

Installation of floor heating film for ceramic tiles, granite and other stone or composite flooring

Read through this entire manual before starting installation.

- All electrical connections must be made by a licensed electrician in accordance with national and local codes and standards
- Always join multiple heating film lines in parallel ONLY (never in series)
- Always make sure to check the heating film before, during, and after installation of the floor covering
- Each thermostat requires a dedicated circuit at the breaker box
- Must not be installed in damp or wet areas as defined by the National Electrical Code
- Do not fold or wrinkle the heating film, walk on it unnecessarily, or drop heavy or sharp objects on it
- Never overlap the heating film
- Do not install electrical wires or pipes in the floor with the film
- Be sure underlayment contains no cellulose
- Install film only when room temperature is above freezing
- Leave a 6-inch space between film and fireplaces, chimneys, or hot water pipes
- Never use any type of insulation material on top of the heating film
- Do not install the heating mats directly over a foil backed insulation material
- When installing carpet a low tog underlay should be installed followed by a good quality hessian backed carpet

The list of necessary materials before starting the installation of floor heating:

1. Infrared heating film standard width of 19 3/4" (50 cm) for 120V and 11 7/8 (30cm), 31 1/2" (80 cm), 39 3/4" (1m) for 220V power supply;
2. Electrical wire. US standard:
 - A. 12AWG, Stranded, THHN (to make connections from thermostat to heating film);
 - B. 12-2 NM cable (to make connection from thermostat to breaker);
 - For Europe and other countries: recommended parameters of conductors: Copper - section - not less than 1.5 mm²;
3. Clamp Connectors and Mastic insulator;
4. Floor Insulation material. Using a heat insulator with a metallic coating is not recommended;
5. Plastic film thickness of not less than 0.1 mm, to use as vapor barrier (Blue Hawk 10-ft x 25-ft x 4-mil Clear Consumer Sheeting);
6. Plastic mesh with sections of 3/8" X 3/8" (1x1 cm) (Tenax 3 ft. x 25 ft. Black Poultry Hex Fence);
7. Screws;
8. Scotch-tape;
9. Thermostat with temperature sensor

List of required tools before starting the installation of floor heating:

1. Screwdriver;
2. Pliers;
3. Scissors;
4. Knife assembly;
5. Wire cutters;
6. Hammer;
7. Punch;
8. Drill Bit (6 X 120) etc.

Before Installation:

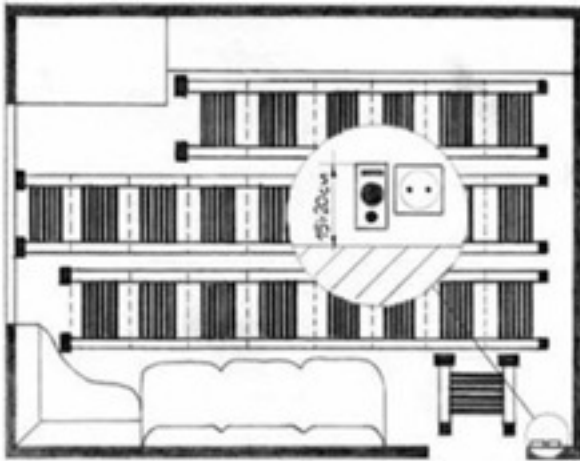
- Make sure floor is free of dirt, stones, debris and water and has a smooth surface;

- For thermo- and vapor barrier is used conventional materials;
- If sufficiently thick material is used for insulation (for example: polystyrene) to layer on top of the heating film you need to apply a cement layer. Laying ceramic tiles need to be addressed after the curing of the cement layer;
- Laying heating film is recommended by the length of the room, thus avoiding unnecessary joints. The joints should be placed above the wall (the most optimal location - near or under the skirting);
- Cut the film is only on specially designated places. It is prohibited to cut the film in any other areas. The length of one section of the film is 9 5/6" (25 cm);

Step by step instructions for the installation

1. Layout of electric underfloor heating systems

Sketch a plan showing how the film will be installed. In drawing up a plan, should take into account that the organization of the main floor heating is necessary to cover at list 70% of the usable space. Do not install film under built-in cabinets, stationary design elements, appliances, in small closets (walk-ins are okay), or under other structures that do not have air circulation space under them. To arrange comfortable heating it must be covered for at least 40% of the surface aria.



Leave a space and padding around the perimeter of the room size from 4"-8"(10 to 20 cm) spacing between the strips of film - not more than 3 1/2" (9 cm) and no less than 1" (2,5 cm)

Not allowed: overlapping film on a film

When planning the placement, should take into account that the heating film is cut into sections at designated places specially designed for cutting. The length of a single section is 9 7/8" (24.85 cm).

2. Calculations capacity of the heating system, as well as the definition of the required number of thermostats and electrical power capabilities

The maximum power consumption of infrared heating film is 220W +-10% = 242 W/m². Given this fact and the amount of space covered by heating film, electrical

$$I=P/U,$$

current can be calculated by the following formula:

Where: I - Current;

P - Required heating capacity;

U - Voltage.

The amount of current required for selection of appropriate gauge wiring, and to select the thermostat model.

Consider this calculation on a specific example. For example, the room allocated for installation of floor heating has a total area of 200 sq ft (18.6 sq m), the type of heating - basic flooring - laminate. Excluding the area cluttered with furniture and other design elements, a useful area or the area of the film coating will be 150 sq ft (13.9 sq m).

Heating Film 120V uses 20.5W and 0.2 Amp per sq ft

220V uses 20.5 W and 0.1 Amp per sq ft.

| 120V System | 220V System |
|---|--|
| 75 sq ft x 0.2 Amp = 15 Amp | 150 sq ft x 0.1 Amp = 15 Amp |
| $P = I \times U = 15 \text{ Amp} \times 120\text{V} = 1800 \text{ W} = 1.8 \text{ kW}$ | $P = I \times U = 15 \text{ Amp} \times 220\text{V} = 3300 \text{ W} = 3.3 \text{ kW}$ |
| For the thermostat selection it should be guided by the following data: 15 Amp, 1.8 kW = 75 sq ft (6.95 sq m); 27 Amp, 3 kW = 125 sq ft (11.6 sq m) | 15 Amp, 3.6 kW = 150 sq ft (13.9 sq m); 27 Amp, 6 kW = 250 sq ft (23.2 sq m) |

If the area of the floor heating is larger than presented above, it would be necessary to use more powerful thermostat or use contactor and seek help from qualified professionals.

3. Select location of the thermostat, the point of connection to the electrical outlet and temperature sensor.

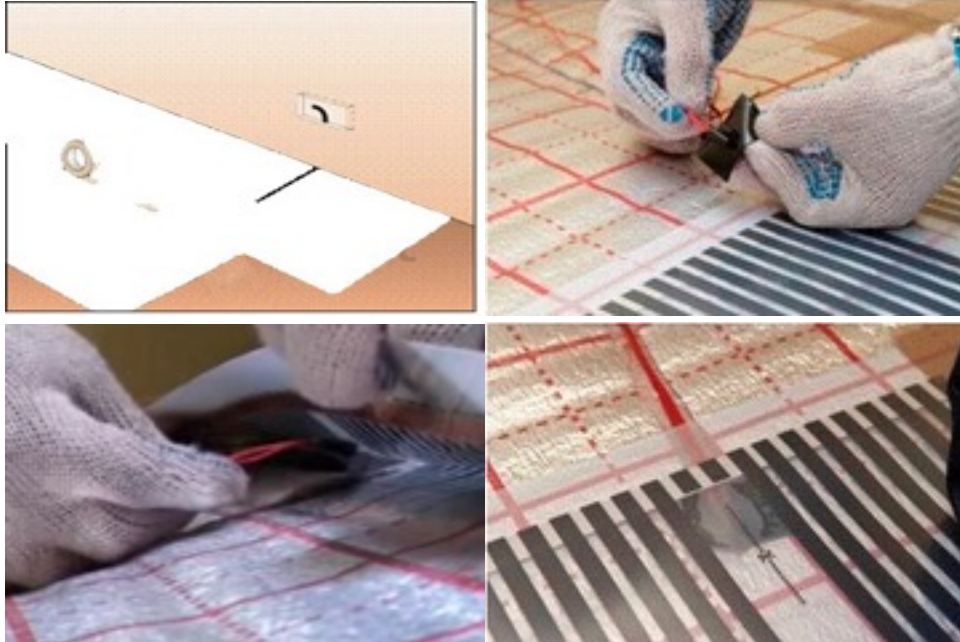
Thermostat location can be set at any convenient position for the user on the wall. It should take into account that the most optimal and recommended place is at a height of 3' – 4' (100-120 cm) from the floor and close to electrical outlet. The connection is made via a fixed connection or hidden connection using the same cable. Consider the presence of other devices connected to this outlet. Installation wires and sensors for a more aesthetic look to be hidden in a wall or close to special decorative boxes. If the power system is more than 3 kW, it is recommended that you connect through a separate circuit breaker.

4. Prepare the floor (planning, cleaning). Spread out the Plastic film “vapor barrier” on the floor and thermal insulator (you can use a vapor barrier film with reinforced glass fiber, film with a heat reflecting surface or a solid insulator).
5. Remove shoes and work in stocking feet when installing film. Be careful not to drop objects on the film. Roll out the film with the bright copper strips facing down. Start at one side of the room rolling out the underfloor heating film from the non-connection end of each line (end with no connection tails), ideally towards the wall the underfloor heating thermostat is located.
6. Cut out the heating film according to the scheme planned and put on the prepared surface, secure with adhesive tape. Each heating film line can be held in place by using a suitable adhesion tape such as duct tape along the ends and side of the film. Between heating film’s strips must be a space of 1”-3 1/2” (2.5-9 cm) for further reinforcement.



7. Underfloor Heating Thermostat Floor Sensor Installation

Install the underfloor heating thermostat floor sensor supplied with the under floor heating thermostat. Cut a small channel into the underfloor insulation layer to allow the thermostat floor sensor/probe to be laid into, so that the sensor and its wires are below the level of the pad. Run the wire from the sensor to the thermostat and tape it to the pad and the floor. The channel should be located under one of the underfloor heating film. Position the floor sensor under the heating film clear area, not under black carbon heating strips.



8. Connecting the heating film strips to the thermostat and electrical connections are made only in a parallel manner.

A. Strip the insulation from one end of a 12 gauge stranded THHN wire. If the wire is double insulated—be sure to strip both layers of insulation.



B. Insert the barrel of the connector into the crimping tool so that the “W” of the tool presses on the split side of the barrel. The tool will not release until there is sufficient pressure on the crimp. After crimping, test the wires to be sure they are tight in the connector. If only one wire is to be crimped in the connector, strip 1/2 inch of insulation and double the wire over into a “U” shape before crimping. If two wires are to be crimped together, strip 1/4 inch of insulation from each wire and insert them into the connector together. After crimping, test the wires to

be sure they are tight in the connector.

C. Place the connector over the copper strip on a corner of the film and crimp it so that the teeth on the connector bite into the copper strip.



9. The contact points, clamp connectors and free ends of the film insulated by an insulation tape.
 - D. Cut 2-inch-wide mastic insulating tape into 2-inch squares. Apply a square of tape to both the top and bottom side of each wire connection and press them together firmly to form a tight seal.

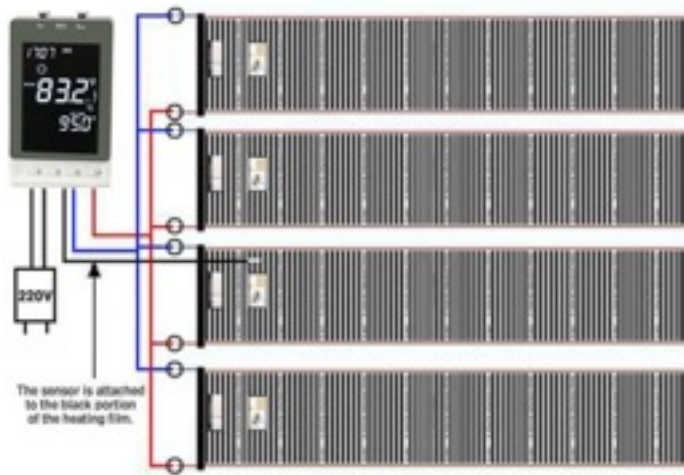


- B. In the same way, use the mastic tape to cover all of the bare ends of each copper strip that do not have wire connections.

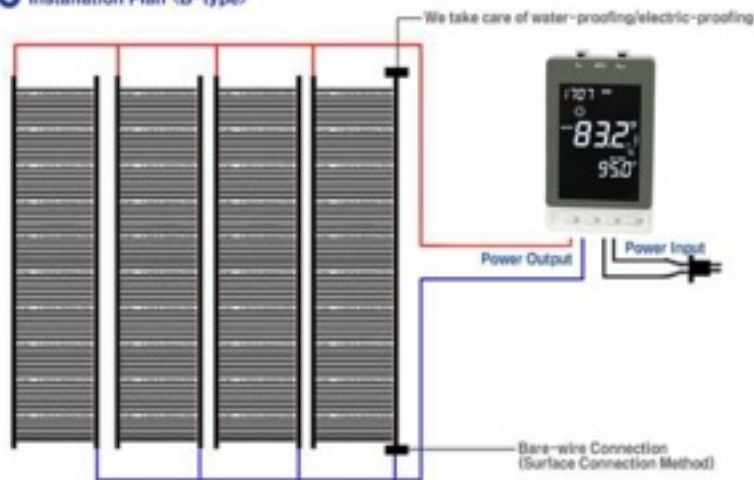


10. Once the underfloor heating mats have been laid and fixed in place over the floor the connection tails should be run back to the underfloor heating thermostat or junction box location. The diagram below shows the two ways underfloor heating mats can be connected back to the underfloor heating thermostat. (Underfloor heating mats must always be connected in parallel never in series).

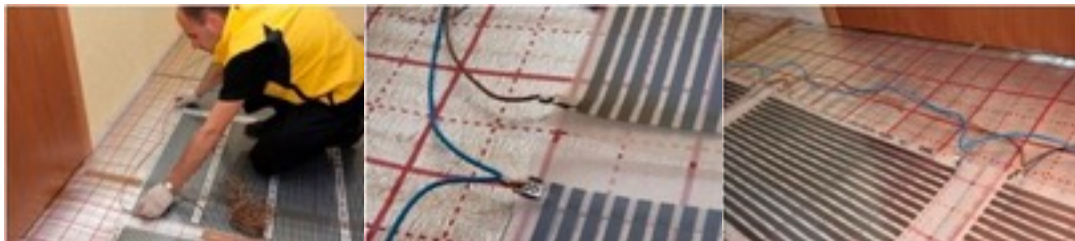
Installation Plan (A-type)



Installation Plan (B-type)



11. The cold ends can be laid in grooves cut in to the insulation for convenience and ease of fitting, the cold ends should not cross under or over the heating film. It is advisable to label and identify the individual cold tails to the heating film for ease of wiring (the heating film do not have a polarity).





12. The connection ends and cold tails can be pressed into the underfloor insulation by scoring the underfloor insulation and firmly pressing the tails / ends into the scored underfloor insulation. It is advisable to tape over the connection tails and cold ends to keep the underfloor heating mats held in place during the installation of your wood / laminate floor.



13. Infrared heating film is covered by plastic vapor barrier with elements overlapping by 40" (100 mm). If necessary the vapor barrier can be taped around the edges to hold it in place.



14. The next step is overlapping plastic mesh by 20" – 28" (50-70 mm) and overlap vapor barrier by 20" – 28" (50-70 mm)

Customers from USA and Canada instead of having a plastic mesh and self-leveling mortar or cement, can use 1/4" HardieBacker cement board and install tile on top.



15. In the space left 1"-3 1/2" (2.5-9 cm) between the heating film strips, drill right through the layers of plastic vapor barrier and thermal insulation and plastic mesh. Drill holes every 6"-8" (15-20 cm) then drive screws into the holes securing plastic mesh and providing reinforcement of tile adhesive to the concrete subfloor.

Caution:

- Use extreme caution when drilling. Do not damage the surface of the heating film;
- Before drilling make sure to verify the absence of any obstruction under the floor surface (pipes, wires) to avoid their damage.



16. After installation of heating film, isolation of all the contacts and connecting thermostat. It is necessary to carry out the verification step. First, carefully visually inspect all joints for exposed contacts and any damage done during installation. Second, make a trial run of the system for 15-20 minutes. To check the operation.

17. Recommended to the entire surface of the heated floor to apply a self-leveling mortar or cement not less than 3/8" (8 mm) on top of the plastic mesh.



18. The final stage of installation is laying flooring (tile, ceramic, etc.). Tile glue has to be applied not less than 3/8" (8 mm).

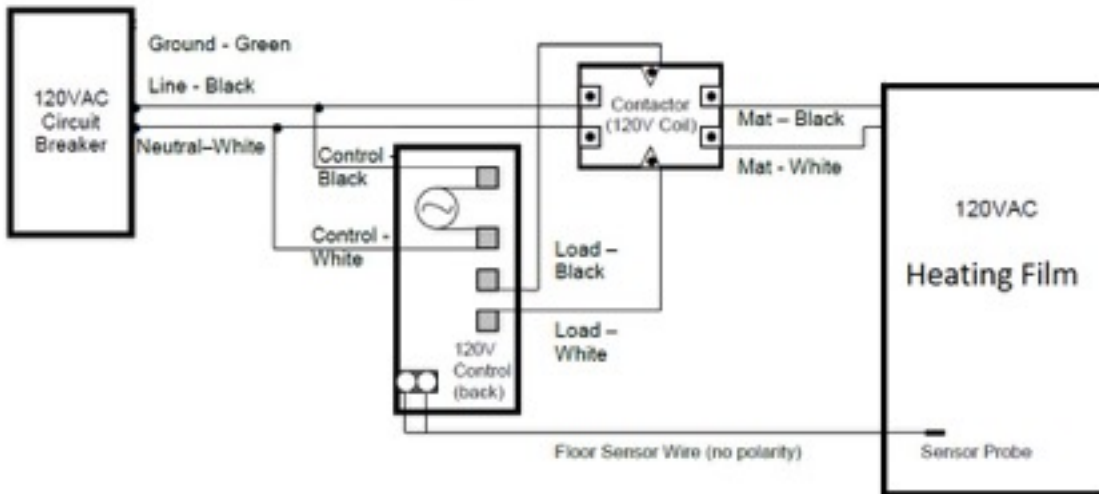
- You cannot include underfloor heating system until complete hardening of cement layer or tile adhesive. To allow the adhesives to setup properly, give it a minimum of 28 days before operating your new heated floor;
- In case of water spill or leakage, you cannot run a heating system until its complete dry.

19. Installing a Relay (Contactor)

Depending on the Amperage requirements of multiple Heating Film lines (If the circuit allows for more Amperes than the thermostat), a contactor / relay may be required. Heating Film 120V uses 21W and 0.2Amp per sq ft, 220V uses 21W and 0.1Amp per sq ft Consult with an electrician to determine the type and size of contactor / relay required.

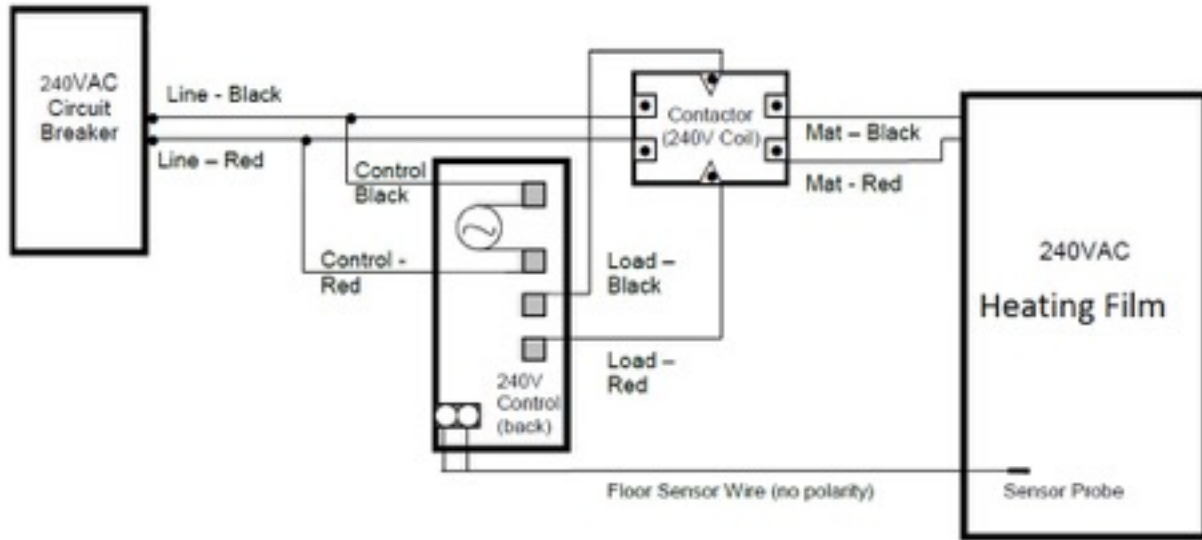
The total Amp load of the Heating Film Lines must not exceed the thermostat's 15 Amp limit or the Amperage rating of the circuit or other control switch without using an appropriately rated contactor / relay - see (120V contactor circuit) or (240V contactor circuit).

Typical Electrical Wiring Diagram w/contactor & thermostat control (120V)



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, Part IX of the NEC, ANSI/NFPA 70 and Section 62 of CEC Part I.

Typical Electrical Wiring Diagram w/contactor & thermostat control (240V)



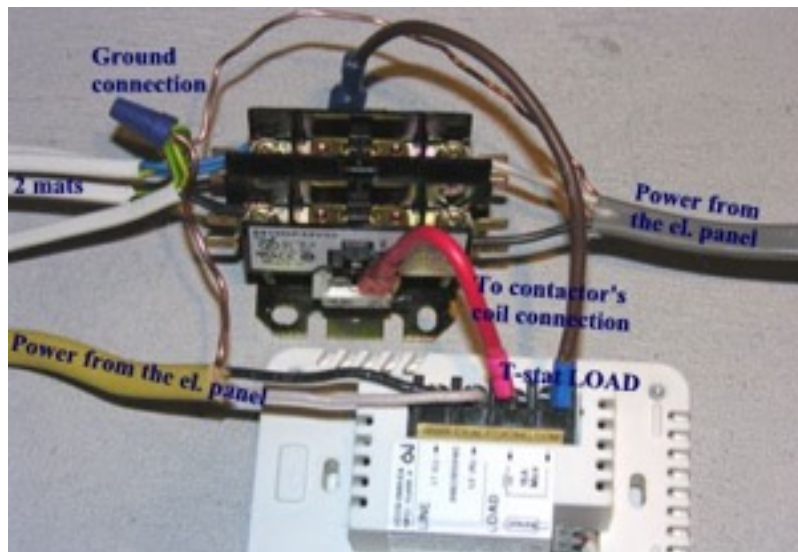
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A contactor or relay is an electrical device that takes a control signal usually 12 volts DC, or 24, 120, 208-230 volts AC and creates a magnetic field to pull in a set of contacts that controls another device that may or may not get its electrical power from the same circuit.

Contactor is like a switch in the OFF position. When appropriate voltage is applied to the contactor's coil terminals, 'the switch turns itself ON' making the connection between the power supply and the heating system.

In his case the coil voltage is applied by the thermostat calling for the heat.

Contactor is meant to take the load of the control device - a thermostat in this case. Please note how the contacts of the thermostat (where normally the floor heating would be hooked up), are connected to the coil of the contactor and the contactor is handling the connection between the power source (GRAY wire) and the load of the floor heating mats (4 white cords) in this case.



Two parameters of the definite purpose contactors are important:

- Max. Amperage.
- Coil Voltage.

If the thermostat voltage is 120V then the contactor's **coil voltage** HAS TO BE 120V, but the mat(s) can be 240V BUT CONNECTED BY WAY OF A CONTACTOR TO 240V power source. The same can be said about 120V when connected to 120V power - but again - by way of the contactor.

- Contactor's coil voltage has to agree with the device 'driving it', the thermostat in this case.
- Heating Film Lines voltage has to agree with the voltage of the power source regardless of the contactor's coil voltage. Heating Film Lines TOTAL AMPERAGE has to be smaller than the one of the contactor AND THE AMPERAGE OF THE POWER SUPPLY.

Please Note: nothing should be subjected to operation under full load for long periods of time even if allowable by specs.

This said, if the thermostat max. load is 18A, and if the real load from floor heating is 16A or more: USE THE CONTACTOR! Definite purpose contactors are inexpensive and not difficult to connect.

It is normal for the contactor to wear out over time like brake pads on a car. If the contactor shows any signs of wear it should be replaced as a preventative measure or as part of maintenance. The electrical box housing the contactor should be closed. First, because of the safety - there is line voltage present there and also because you can have problems with spiders building nests in the contactor; the silk is an insulator and will prevent electricity from flowing!

Contactor Samples:

110-120V:

1. 20 AMP 120 VAC Double 2-Pole Definite Purpose Contactor HVAC Packard C220B
Use this contractor with up to 100q ft 120V heating film

2. 30 AMP 120 VAC Double 2-Pole Definite Purpose Contactor HVAC Packard C230B
Use this contractor with up to 150q ft 120V heating film and 10 gauge electrical wire:
10AWG, Stranded, THHN, 30Amp.

220-240V:

1. 20 AMP 208 / 240 VAC Double 2-Pole Definite Purpose Contactor HVAC Packard C220C . Use this contractor with up to 100q ft 120V heating film

2. 30 AMP 208 / 240 VAC Double 2-Pole Definite Purpose Contactor HVAC Packard C230C . Use this contractor with up to 150q ft 120V heating film and 10 gauge electrical wire: 10AWG, Stranded, THHN, 30Amp.

