.1.3. Mark the locations of any toilets, heating vents or any other heating appliance.

Note on the drawing that the heating cable must be installed at a minimum distance of :

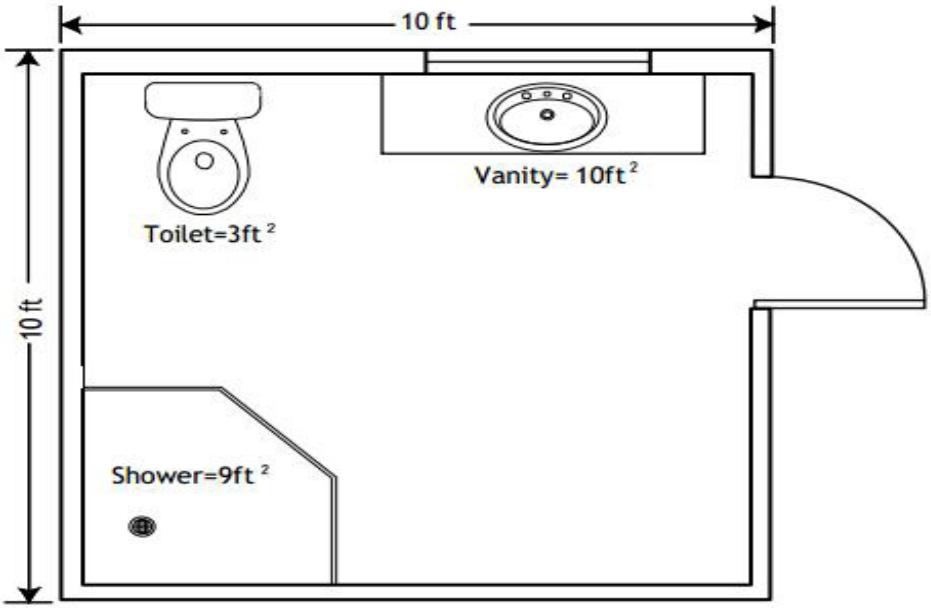
a. 6'' from the center of the toilet drain.
b. 8" from heating vents or any other heating appliance.
c. 3" from the walls (4" for combustible surfaces)

9.1.4. Determine the heating area of the floor by subtracting the permanent fixtures.

For example : In the Figure below, the room is 10 ft X 10 ft equaling 100 sqft (ft^2).

The area of each permanent fixture is as follows :

a. Vanity = 10 ft^2
b. Toilet = 3 ft^2
c. Shower = 9 ft^2
d. Total heated area : = 100 ft^2- 22ft^2 = 78ft^2



9.1.5. Border allowance : Heating cable should be installed between 3” and 6” from the perimeter walls, but more than 4” from a kick space vanity, shower, bath tub, counter or doorway. It is not necessary to heat the floor all the way to the walls as it is not typical that people will stand that close to the wall. In addition, the heat will radiate out an additional 2” from where the cable is embedded.

9.1.6. In most cases, simply select the cable kit that is 5 % but no more than 10 % less than the total square footage of the area to be heated as calculated in the previous step.

For example : If the square footage after deduction of the fixed obstacles equals 78 ft² , than the closest cable kit is 70 ft which is 10 % less allowing for an unheated border. The next size down is 60 ft which is too small and would not be enough cable to properly heat the room.

9.2 Cable Spacers

Two types of Cable Spacers are recommended to be used, with 1” standard spacing

A. Plastic Molded Spacers
B. Aluminum Mounting Tape

Both of above types are shown below :

Aluminum Mounting Tape

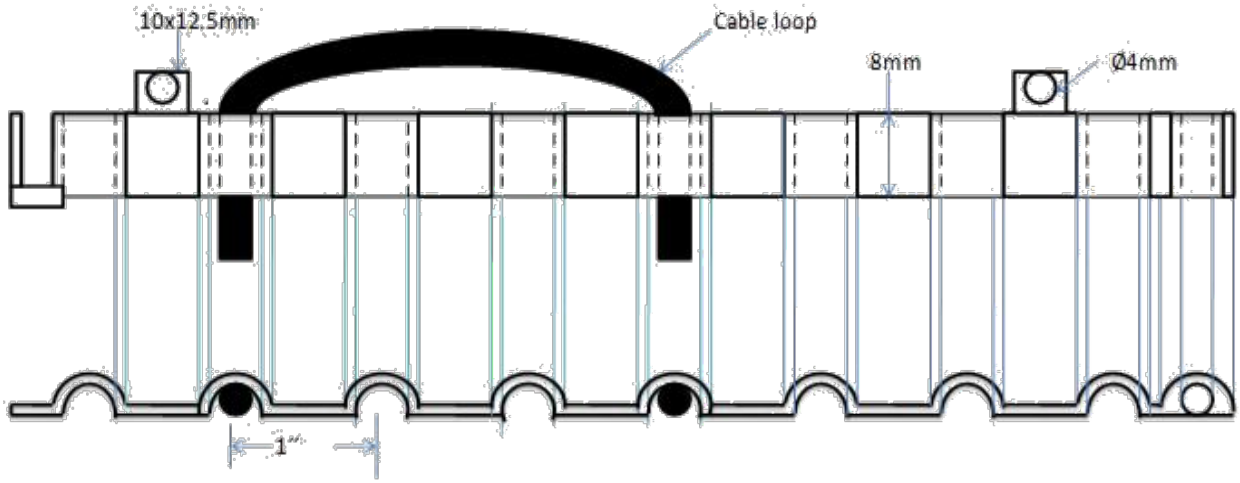
Plastic Molded Spacers

These spacers can be supplied on request.

9.3 Selecting the Cable Spacing

A. 3” is the standard spacing and recommended for most flooring heating applications (12 W/ft²).

B. 2.6” spacing is used for high heat loss applications such as a non-insulated concrete basement floor or bathroom with a large exterior wall (14 W/ft²).



C. 4" spacing is used for low heat loss applications such as warmer climates where there is a modest temperature rise of less than 15˚F (10 W/ft²).

D. Standard cable strapping provides both 3" and 4"spacing.

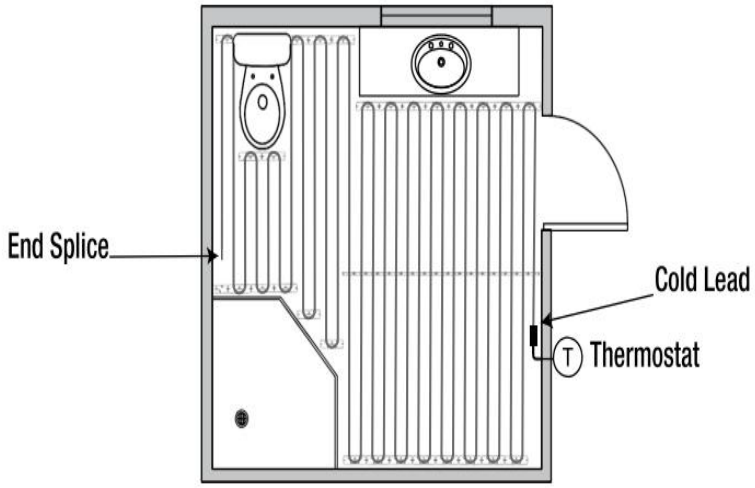
E. For 2.6" spacing (14 Watt/ft²), mark the cable layout on floor and use 1'' Duct tape to hold down the cable to the floor (Not strapping).

9.2.1 Select either 120 or 240 volt cable depending on the power supply available.
DO NOT mix voltages on the same system when more than one cable is used to cover a room.

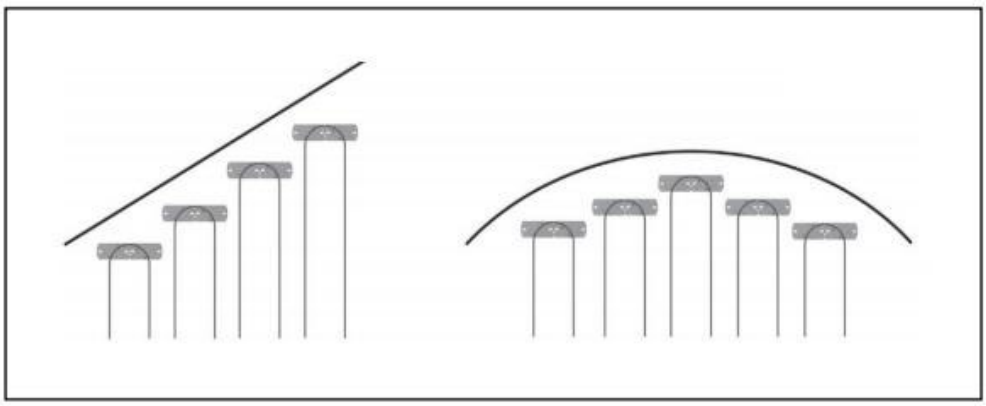
9.4 Thermostat Location and Strapping Layout

9.4.1 Draw in the location of the strapping guides, making sure to identify both the center and the end straps in the drawings. The end straps are used to turn the cable 180 degrees while the center straps are used to hold the cable when the end straps are more than 48" apart.

9.4.2 Mark the location of the thermostat on the drawing. This is where the cold lead will drop from the wall box and become the starting point for the heating cable as well as where the floor sensor will be installed.



9.4.3 For walls or obstructions with angles or curves , the strapping can be cut into smaller sections and installed as demonstrated in Figure below-



9.4.4 Determine the direction of the cable runs. It is recommended that the cable runs parallel to the wall that the thermostat is mounted. Center straps are required when the distance between end straps is more than 48". Center straps should be 3 to 4 feet apart.

9.4.5 On average, a 5 to 10 % deduction in heated area will create a 2-4" border. To determine the exact distance to mount the cable from the wall, take the actual room square footage less the selected cable kit to determine the unheated border. Then take the unheated border and divide it by the perimeter. Now multiply by 12 for the number of inches to mount the cable straps away from the wall.

A. 10ft x 10 ft room = 100 ft²
B. 4 ft x 10 ft room = 40 ft perimeter
C. Cable kit selected = 90 ft²
D. 100ft²-90 ft² = 10ft ² unheated border
E. 10 ft²/40 ft = 0.25 ft
F . 0.25 ft x 12 inch/ft = 3 inch from the wall

The strapping should be mounted 1 ½" away from this.

9.4.6 Shower Area

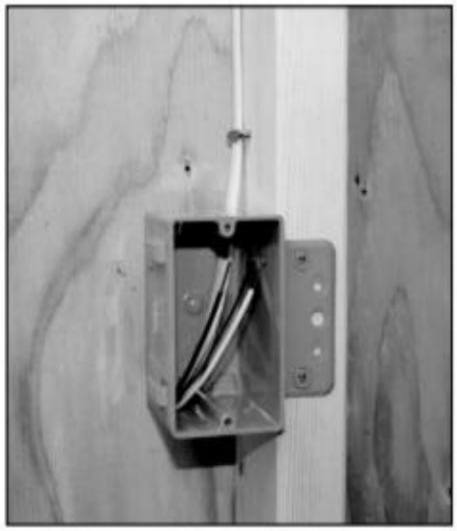
It is preferable to use a separate cUL wet rated cable in the floor of the shower area. It must never be installed into walls. In general, the cable mat should be completely embedded into mortar directly below the surface covering of tile or stone. Other type of coverings are not recommended.

Make sure the power lead factory splice (the connection between the power lead and the heating cable) and the cable end seal, are 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.

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

9.4.7 It is difficult to predict exactly where the heating cable will end, thus it is important to have a buffer zone. A buffer zone is an area where heating is not essential and if unheated, will go unnoticed. This area is also used for any excess cable where a higher heated density will also be unnoticed. While laying the cable in this area using duct tape, maintain 3" spacing (minimum 2.6").

9.5 Electrical Rough- In



Mount Electrical Box

9.5.1. Determine the proper location and height (typically 60'') for the junction box. The cold lead and the floor sensor lead wire should be in the same stud cavity as the electrical junction box. Install the junction box for the thermostat and run the power supply wire into the box.

Drill Horizontal Hole

9.5.2. Drill a ¾" hole 1-1/2" deep horizontally into the sill plate for the cable routing. Drill the hole as close to the bottom of the sill plate as possible. Chisel out the bottom of the sill so that the cold lead wire will not create a high spot in the floor when the thin-set is applied.

9.5.3. Drill a ¾" hole vertically into the sill plate 1-1/2" deep. If installing a floor sensor, drill a second set of holes 4" away in the same stud cavity.

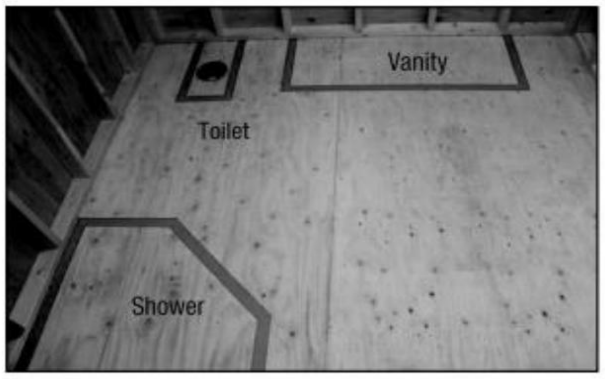
9.5.4. Clear the cable routing holes of debris and install in the same stud cavity.

9.5.5. It is recommended to thread a pull string as the cable installation will be done after the drywall is in place.
Run a second pull string if a floor sensor is being installed. Otherwise the wires can be fished through the wall with an electrician's fish tape after the drywall is installed.

9.6 Transfer Layout to floor and plan cable routing

9.6.1 Use tape to mark the fixed objects in the room the cable needs to avoid, such as a vanity, shower or bath tub. These areas will remain unheated.

9.6.2 Plan the cable routing around the fixed objects. It is best to plan the cable runs parallel to the longest wall in the room. Be sure to have a plan for the end of the cable, including an overflow area to place any excess cable. The cable must not be cut.



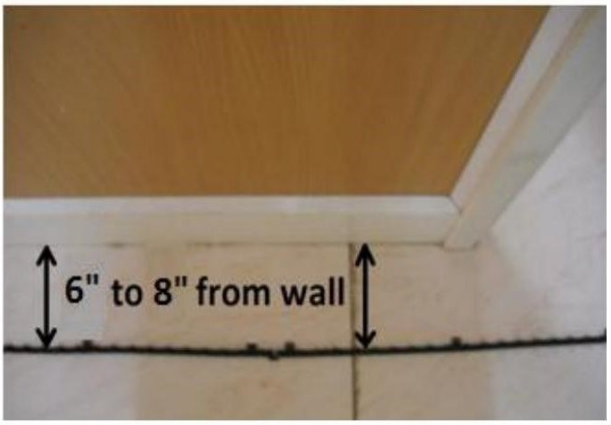
Plan routing of cable.

9.7 Installing the strapping

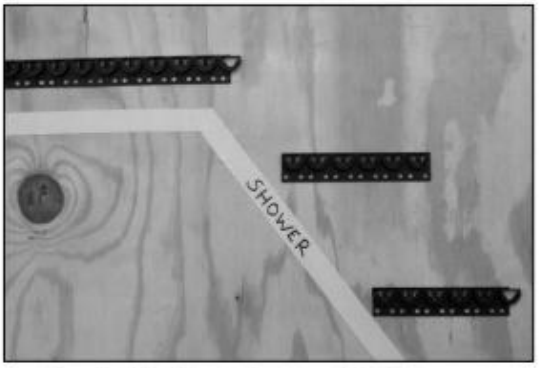
9.7.1. The strapping can be used for both end and center lacing of the cable. Each strapping is used around the border while center straps are installed between the end straps when greater than 4 feet apart.

9.7.2. Strapping is designed to be cut in smaller sections, in one inch increments by cutting between two of the tabs as shown. Cut the strapping into smaller segments to fit the cable layout scheme.

9.7.3 On wood sub-floors, strapping should be fastened with 3/8" staples every 6". The strapping can also be mounted using nail with 0.25" head or #10 screws. Fasteners are required at the end of ends of each piece of strapping to keep it secure.

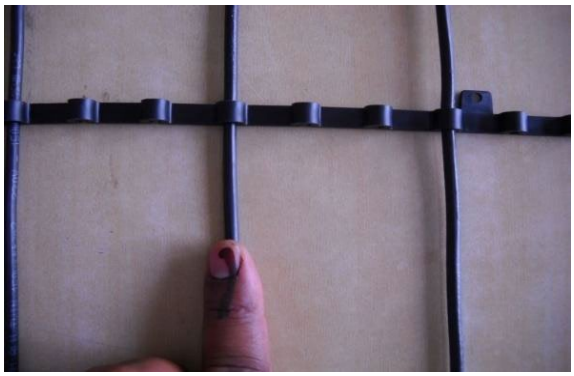


Installing the strapping



Installation in angled areas

9.7.4. For angled areas such as a corner shower, cut 6 " pieces of end strapping then mount each piece in a staggered fashion as shown.



Centre Strapping

9.7.5. When end strapping is greater than 4 ft apart , then the center strapping must be installed to secure the cable. Snap a chalk line between the end strapping the center strapping to make sure the tabs are aligned on centers.

For Concrete Subfloor Applications

9.7.6 For installation on concrete surfaces the strapping may be attached using double side tape, hot glue or concrete anchors.

9.8 Installing the Cable

9.8.1. It is important to uncoil the cable properly to prevent twisting and pig tailing.

Insert a rod into the spool hub and let the spool unreel. Unreel the power leads of the cable up to the factory splice and feed it up the wall into the thermostat junction box through a recognized UL listed conduit. The factory splice MUST BE mounted on the floor and MUST NOT be installed in the wall.

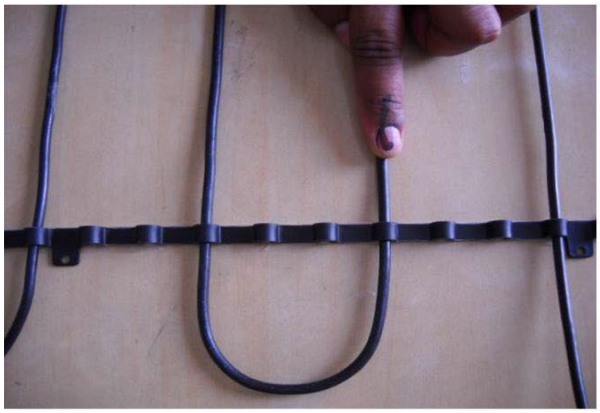
9.8.2. Due to large diameter of the cold lead splice, a deep channel may be cut into the floor to avoid interference with the finished floor. For a wood floor use a router or wood chisel. For a concrete floor, use an appropriate masonry chisel or power hammer. Remove any debris to avoid damage to the cable.

9.8.3 Secure the cold lead splice into the chiseled channel with hot glue. DO NOT USE SCREWS OR STAPLES TO SECURE THE COLD LEAD.

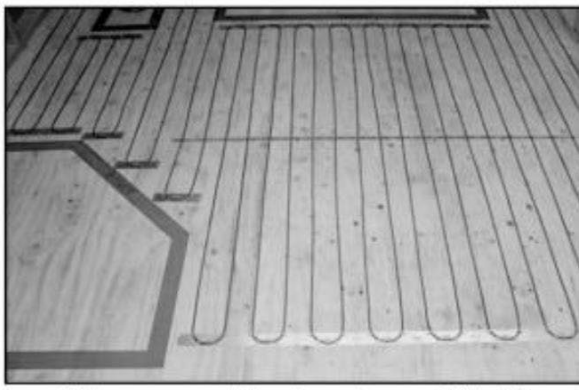
IMPORTANT : THE COLD LEAD SPLICE MUST BE FULLY EMBEDDED IN THE MORTAR. In addition, the cold lead splice must not be bent. No portion of the cold lead splice should enter into a wall.

9.8.4. Secure any loose (red) heating cable between the start of the run and the location where the cable is first laced through the strapping using duct tape.

9.9 Lacing the cable through the strapping



Lace around end strap



Weave cable back and forth

9.9.1. Begin at the cold lead splice by running the heating cable into the first end strap. Pull the cable around the end strap keeping light tension on the cable while seating it under as well as all the way into the tabs.

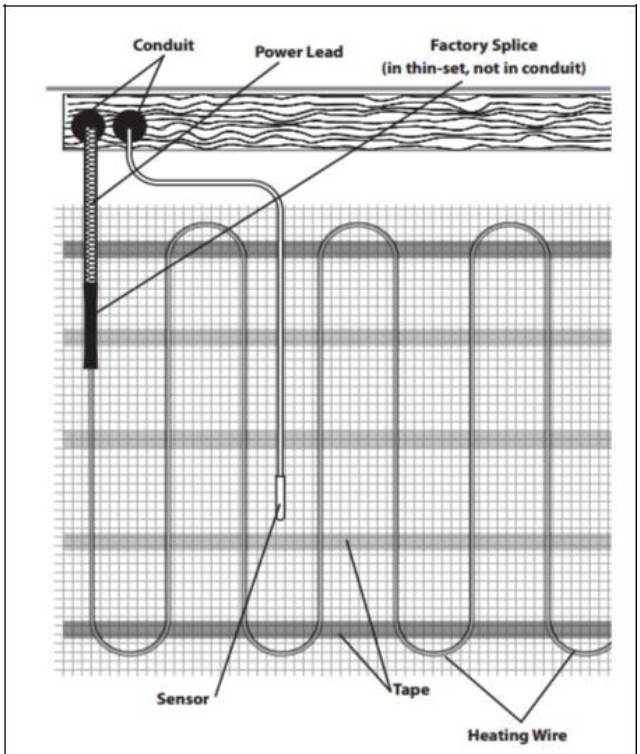
9.9.2. Lace the heating cable back and forth while maintaining light tension. Lace across the area in the desired spacing, DO NOT space cable closer than 3" with cable strapping. DO NOT pull the cable too tight. It is only necessary to create enough tension to keep the cable from lifting up when applying thin – set.

9.9.3. Once the area is completed, lightly press down the center straps to secure the cable into the tabs. DO NOT use a tool, push lightly by hand. It is not necessary to clamp the cable firmly, apply just enough pressure to keep the cable from coming up when applying the thin-set.

9.9.4 Always maintain a minimum distance of 3" spacing and ensure the same spacing is maintained throughout installation.

IMPORTANT : NEVER LAY ONE CABLE OVER THE TOP OF ANOTHER . NEVER STAPLE OVER A CABLE, AND ONLY USE STRAPPING TAB TO HOLD DOWN THE CABLE.

9.9.5 The tail splice is slightly larger in diameter than the heating cable and must be recessed into subfloor. Make a 0.25" channel into subfloor and secure the tall splice into the channel and secure with hot glue.



Top-Down view of TapeMat and the sensor entering wall.

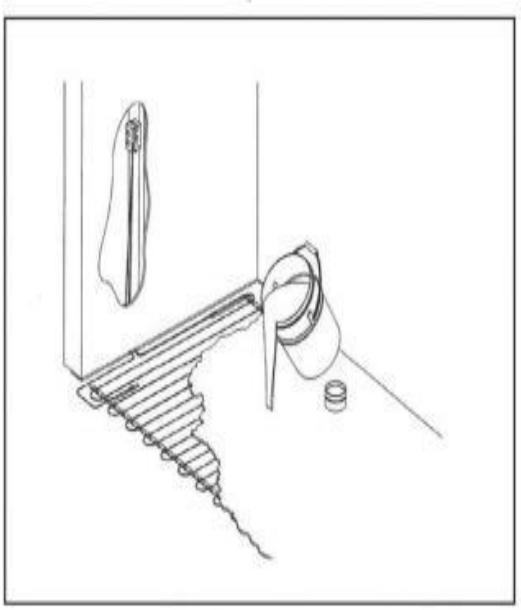
9.10 Install the floor sensor

9.10.1. The floor sensor must be positioned exactly halfway between two heating cables to accurately read the floor temperature. Place sensor 12" min. in heated area.

9.10.2. To make sure the sensor bulb will not create the high spot in the floor , chisel a 0.25" channel into the floor and hot glue the sensor bulb into the channel to secure.

9.10.3. Use a fish tape or pull string to pull the sensor wire to the electrical box, but not in the box.

9.11. Apply the scratch coat (Optional)



9.11.1. Apply a scratch coat of the polymer modified thin-set or self-leveling mortar uniformly over the entire floor area .Make sure the heating cables are completely embedded. Follow the compound manufacturer's instructions. Ensure a good bond by brushing the sub-floor with cement powder or pre glue or primer.

9.11.2. Use a plastic straight edge trowel and cover the entire areas to maintain uniform height.

9.11.3. Apply the mortar in the same direction of the cable runs to minimize lateral movement.

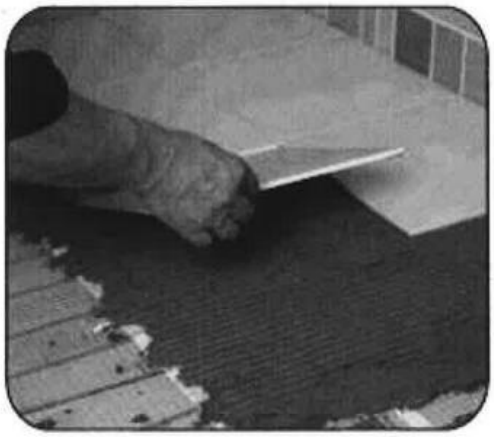
9.11.4. Allow it to cure before the tiles can be laid or other type of floor coverings applied, using thin-set mortar or self-leveling cement.

9.12 Completing the Installation

There are two recommended methods of covering the cable

Concrete or wood floors using Polymer modified thin-set mortar-skim coat.

Working with a width of about 2' at a time, apply polymer modified thin –set mortar on top of the cable so that it is completely covered, ensuring that there are no air pockets. This should be done using a plastic / rubber backed trowel or similar, taking care not to damage the cable. Once dry, another layer of thin-set mortar can then be applied carefully using a notched trowel to comb the thin-set mortar before laying the tiles.



Concrete and Wood floors using self – leveling cement :

An alternate method for all but the smallest installation is to cover the cable mat installation with suitable self-leveling cement. This product will find its own level and once dry will provide a suitable flat surface to apply a layer of thin –set mortar before laying the tiles.

Important :

1) The heating cable must NOT be cut or shortened and the joint between the cold lead wire (black) and the heating cable (Red) must not be bent or put under strain. Red heating cables should never cross or touch (2.6" gap min) and must be installed in the floor. To ensure no heating wire enters the wall, leave 3" of lead wire in the floor.
2) Always wear rubber soled shoes and do not walk on the cable mat until the cable is completely protected under a screed or layer of thin-set mortar.
3) A fully qualified electrician must now make the final connections to the main power supply and install the thermostat. The thermostat should be installed in the room to be heated .For bathrooms, the thermostat must be placed outside the shower at least 4 ft. Control of the heated floor in this application is provided by the floor sensor only.
4) Make sure to check that the heater is connected to the proper voltage supply – 120 Volt or 240 Volt.

Finally the electrician should check for continuity of the floor sensor and retest the resistance of the cable. The installation should be protected by a Class A GFCI for safe operation.

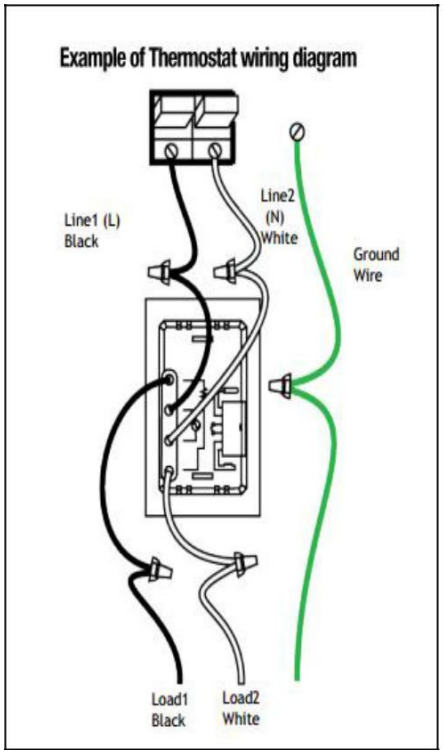
IMPORTANT TEST : TEST THE CABLE RESISTANCE, CABLE INSULATION AND FLOOR SENSOR RESISTANCE TO BE SURE NO DAMAGE OCCURRED. RECORD THE READINGS ON THE CABLE LABEL AND THE DATA LOG ON PAGE 10.

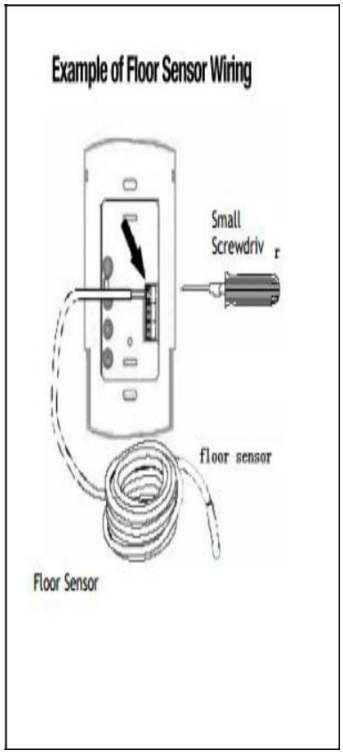
10.0 Install the thermostat

Before starting any wiring, verify that the power supply is turned off.

Follow the thermostat manufacturer's Instructions.

10.1 The thermostat built in relay typically has a rating of 16 amp (Check the manual supplied with the thermostat). If multiple mats are put in parallel on a single thermostat and the total current drawn exceeds 16 amp, then a contactor must be used for switching On / Off the power. The contactor current rating must be higher than the maximum current drawn.





10.2 Connect the power supply wire and the load side heating wires.

10.3 Connect the floor sensor wires to the thermostat. These are low voltage wires and should not enter the line voltage junction box. These low voltage wires typically run through the wall and connect into the face of the thermostat away from the line voltage wire.

11.0 Switching ON

Consult the thin-set mortar manufacturer's instructions to determine a suitable drying out period before turning on the system. Once the thin-set mortar has completely dried, operate the system at a reduced temperature, gradually increase it over a seven day period to full operation.

12.0 Trouble shooting

Should you experience any problems with your installation not warming your sub floor surface, please carry out the following test, before calling the floor heat system technical support team.

Symptom	Probable cause	Solution
Cable test resistance measurement is wrong	Meter is out of calibration or inaccurate	Try another meter
	Test measurement indicates open or short circuit	Cable is most likely damaged and must be replaced
	Measurement is slightly out of specified range	Room temperature can effect reading , retake the reading at room temperature around 70˚ F
	The ohm meter could be set to the wrong scale	The typical scale is 200 ohms, unless the cable label is rated for more than 200 ohm (Maximum 530 ohm)

Floor does not heat up	The cable is damaged	Measure the resistance. If it reads open or short then it must be repaired. Find the damage cable and have it repaired by a qualified installer using a factory repair kit.
	GFCI is tripped	Reset GFCI control on the thermostat or circuit breaker. If GFCI continues to trip, check circuit breaker and thermostat wiring.
	No voltage	Check circuit breaker, if it is on then test for voltage at the line side of thermostat.
	Thermostat is turned off	Refer to thermostat manual for operating instructions.
	Incorrect power supply	A 240V volt cable supplied with 120V power will not generate sufficient heat. Measure supply voltage with a volt meter.
	Multiple cable wired in series	Multiple cable must be in parallel
Floor heat does not turn off	Wring is incorrect .The control is bypassed.	Refer to the thermostat instruction for proper wiring.
	Defective thermostat or floor sensor	Replace thermostat and/or floor Sensor.
Control is not working properly	Check the proper power supply voltage ,check program ,check floor sensor, check for loose connection.	Refer to the thermostat instruction for proper wiring .Replace thermostat if found to be defective.
GFCI false trip	More than one GFCI on circuit.	Verify that there is only one GFCI on circuit.
	Electric motor or ballast is sharing the circuit.	The floor heat must be on a dedicated circuit, run a new circuit.

13.0 WARRANTY CERTIFICATE

Following installation, the Warranty certificate on the back of this installation guide should be **FULLY** completed, including a plan of mat lay out and position of the floor sensor. This could then be used for locating the cable mat in warranty claim situation. This booklet should be permanently fixed in or near the installation main power panel.

WARRANTY CERTIFICATE

10 Year Warranty

KLIMA

Electric Underfloor Heating Systems

This warranty is only valid under the following conditions :

- All electrical connections were carried out by a qualified and licensed electrician.
- The warranty covers faults in material for 10 years for KLIMA heating mats and cables from the date of purchase.
- The completed warranty and proof of purchase must be presented in connection with warranty claims.
- The KLIMA installation plan has been completed by the installer and the electrician.
- The warranty covers the repair / replacement of goods found to be faulty due to manufacturing defect and does not cover any secondary charges relating to the repair / replacement of any floor covering.
- The Radiant Electric Heat LLC warranty does not cover faults resulting from incorrect design or installation or damage caused by others.

Please complete this installation completion certificate and retain a copy to validate the warranty			
Owner's Name :			
Address :			
Room(s) Installed			
Mat			
Resistance (Ohms)			
Installer's Name :		Phone :	
Electrician's Name :		Phone :	
Electrician's License Number : :			
Signed by electrician :		Date Completion Tested	
This instruction manual must be left at the main power panel along with a copy of the thermostat operating instructions and the original sales receipt. The supplied stickers should be placed near the power panel and in the room installed with the underfloor heating.			