

# Nano Poly Carbon PTC Heater



# Our primary product lines are complete heating systems “ready to install”

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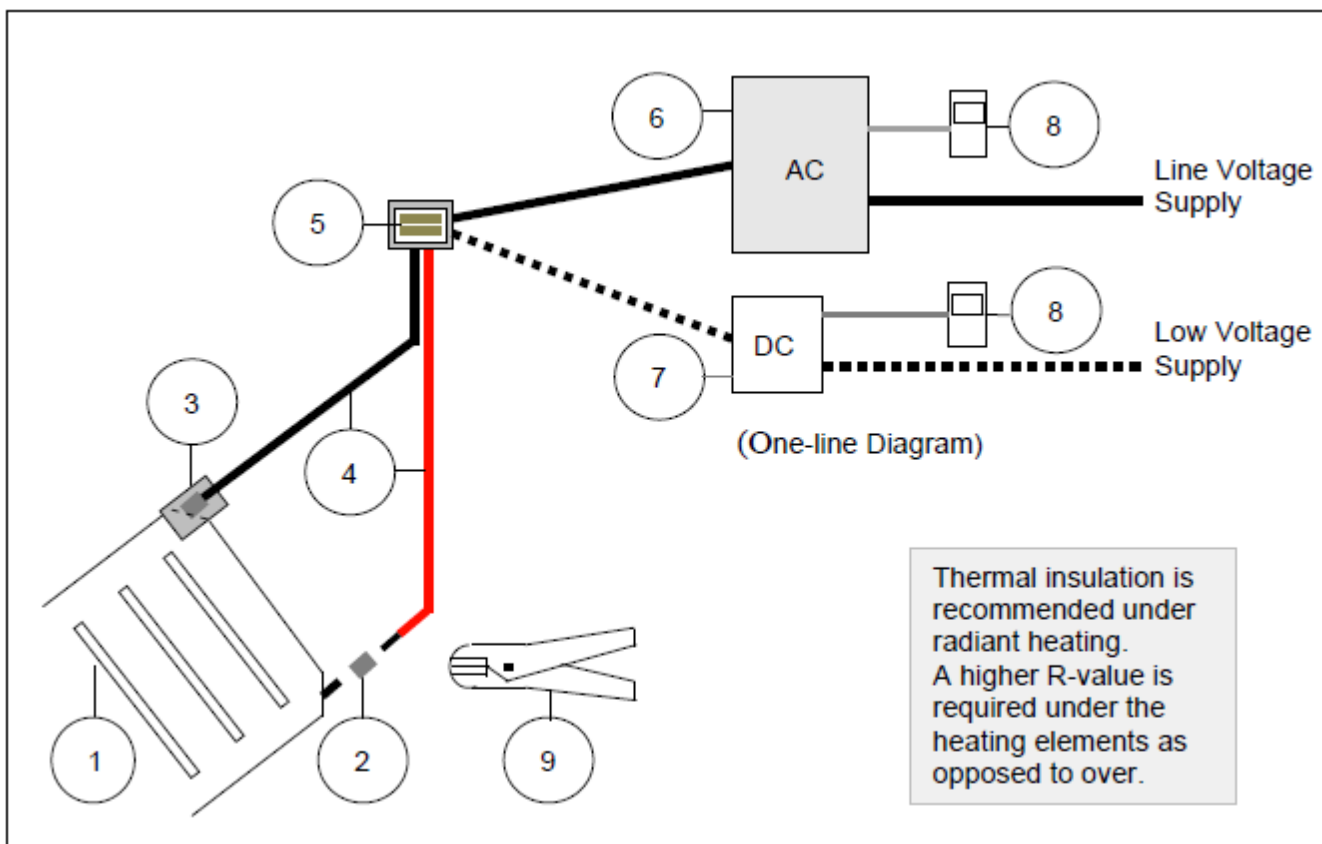


## List of components, accessories and tools

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# Parts and accessories for the STEP system



1. STEP Heating Element
2. STEP Connector
3. Sealant Tape
4. Stranded Tinned Copper Wire

5. Terminal Block (optional)
6. STEP Power Supply 24 VAC
7. STEP Controller 24 VDC
8. STEP Touch Thermostat
9. STEP Crimp Tool



# A STEP Warmfloor® heating systems consists of:

## Thermostat



- ✓ STEP® Touch – low-voltage thermostat
- ✓ Can be used in conjunction with all the EPI-LX-R power supply series and the STEP® DC Controller
- ✓ Interior or snowmelt with remote temperature control
- ✓ Displays ambient or floor temperature
- ✓ Precise temperature control
- ✓ Controls unlimited power supplies

## Power Supply



- ✓ High efficiency (96%) and silent
- ✓ SELV (Safe Extra Low Voltage)
- ✓ Primary and secondary circuit protection
- ✓ Extruded aluminum profile w/ heat sink
- ✓ RoHs compliant interface

### Models:

- ✓ EPI-LX-R-500W / -1000W / -1500W
  - ✓ Regulator board
  - ✓ 120, 208 or 230V AC primary, 24V secondary
- ✓ EPI-LX-250W / -500W
  - ✓ 120 or 230V AC primary, 24V secondary

## Heating Element



- ✓ STEP Warmfloor® – low voltage (24V AC or DC)
- ✓ Self-regulating PTC (Positive Temperature Coefficient ) Nano-carbon polymer
- ✓ Width: 3", 6", 9" or 12" (305 mm)
- ✓ Thickness 3/64" (1.2 mm)

### With different heat outputs:

- ✓ Interior applications – from 4.6 W/ft to 11 W/ft
- ✓ Exterior applications – from 13 W/ft to 80 W/ft



# Connect the elements using the recommended crimp tool, wires, connectors and tape

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## EXTENSION WIRE

- Extension wire for field wiring from power supply to elements
- #14, #12 or #10 AWG stranded tinned copper
- To differentiate polarities use two different wire colors



## CONNECTOR & TAPE

- Tinned copper crimp connectors
- Insulating electrical moisture sealant tape
- Always check that the connections are secure



## CRIMP TOOL

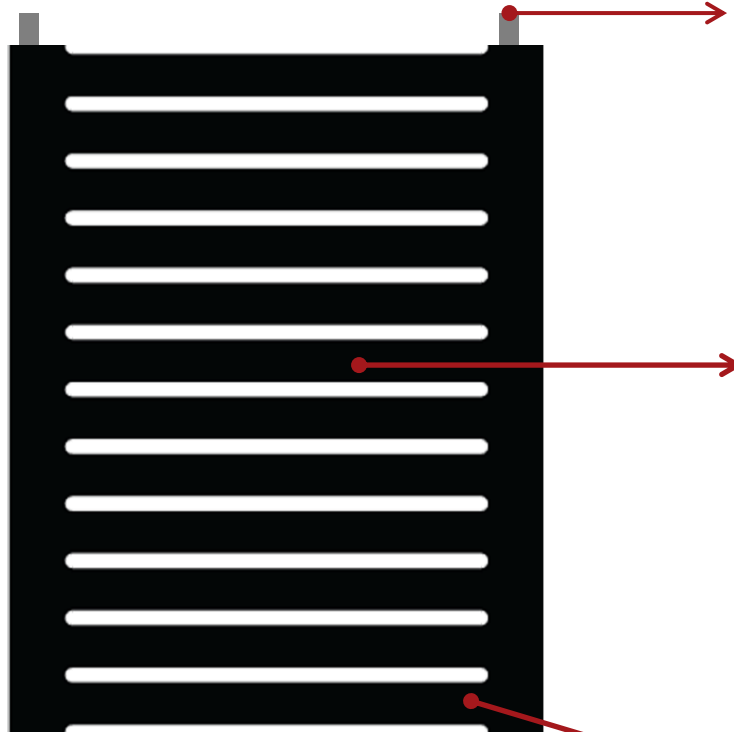
- TOOL-PRO ratchet crimp tool is required as it is specially designed to properly crimp the connections.
- Use to crimp the CON-DB connector to the extension wires.



## TERMINAL BLOCK

- Two-pole, power terminal block enclosed in extruded aluminum profile w/ heat sink.
- Set screw lug terminals sized for #14-#4 AWG wires

The PTC heater is a homogeneous, flat, thin, strong, flexible mat made of a unique polymer blend that heats when electricity passes through it



3", 6", 9", 12" wide element

#### **Two bus braids (24V)**

The heater has two or more conductors (flat bus braids) embedded along each side of the material and are only there to bring in the low-voltage current; they do not heat.

#### **Semi-conductive plastic**

The heat transfer is done through the polymer material (semi-conductive plastic). The polymer constitutive of the heater has in its composition molecular particles distributed in a homogeneous manner that when in contact with one another permits the passage of electrical current due to its semi-conductive configuration.

#### **Dielectric insulation**

The heating element is protected with a pair of layers of a chemical-resistant and a water-resistant insulation.

# The self-regulating heating elements are inherently safe

**As the electrical resistance increases less current can circulate and the emission of heat decreases**

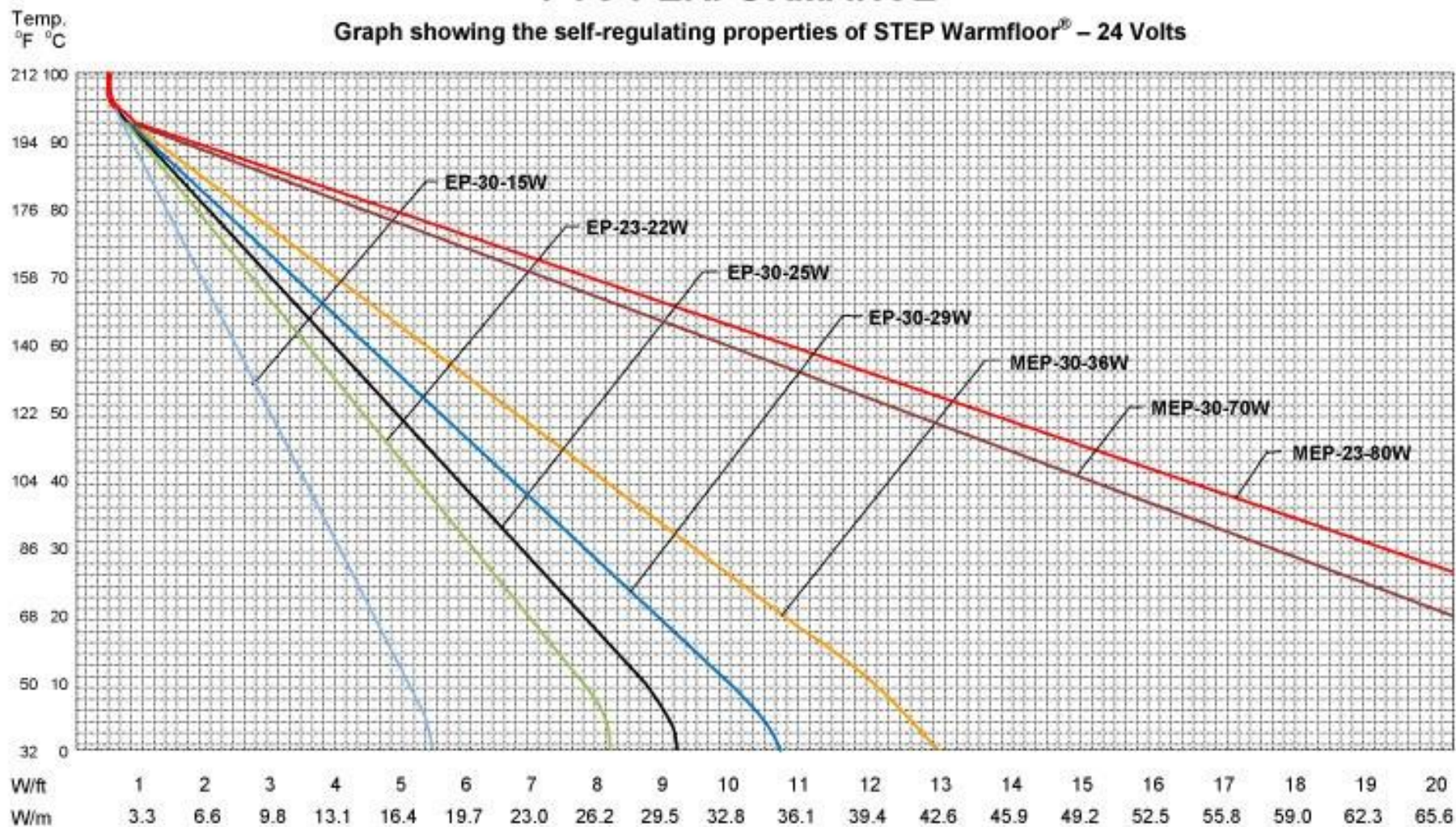
- The Nano-carbon polymer constitutive of the heating elements has in its composition molecular particles distributed in a homogeneous manner that when in contact with one another permits the passage of electrical current due to its semi-conductive configurations.
- When the ambient temperature increases, the morphology of the polymer structure changes and the particles separate reducing the points of contact between each other. As the electrical resistance increases less current can circulate and the emission of heat decreases.
- When the ambient temperature is cold, these particles are closer to one another permitting a greater passage of electrical current and thereby generating more calorific power

**The self-regulating property makes that the material cannot overheat.**



# PTC PERFORMANCE

Graph showing the self-regulating properties of STEP Warmfloor® – 24 Volts



Energy in watts at other voltages can be calculated from this chart:

$$\frac{W}{24^2} \times [\text{applied voltage}]^2$$

E.g.: 12 volts on Heating Element EP-30-2-24W at 86°F (30°C):

$$\frac{6}{24^2} \times 12^2 = 1.5 \text{ W/ft}$$

© STEP Warmfloor®

# PTC heater benefits:

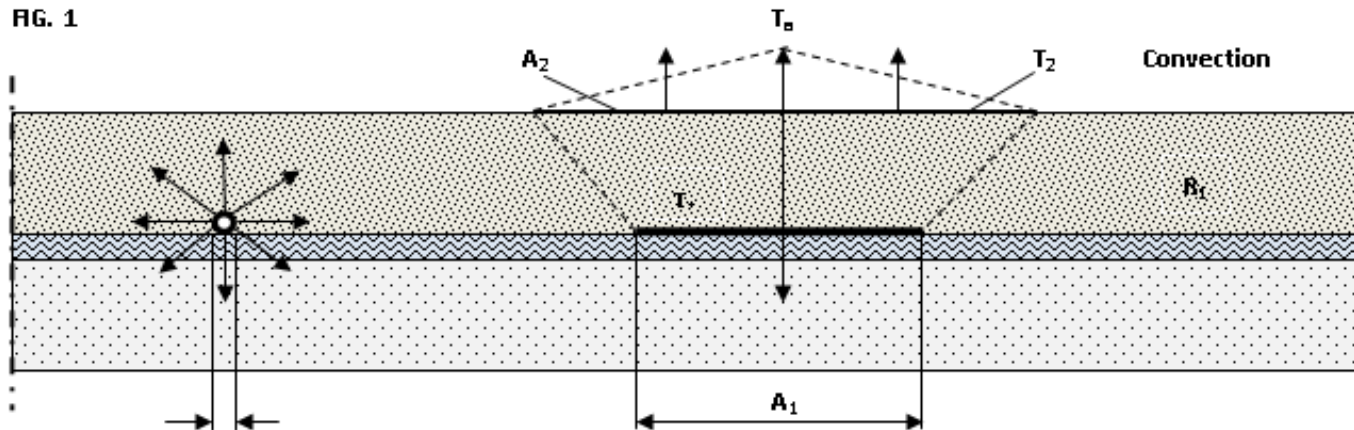
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## Because the PTC heater is self-regulating:

- ✓ It draws only the energy required to maintain the designed temperature.
- ✓ It reacts fast to external temperature changes.
- ✓ It can be placed closer to the surface than any other radiant floor heating.
- ✓ It can go under any type of non-conductive material, including wood.
- ✓ It cannot overheat, even under area rugs, heavy furniture, etc.
- ✓ It's method of continuous heating is more efficient than other cycled heating systems.

# The 12" wide flat heater gives an enormous energy efficiency advantage

Energy efficiency through heat distribution:



A typical total heating installation with the **STEP Warmfloor®** system requires:

**4.5 W/ft<sup>2</sup>**

To give the same heat output, an **Electric Cable** system would require:

**11.25 W/ft<sup>2</sup>**

$2 \text{ ft}^2 / 0.78 \text{ ft}^2 = \underline{2.5 \text{ times more wattage}}$ ; which would be  $4.5 \text{ W/ft}^2 \times 2.5 =$

While a **Water Tubing** system would require:

**9.36 W/ft<sup>2</sup>**

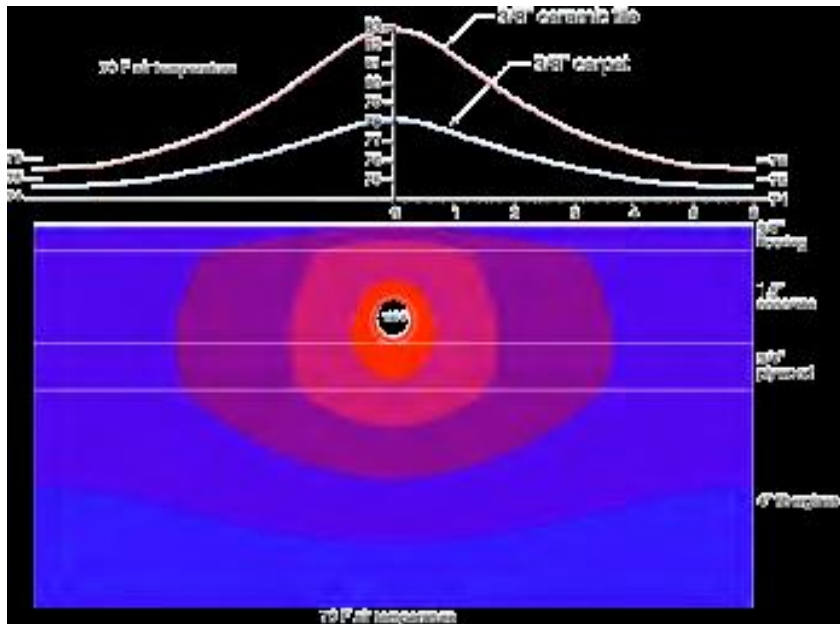
$2 \text{ ft}^2 / 0.96 \text{ ft}^2 = \underline{2.08 \text{ times more wattage}}$ ; which would be  $4.5 \text{ W/ft}^2 \times 2.08 =$

When installed, the 12" wide elements cover over 60% of the floor, thereby warming evenly the floor with a lower temperature. This provides an efficient and even heat distribution and minimizes power consumption.

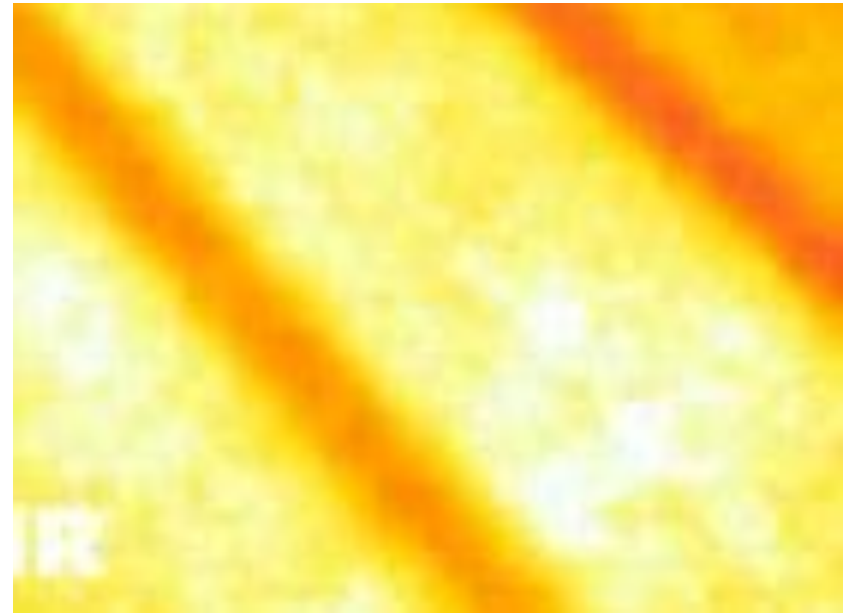
# The heat distribution with electric cable or water tubing differs substantially from a flat heater

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Electric cable or water tubing



STEP Warmfloor®





# The heating element runs at a low temperature and can be installed directly under the floor covering

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- STEP Warmfloor® low voltage system can be placed safely closer to the floor surface than any other heating system:
  - With less mass to heat, the system reacts fast to its regulated temperature. This eliminates the disadvantage of a large thermo-bed heating the house when the ambient temperature does not require additional heat.
- STEP Warmfloor® flat radiant heating element runs at a low and even temperature over a larger surface.
  - With a reduced operating temperature there is less heat loss to the ground. E.g.. A water tubing system would require a higher temperature (120°F) compared to STEP Warmfloor® (84°F) increasing the temperature loss to the ground from 5W to 10W.



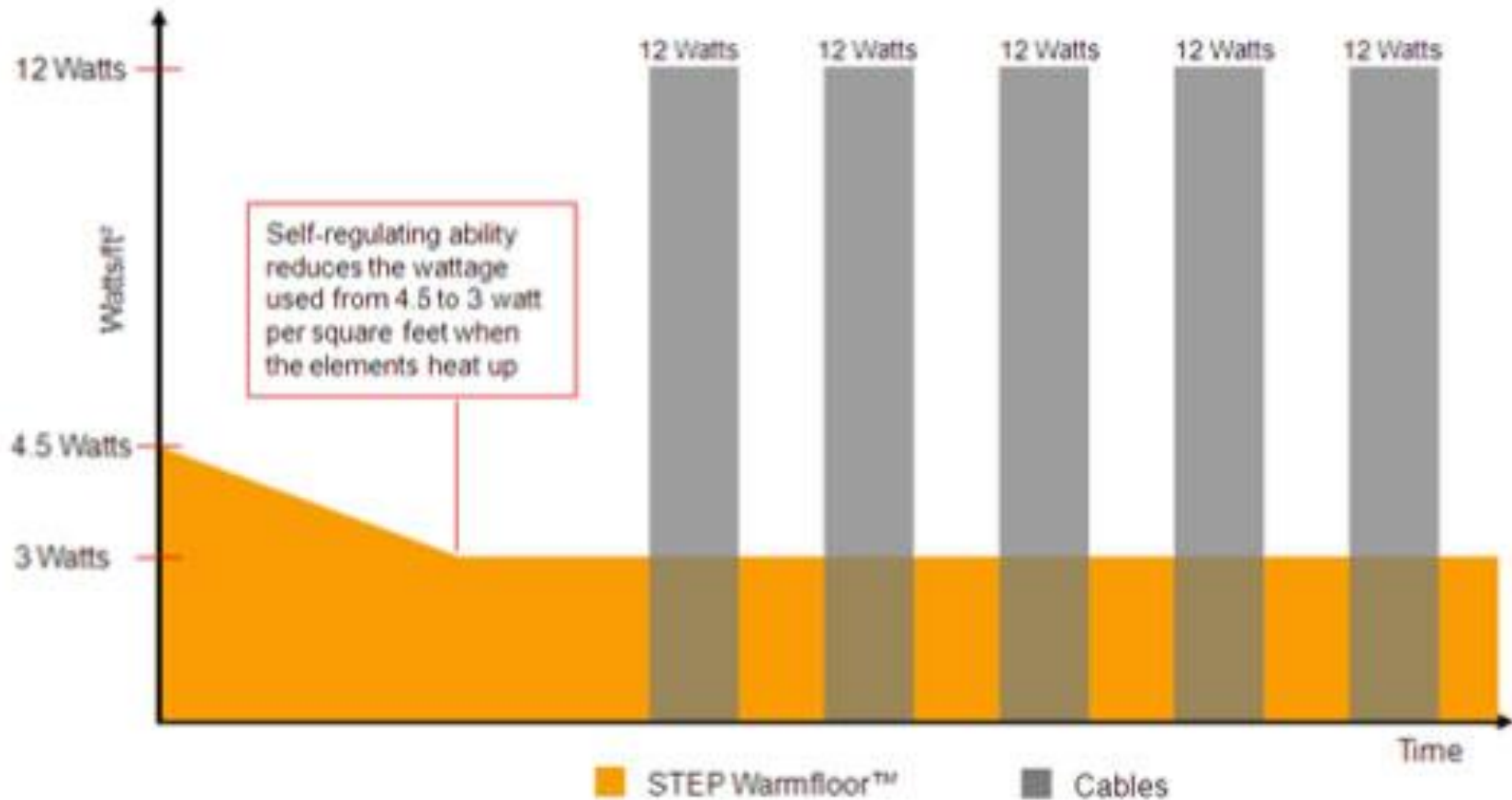
# The heating element acts like a floor sensor

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- The STEP Warmfloor® self-regulating element acts as a floor sensor over the whole surface, supplying more wattage when cold and less wattage as they warm up.
  - The element cannot overheat. As the electrical resistance increases the current flow is proportionally restricted.
- STEP Warmfloor® heating element uses only the energy necessary to maintain an even temperature.
  - Maintaining a continuous even temperature is more efficient than an on-and-off heating system. Depending on the thermal insulation and the floor covering, the floor surface temperature with the residential elements will not raise above 78-82°F, which is more than sufficient to heat most rooms.

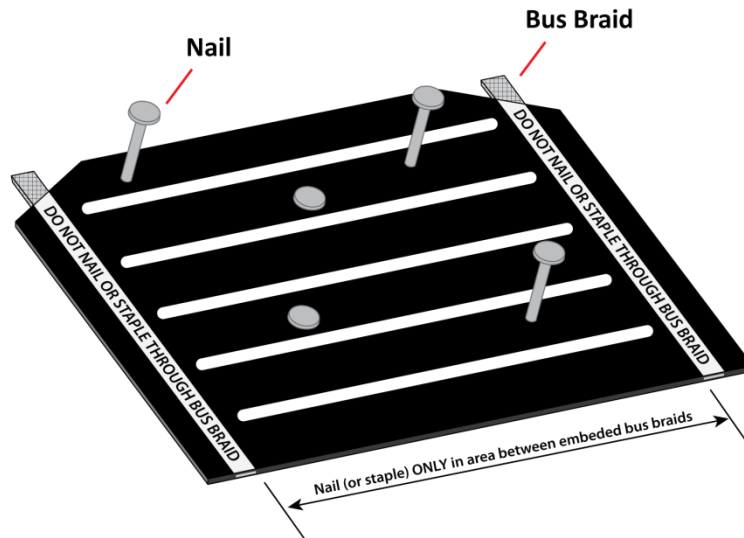


# Maintaining a continuous even temperature is more efficient than an on/off heating system



# The low voltage semi-conductor can be penetrated and is the safest electric heating solution available

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A nail or staple penetrated in the plastic material will have no adverse consequence to the heating properties. Note: the bus braids should not be penetrated.



As a safety extra-low voltage product it is ideally suited for bathrooms and other wet environments. Because it is mainly polymer, it is unaffected by moisture.

# STEP Warmfloor® energy efficient radiant heating elements are made of recyclable non-hazardous materials

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- STEP Warmfloor® is made of recyclable non-hazardous materials and the product complies with LEED®, LEED® for Homes and NAHB standards and as such, may earn credits that contribute to a project's certification under a green building rating systems. Polyethylene does not produce hazardous gases and is biodegradable in sunlight.
- Under the LEED® (Leadership in Energy and Environmental Design) green building program, STEP Warmfloor® may contribute to earning credits in the following categories:
  - Energy and Atmosphere
  - Indoor Air Quality
  - Materials and Resources
  - Innovative and Design Process

# The PTC heater runs on 24 Volt AC or DC

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- The PTC heater can run on either AC or DC current.
- The heater is normally connected to a SELV (safety extra-low voltage) isolating transformer.
- The heater can be connected directly to solar or wind power, as it can take dump load.
- The heater can run on a generator or batteries.



# The STEP® Power Supply is specifically made to be used in conjunction with STEP Warmfloor®



## Rating of the STEP® Power Supply

- The transformers are SELV
- The primary voltage is 120, 208 or 230 VAC, 50/60 Hz.
- The secondary voltage is normally 24V, but the system is approved for 30V or less.
- The transformer has circuit breakers on the primary and on the secondary.
- Each secondary circuit is rated not to exceed 25 amperes, having a maximum out put of 500 VA.

# STEP® Touch Thermostat EPI-LX-TC & Sensor EPI-LX-TS

- The STEP® Touch thermostat can be used in conjunction with all the EPI-LX-R power supply series
- The low-voltage (24V) thermostat can control up to 20 power supplies or 20 DC controllers
- The EPI-LX-TC thermostat has four settings:
  - Pos.1 (°C) or °F                      ► displays Celsius or Fahrenheit
  - Pos.2 or DIM                           ► display is lit or dimmed
  - Pos.3 or EXT                           ► displays the ambient or floor temperature using sensor EPI-LX-TS
  - Pos.3 or SM                           ► interior or snowmelt with remote external sensor EPI-LX-TS
- The thermostat is operated by two touch buttons only; up or down to add or reduce heat, or press both buttons simultaneously to switch the system on or off.



Customer feedback has shown that operating a STEP Warmfloor® system with an EPI-LX-R power supply and STEP thermostat, the temperature is steadily held by a margin of less than 1°F.

# Benefits of the STEP® Power Supply and STEP® Touch Thermostat

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- ✓ Highest quality and energy efficiency
- ✓ Trusted, refined, and perfected regulation technology
- ✓ Provides a pulsed output that complements the self-regulating nature of the heating elements
- ✓ “Soft” switching of toroidal transformers, which inherently have very high startup inrush currents
- ✓ Unlimited EPI-LX-R power supplies can be switched on from one controller, with a delay of 1.5 seconds between each power supply to avoid a massive, combined startup draw
- ✓ Together maximizes the efficiency of the STEP Warmfloor® system
- ✓ 10 years warranty for the coils and 3 years for the electronics



# Step Warmfloor® can be used for primary or complimentary heating and floor warming

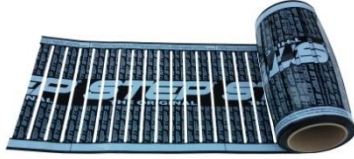

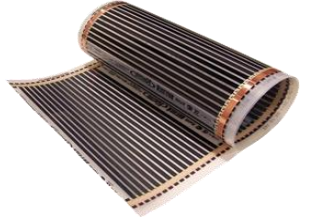
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- For primary heating a heat loss calculation is required. Information needed includes, measurements of the area and thermal insulation values of floor, walls, windows and ceiling This can be done per room or for the whole house.
- As a complementary heat source it will provide a gentle and even underfloor heating experience in addition to the existing heating system or it can help warm areas that need extra heat.
- Floor warming systems take the chill out of your cold floors, but are not designed to be the primary heat source. Typically, a radiant floor warming system is installed in a bathroom, underneath tiles in the kitchen, hallways or any other area where you want the comfort of underfloor radiant heating.

STEP Warmfloor® provides services for project specific heat loss calculations.



# STEP Warmfloor® excels in many areas compared to other electric floor heating systems

<p>Comparison Chart</p> <p>PTC Nano Poly Carbon Elements vs. Resistance Electric Cables vs. Carbon Ink Dispersion Films</p>	 <p>Low-voltage PTC Nano Poly Carbon Heating Elements</p>	 <p>Resistance Electric Heating Cables</p>	 <p>Carbon Ink Dispersion Thin Films</p>
Product Description	PTC (Positive Temperature Coefficient) heating elements made of <b>homogeneous conductive polymer</b>	Single or dual <b>resistance heating cables</b> on a spool or embedded in a mat or mesh	Overall coating or strip type <b>printed carbon black</b> laminated with a PET film
Product Type	<b>Self-regulating</b> - as the ambient temperature increases, the electrical resistance increases and the consumption decreases	<b>Constant wattage</b> - provides the same power output regardless of the temperature of their surroundings	<b>Constant wattage</b> - provides the same power output regardless of the temperature of their surroundings
Watts consumed per square foot	More efficient as it only uses the energy necessary to <b>maintain</b> the temperature	<b>On / Off</b> cycling requires more energy	<b>On / Off</b> cycling requires more energy
Safety	An <b>extra low-voltage</b> , AC / DC, system is safe and does not require grounding	A <b>line voltage</b> system has to be grounded and requires a GFCI	A <b>line voltage</b> system has to be grounded and requires a GFCI
Heat Distribution	Warming evenly the floor <b>on a larger surface</b> with a <b>lower temperature</b> provides the ideal comfort and is more efficient	Heating cables cover a <b>small surface</b> and need <b>more power</b> and <b>more mass</b> to be able to distribute the heat evenly	Films heat a <b>large area</b> but at a <b>higher temperature</b> because they are not self-regulating



## Example: Snow free installation



# Thermal bed concept uses a vertical insulation construction method

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- The thermal bed concept relies on maintaining a frost-free area under the protected surface to allow the earth's stored energy to provide the bulk heat required for the snow or ice event.
- A vertical and wing configuration allows placement of insulation that will reduce frost penetration and reduce excavating and backfilling.

