



STEP[®] Marine Deicing Installation Manual



STEP Deicing[™] System

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STEP® MARINE DEICING SYSTEM

STEP® Marine Deicing is a heating solution to prevent snow buildup and ice damming on deck, bulkhead, stairs and walls. The deck deicing is for the safety of crew and the wall deicing is for the stability of the ship.

STEP® Marine Deicing™ systems are custom designed for each individual application and consist of thin, flexible heating elements that operate on extra-low voltage (AC or DC). These lightweight heating elements are strong and durable and last the lifetime of the ship. The heating elements can be cut to any length and formed to fit the structure under decks and walls.

STEP® Deicing™ heating elements are powered by an extra-low voltage (24 V) EPI-LX-R power supply. The heating elements can be cut to size on site and are available in different widths. The elements are protected by a chemically, inherently inert and dielectric insulation. This liner protects against physical damage and aggressive materials and allows heating elements to be installed in the framework under deck or on the inside of an exterior wall.

STEP® Marine Deicing heating elements are made of a homogeneous, semi-conductive polymer, which by nature are self-regulating. This self-regulating, positive temperature coefficient (PTC), technology allows them to heat with maximum power in cold environments and use less electricity as their temperature increases. This minimizes power consumption and reduces operating costs by as much as 60% compared to conventional electric cable systems.

BENEFITS

- STEP® Marine Deicing is a flat, flexible and thin heating element.
- The heating element can be cut to length and can be bent 90 degrees to fit any contour.
- The element can be stapled/nailed to a non-conductive surface without affecting the conductivity (just avoid penetrating the two conductors on each side).
- The element is strong and has no failure rate during installation.
- STEP® Marine Deicing heating elements have the ability to self-regulate - as the material gets warmer, less electricity passes through it and a positive temperature is maintained with less consumption.
- The element covers a large area with a low temperature and thereby reduces expansion and contraction.

INSTALLATION GUIDELINES

IMPORTANT INSTALLATION GUIDELINES

- Choose qualified personnel who are familiar with the STEP® Marine deicing system.
- This is an electric heating system and requires trained personnel in the National Electrical Code that understands the importance of preventing mistakes that can cause an electrical fire.
- The installation shall be made in accordance with local codes, ordinances, trade practices, and manufacturers' instructions.
- Make sure that all materials used are approved for the specific application and have no adverse compatibility with the heating elements.
- Use only components recommended by the manufacturer.
- Read and follow the installation instructions to assure having the best satisfaction for a reliable and energy efficient deicing system.

CAUTION

- STEP® Marine Deicing elements should not touch, cross or overlap at any point.
- Do not energize rolled up heating elements.
- Make sure to note the locations of the conductors on each side of the heating element to avoid fastening through them. Penetrating through the element is okay, provided the fasteners do not go through the conductors.
- An electrical inspection may be required before, during, and/or after installation of the STEP® Marine Deicing system. Consult your local electrical and/or boat builder authorities for more information.
- These instructions have been prepared for use with standard NEC electrical codes. Consult an appropriate electrical professional.

These installation instructions assume that the STEP® Marine Deicing system to be installed has been designed by Electro Plastics, Inc. or by the shipyard engineering office. and is being installed according to the proposed Design Specifications, Terms & Conditions of Sale and Limited Warranty provided with the STEP® Marine Deicing quotation.

If you need a copy of your Design Specifications, call Electro Plastics, Inc. at 877-783-7832 or the STEP® Marine Deicing distributor that originally provided the quotation. To obtain a quotation, contact Electro Plastics, Inc. or an authorized distributor by visiting www.warmfloor.com.

BEFORE STARTING

DESIGN AND CALCULATIONS

- The installation shall be calculated and a layout made to determine the materials required.
- The more specific the layout the easier will be the installation. Indicate for each area:
 - Exact measurements of the areas(s) to be heated.
 - Placement and number of strips of elements.
 - Length and wattage per element strip.
 - Location of power source, including control and power supply(s).
 - Size of power supply and load distribution on the interface board.
 - Wire size and length according to load and distance to the power source.
 - If required, location of electrical box and terminal block(s).

SUPPLIED PARTS



STEP® Heating Element 24V

MEP-30-36W / MEP-30-70W
MEP-23-36W / MEP-23-80W
MEP-7-30W



STEP® Power Supply 24V

EPI-LX-R-500 120-230V
EPI-LX-R-1000 120-230V
EPI-LX-R-1500 120-230V



STEP® Connector Kit

C&T-10 Tinned copper connectors and Sealant Tape
(10 each for 5 element strips)



Extension Wire

TCu12-xxx-B/-W Tinned copper
TCu10-xxx-B/-R Tinned copper
(B=black; W=white; R=red
Length: xxx=100,150,250,500ft)

STEP® Heat Retention Membrane

HT-0.085"
Roll 6' wide x 450' = 2700 sqft.

BEFORE STARTING

OPTIONAL COMPONENTS

- Two-sided Tape – PET-TAPE
- Terminal Block - T-BLOCK
- Control

REQUIRED TOOLS

- STEP[®] Crimp Tool
- Utility knife or scissors
- Wire stripper
- Screw driver
- Multi-meter (clamp meter preferred)

DESIGN AND CALCULATION

ELEMENT TYPE AND WATTAGE

ELEMENT DATA at 24 VOLTS @ 32°F					INSTALLATION DATA
Element Type		Ohms	Linear	Density	Max. Length @ 450W feet
Width	Model	/ft.	W/ft.	W/sqft.	
12"	MEP-30-36W	44	13	13.0	34
12"	MEP-30-70W	24	24	24.0	19
9"	MEP-23-36W	44	13	17.3	34
9'	MEP-23-80W	21	27	36.0	16
3"	MEP-7-30W	53	11	43.2	40

ELEMENT LENGTH AND WATTAGE PER POWER SUPPLY

The EPI-LX and EPI-LX-R power supply series consist of one to three 500 watts circuits.

Designed wattage is 90% or 450 watts.

- 1) Do not exceed the maximum length @ 450W for the selected element in table "Element type and wattage"
- 2) Combine element strips from the layout to optimize distribution for each 450 watt circuit in the power supply.

POWER SUPPLY	DIMENSIONS			PRIMARY CIRCUIT BREAKER		SECONDARY CIRCUIT BREAKER
	Height (inch)	Width (inch)	Depth (inch)	120 VAC	230 VAC	24 VAC
EPI-LX-500	10.75	6.25	3.5	10A	5A	1 x 25A
EPI-LX-R-500	14.0	6.25	3.5	10A	5A	1 x 25A
EPI-LX-R-1000	22.0	6.25	3.5	15A	10A	2 x 25A
EPI-LX-R-1500	28.0	6.25	3.5	20A	15A	3 x 25A

DESIGN AND CALCULATION

WIRE GAUGE AND TERMINAL BLOCK USAGE

Minimize voltage drop by planning the wire runs as short as possible. Use larger wire gauge for more power output.

Refer to the following chart for maximum secondary wire length, both wires included, per circuit in feet.

Power Watts	Wire Gauge and Wire Length (ft.)					
	14 AWG	12 AWG	10 AWG	8 AWG	6 AWG	4 AWG
60 VA	40	63	100	159	252	401
90 VA	27	42	67	106	168	268
120 VA	20	32	50	80	126	201
150 VA	16	26	40	64	101	161
180 VA	14	21	34	53	84	134
210 VA	12	18	29	46	72	115
240 VA	10	16	25	40	63	101
270 VA	9	14	23	36	56	90
300 VA	8	13	20	32	51	81
330 VA	8	12	19	29	46	73
360 VA	7	11	17	27	42	67
390 VA	7	10	16	25	39	62
420 VA	6	9	15	23	36	58
450 VA	6	9	14	22	34	54

To simplify distribution to the elements use a terminal block when you have multiple elements.

Keep each terminal block to maximum 450W and then calculate the appropriate wire size used to run to the power supply.

Refer to Wire Gauge and Length Calculator on www.warmfloor.com.

ELECTRICAL GUIDELINES

ELECTRIC RADIANT HEATING EQUIPMENT OPERATING AT 30 VOLTS OR LESS

General

- 1. Scope.** This installation instruction covers electric equipment and associated components operating at 30 volts or less for indoor and outdoor use. For the purpose of this manual heating equipment shall include heating elements, unit heaters and power supplies.

- 2. Definition.**
Heating Systems Operating at 24 Volts. A complete heating system consisting of components such as low-voltage isolating power supplies and heating elements, including associated components that are all identified for the use. The output circuits of the power supply are rated for not more than 25 amperes and operate at 30 volts or less under all load conditions (SELV – Safety Extra Low Voltage).

- 3. Listing Required.** Heating systems operating at 24 volts shall comply with (A) and (B).
 - (A) **Listed System.** Heating systems operating at 30 volts or less shall be listed as a complete system. The heating elements, power supply and fittings shall be listed for the use as part of the same identified heating system.

 - (B) **Assembly of Listed Parts.** The listed system and approved system components shall be installed in accordance with the manufacturer’s instructions.

- 4. Specific Location Requirements.**
Floors, Walls, Ceilings and Decks.
 - (A) Extension wires (non-heating leads) from the heating elements can be routed on the subfloor to the wall provided they do not cross one another in the floor.

 - (B) Conductors extended through a wall, ceiling or roof shall be in accordance with NEC Chapter 3. Wires shall be run in conduits through building structure.

- 5. Secondary Circuits.**
 - (A) **Grounding.** Secondary circuits shall not be grounded.

 - (B) **Isolation.** The secondary circuit shall be insulated from the branch circuit by an isolating transformer.

ELECTRICAL GUIDELINES

6. Provisions.

- (A) **Electric Radiant Heating Panels and Heating Panel Sets.** Installation shall be made in accordance with NEC 424.90 through 424.99 with the following exceptions on 424.93 (B) (3) and 424.99 (C) (5) described in (a) and (b) respectively:
- a. **PTC Polymer Heating Panel Sets.** Nailing or stapling of PTC polymer heating panel sets shall be done through the polymer material but at least 6mm (1/4 Inch) from the bus conductors. Nails, staples or other fasteners shall not penetrate the current-carrying bus conductors.
 - b. **Fault Protection.** A device to open all ungrounded conductors supplying the heating panel sets, provided by the manufacturer shall function when short circuit occurs, such as a result of penetration of both bus conductors and extension wires with a metal device.
- (B) **Fixed Exterior Electric Deicing and Snow-Melting Equipment.** Installation shall be made in accordance with NEC Article 426 with the exceptions of grounding and ground-fault protection requirements described under 426.22, 426.27 and 426.28. Secondary circuit shall not be grounded according to 5 (A).

INSTALLATION

1. PLAN

- Design system, and make a layout.
- The STEP® Marine Deicing heating elements have to be imbedded between two layers of STEP® Heat Retention Membrane.
- Installation should conform to local codes, ordinances, and trade practices.

2. INSTALL

- Roll the heating element out, and cut to length according to layout.
- The elements are adhered to the STEP® Heat Retention Membrane with the recommended double sided tape or adhesive.

3. CONNECT

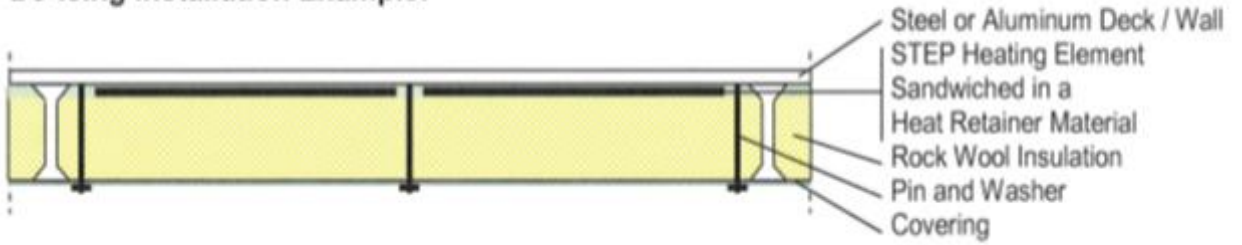
- Connect extension wires to the heating element according to the drawing and electrical diagram. If fail safe wiring is required, see how it is done in the diagram "Fail Safe Wiring".
- Determine wire gauge versus load and length of wire from the element to the power supply. If the distance is longer than 15 feet, connect the extension wires to a terminal block and then route to the power supply using higher gauge wires as shown in the sample wiring diagram.
- Route the wires in a conduit. Connect wires in parallel to the 24 volt power supply. Use only stranded tinned copper wires, and do not twist wire ends when connecting to the interface board in the power supply.
- Distribute the load evenly; the maximum load per circuit is 450 watts or 34 feet (10 m) of heating element (MEP-30-36W-24V).
- The power supply must be installed in a well-ventilated area and wired in accordance with the National Electrical Code.
- Connect the line voltage to a two-pole on/off switch. Use stranded wires from the switch to the power supply.
- The heating elements must be measured and the amp draw noted by a certified electrician before being covered. The warning label must be placed in the service panel and the caution label on the electrical box, or on the low-voltage power supply.
- To be efficient, the heating elements have to be in direct contact with the material to be heated.
- When using pins to hold the heating pads, mark the location of the heating elements to avoid damaging the bus braids.

NOTE: Avoid overlap or contact between heating elements. **DO NOT puncture the bus braids.**

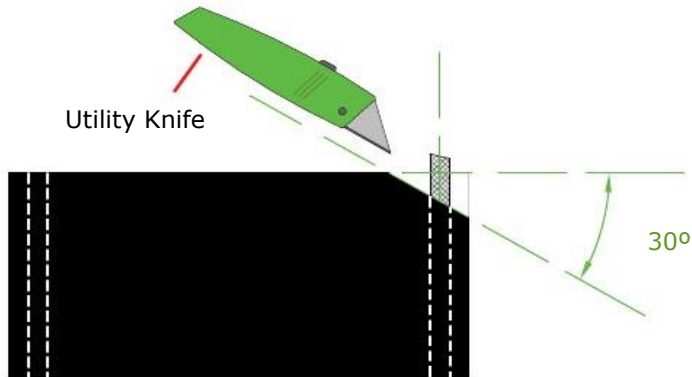
These installation guidelines are general in nature. Specific project information is provided by the distributor.

INSTALLATION

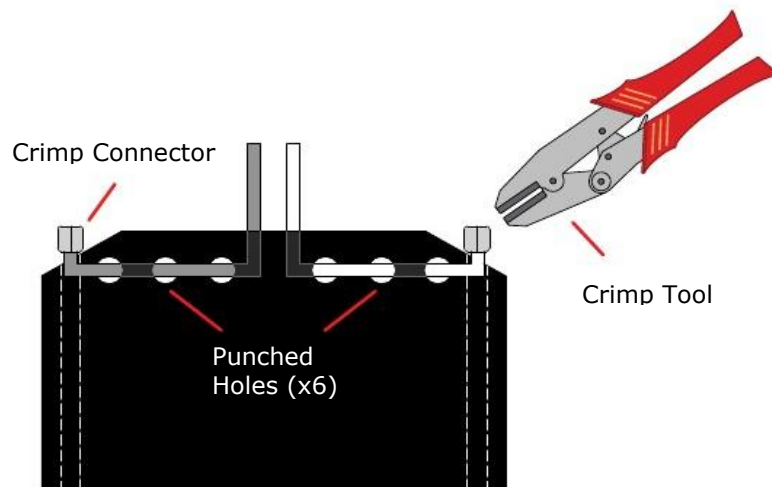
De-icing Installation Example:



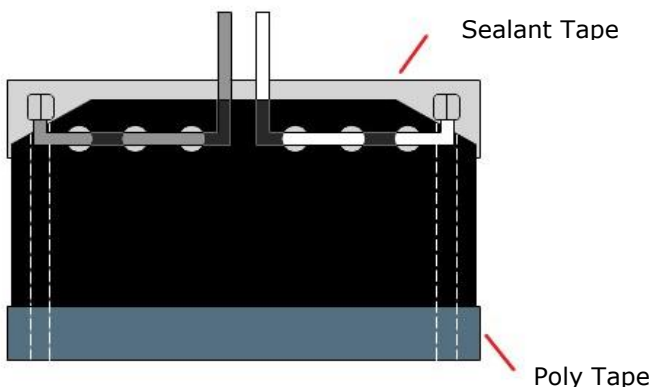
CONNECTING EXTENTION WIRES



• **Expose the bus braid** by making an angled score in the plastic, front and back, and along the bus braid above the angled score with a utility knife. Bend the element where the cuts are made and pull off the corners to remove the surplus of plastic. **Make sure that the bus braid is not cut or damaged.** Should this occur, re-cut the element and re-strip the bus braid. Repeat on the other side.

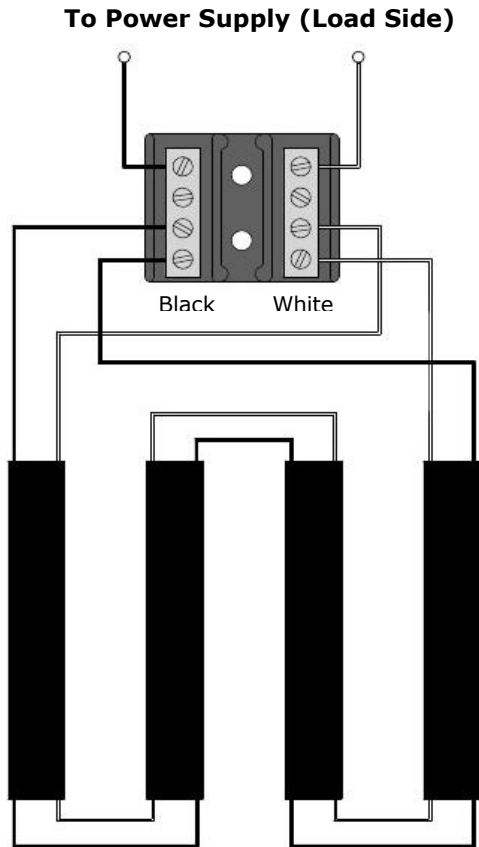


• **Make a strain relief connection** by punching three holes with a hand drill or punch tool. Weave a stranded tinned copper extension wire in the holes. Strip the wire end, and join the wire with the bus braid in the STEP[®] tinned copper crimp connector. Crimp the joint using the recommended crimp tool. Using components not recommended by the manufacturer will void the warranty.

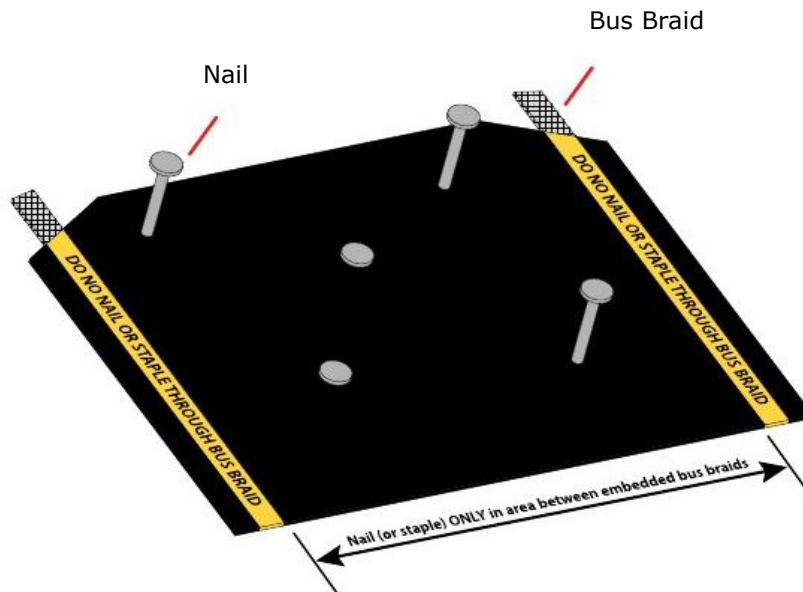


• **Seal all connections** by using the recommended sealant tape on the connector side of the element. Cut two pieces of tape slightly longer than the width of the element. Enclose the wire joints and strain relief connections with the two pieces of tape and firmly press the pieces together while overlapping the element to form a flat and smooth splice. Use the recommended weather resistant poly-tape to cover the opposite end of the element.

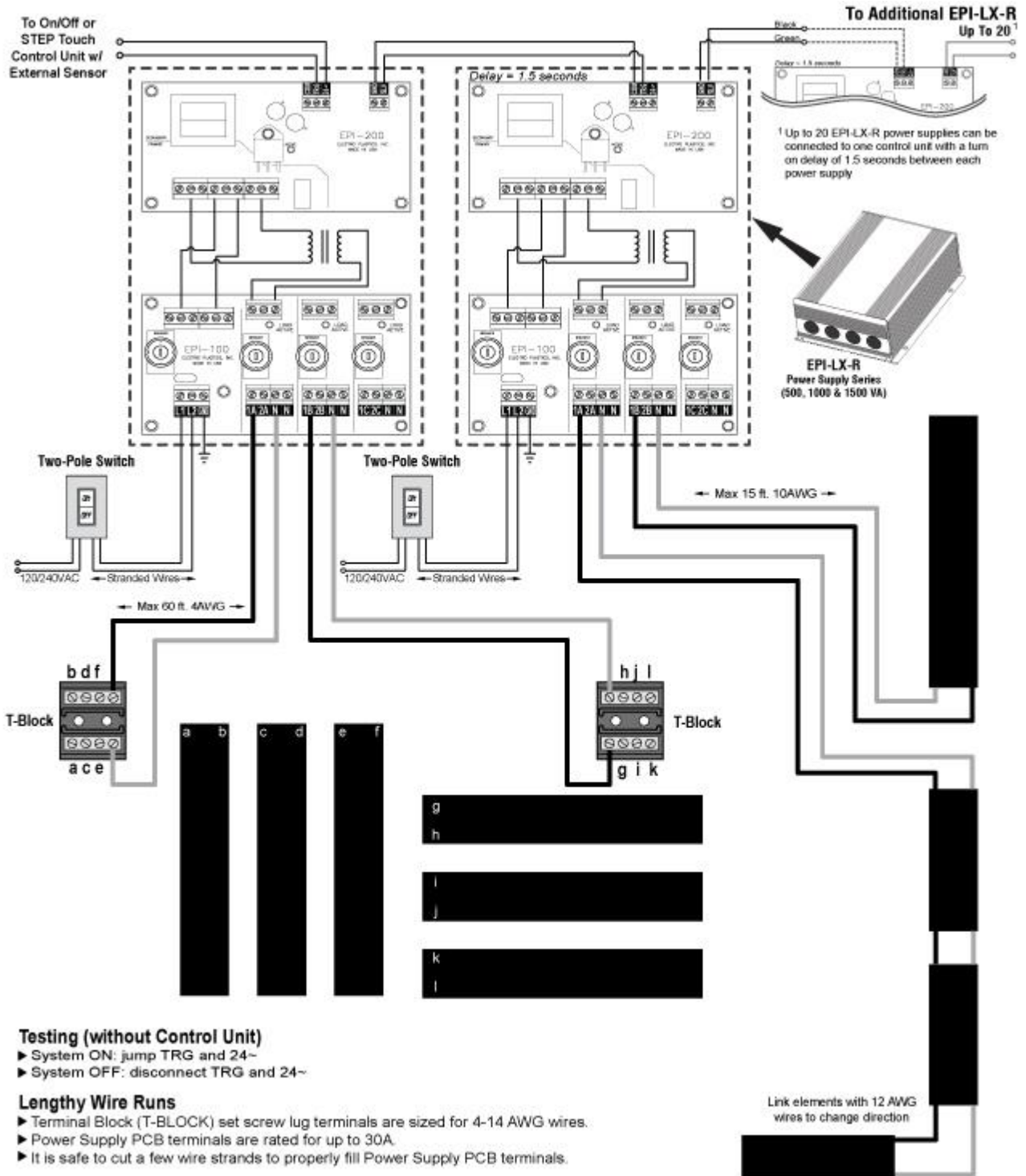
FAIL SAFE WIRING



- The Fail Safe Wiring method is used whenever there may be a risk of damaging the bus braids located on each side of the heating elements. Also, supplying electricity from both ends reduces voltage drop.



MARINE DEICING WIRING DIAGRAM



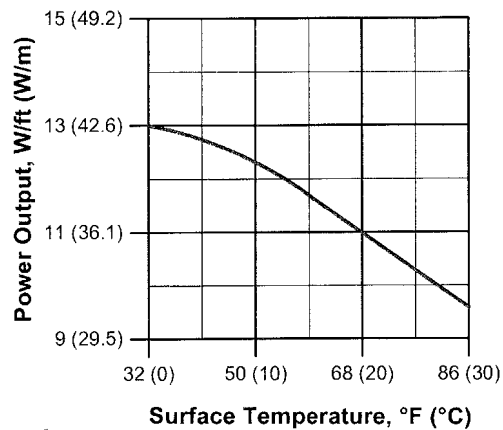
MEP-30-36W & 70W / MEP-23-36W & 80W / MEP-7-30W

PRODUCT SPECIFICATIONS

Heating element type	Positive Temperature Coefficient (PTC) semi-conductive polymer
Dimensions	Width: MEP-30-36W & 70W-24V: 12" (30 cm) MEP-23-36W & 80W-24V: 9" (23 cm) MEP-7-30W-24V : 3" (7 cm) Thickness: 3/64" (1.2 mm) Length: cut to order Weight: 0.21 lb./ft. (0.3 kg/m)
Output wattages	(11, 13, 24 or 27) W/ft. or (36, 42.6, 78.7 or 88.5) W/m 13 W/ft. (42.6 W/m) @ 32°F (0°C) – see power output curve Watt density: MEP-30-36W-24V: 13.0 W/ft ² (140 W/m ²) @ 32°F (0°C) MEP-30-70W-24V: 24.0 W/ft ² (258 W/m ²) @ 32°F (0°C) MEP-23-36W-24V: 17.3 W/ft ² (186 W/m ²) @ 32°F (0°C) MEP-23-80W-24V: 36.0 W/ft ² (387 W/m ²) @ 32°F (0°C) MEP-7-30W-24V : 43.2 W/ft ² (464 W/m ²) @ 32°F (0°C)
Supply voltage	24V AC or DC
Bus braid	15 AWG tinned copper flat braid
Dielectric liner	Thermally bonded to heating element
Minimum bending radius	0.20" (5mm) @ 32°F (0°C)
Maximum exposure temperature	176°F (80°C)
Chemical Compatibility	The MEP element is resistant to most chemicals and adhesives.

POWER OUTPUT CURVE

MEP-30-36W-24V / MEP-23-36W-24V



MEP-30-36W & 70W / MEP-23-36W & 80W / MEP-7-30W

ELECTRICAL DATA

	MEP-30-36W	MEP-30-70W	MEP-23-36W	MEP-23-80W	MEP-7-30W
Amperage draw with 24V @ 32°F (0°C)	0.54 A/ft.	1.0 A/ft.	0.54 A/ft.	1.12 A/ft.	0.45 A/ft.
Nominal resistance @ 32°F (0°C)	44 Ω/ft.	24 Ω/ft.	44 Ω/ft.	21 Ω/ft.	53 Ω/ft.
Maximum continuous element length	34 ft.	19 ft.	34 ft.	16 ft.	40 ft.

Extension wire lengths:

Heater element length:	4 ft. (1.2m)	8 ft. (2.4m)	12 ft. (3.7m)	16 ft. (4.9m)	24 ft. (7.3m)	34 ft. (10.4m)
Max. extension wire length:						
12 AWG 4 mm ²	85 ft. (31m)	42 ft. (15m)	28 ft. (10m)	21 ft. (7m)	14 ft. (5m)	10 ft. (3m)
Max. extension wire length:						
10 AWG 6 mm ²	125 ft. (47m)	67 ft. (23m)	45 ft. (15m)	33 ft. (11m)	22 ft. (7m)	15 ft. (5m)

APPROVALS AND CERTIFICATIONS



UL 1693 3rd Edition
UL 5085-1 & 2
CSA-C22.2 No. 66.1 & 2-06



EN 60355-2-96-2009
EN 61558-2-2:2007



WARRANTY REGISTRATION AND COVERAGE

LIMITED WARRANTY:

Electro Plastics' limited warranty is valid from date of original purchase, as follows (not included in this warranty are OEM and specialty products):

- 20 years for the STEP Warmfloor® Heating Elements.
- 10 years for the STEP® Marine Deicing Heating Elements.
- 10 years for the STEP® Transformer Coils in the Power Supplies.
- 2 years for the Interface Electronics in the Power Supplies.
- 2 years for the STEP® Controls

Electro Plastics sole obligation under its warranty shall be, at its option, to either issue a credit for the purchase price, or repair or replace any article or part thereof, which is proved to be other than as warranted. For this warranty to be valid, a copy of the STEP® Labels shall be delivered to ELECTRO PLASTICS, INC., with a diagram indicating to which branch circuit the system is connected, the location of the element strips, the routing of the wires and their different measurements, voltage, amperage, elements and wire length. Electro Plastics warrants the products to be free from defects in material or manufacturing and to perform under normal use. For the warranty to be valid, qualified personnel who are familiar with the construction and operation of the system must install the equipment and a certified electrician has to verify and measure the STEP® elements BEFORE they are covered.

Exclusions

Electro Plastics shall not be responsible for any loss or damage that may arise due to:

- Non-compliance with installation and/or usage of the STEP® elements and accessories as recommended. It shall be Buyer's and End User's duty to read and follow carefully the STEP Installation Manual™. Technical assistance services, e.g. design and layout are to be used as GUIDELINES ONLY, as each application is specific to local conditions and construction
- Dissatisfaction due to improper Installation of the floor covering. All floor covering shall be installed in conformance with the manufacturer's instructions and shall conform to all applicable trade practices, local codes and manufacturer's specifications.
- Usage of inadequate or non-specified materials with the STEP® heating system or products.
- Any and all defects, deficiencies or failures resulting from improper handling of the product; e.g., cuts made to the STEP® elements, or the wires, etc.
- Tampering with the STEP® heating system or products; e.g., removing, altering or overloading the circuit breakers, overcurrent protectors, etc.
- Installation of merchandise with obvious visible defects.

How to claim this warranty

In order to obtain warranty service, Buyer shall return the unit to the dealer from whom the unit was originally purchased, with a dated sales receipt. The dealer will forward the unit to Electro Plastics. Upon receipt of the defective unit, paperwork and explanation of application, Electro Plastics will inspect and test the unit in order to determine the reason for the alleged failure. If it is determined that the unit was properly installed and failed during normal use, as a result of a manufacturing defect, Electro Plastic will repair or replace the unit, or issue a credit or refund of the purchase price, at its sole discretion. The warranty period for any replacement unit will fulfill the warranty of the original unit and will not be extended.

WARRANTY REGISTRATION AND COVERAGE

Limitations

Under no circumstances will Electro Plastics be liable for labor or other charges related to the installation and use of the STEP[®] heating system or products. This warranty does not cover labor or removal or reinstallation of the product and is void on any product installed improperly, or in an improper environment, overloaded, misused, abused or altered in any manner. THE WARRANTIES STATED HEREIN ARE EXCLUSIVE OF ALL OTHER WARRANTIES, WRITTEN OR ORAL, STATUTORY EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, NONE OF WHICH SHALL APPLY TO THE SALE OF THE COMPANY'S PRODUCTS HEREUNDER. THIS WARRANTY ALSO EXCLUDES INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY WARRANTY ON THE PRODUCTS. Products which are replaced by Electro Plastics in accordance with the foregoing shall become the property of Electro Plastics and shall be returned to it by the purchaser f.o.b. point of shipment. The maximum liability of this warranty is limited to the replacement or repair or purchase price of the defective unit. If a unit is returned and found that no defect exists, or that the user misused the unit, Electro Plastics will inform the user. If the user chooses to have the unit repaired (if possible), labor and shipping charges will apply.

Limitation of Liability

ELECTRO PLASTICS SHALL NOT BE LIABLE FOR ANY LOSS, CLAIM, EXPENSE OR DAMAGE CAUSED BY, CONTRIBUTED TO OR ARISING OUT OF THE ACTS OR OMISSIONS OF BUYER OR THIRD PARTIES, WHETHER NEGLIGENT OR OTHERWISE, IN NO EVENT SHALL ELECTRO PLASTICS' LIABILITY FOR ANY CAUSE OF ACTION WHATSOEVER EXCEED THE COST OF THE PRODUCT GIVING RISE TO THE CLAIM, WHETHER BASED IN CONTRACT, WARRANTY, INDEMNITY OR TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHERWISE. IN NO EVENT SHALL ELECTRO PLASTICS BE LIABLE OR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL OR OTHER SUCH INDIRECT DAMAGES (INCLUDING, WITH-OUT LIMITATION, LOSS OF REVENUES, PROFITS OR OPPORTUNITIES), WHETHER ARISING OUT OF OR AS A RESULT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE

WARRANTY REGISTRATION CARD

Ref. No.

CUSTOMER INFORMATION

Owner's Name _____

Address _____

City / State / Zip _____

Phone _____

Email _____

PURCHASE AND PROJECT INFORMATION

Purchased From _____ Date _____

Address _____

Product Purchased: Deicing

Heating Elements Installed on : Deck Wall
 Bulkhead Other

Heating Elements Installed under: Metal Fiberglass

Type of Project: New Construction
 Renovation

To activate warranty complete and return this warranty registration card signed with a complete checklist and layout showing element distribution as installed to: 11147 Dorsett Road, Maryland Heights, MO 63043, U.S.A.

WARRANTY REGISTRATION AND COVERAGE

CHECK LIST

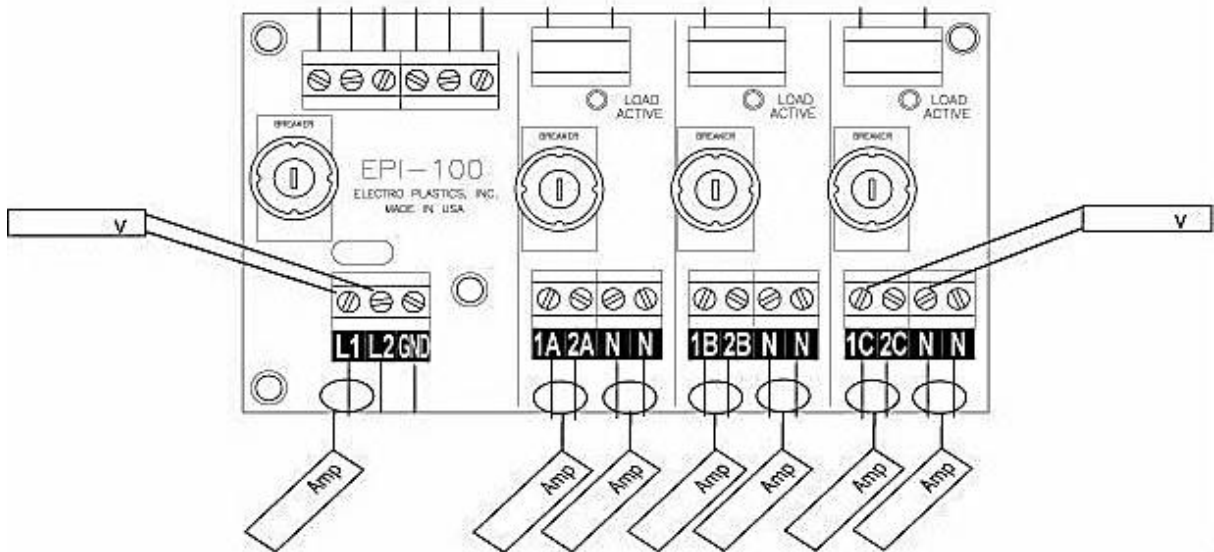
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Control : Air Moisture On/Off

STEP[®] Element Model No. : Total Length Installed : Transformer Model No. : 120V
 MEP-.....-.....W-24V Linear Feet EPI-LX-.....W 230V
 480V

MEASUREMENT INSTRUCTIONS

Measure primary and secondary volts and amps at the transformer terminals. One sheet per transformer.



Installed / measured by:

Date:

Name

Signature

TROUBLESHOOTING

If the following procedures do not solve and relieve the problems encountered, please check with our Technical Service Department.

POWER SUPPLY

Problem:

Solution:

1. Power Supply/DC Controller will not start:

a) No current

- Reset circuit breaker in service panel and switch on line voltage branch circuit.

b) Current is present

- Reset mini circuit breaker in power supply, push plunger in until it stays in.

c) PC board in AC Power Supply / DC Controller has current

- Make sure the thermostat settings are correct and that the thermostat calls for heat. Set the temperature to maximum and wait a couple of minutes for the system to turn on.
- If this does not work, eliminate thermostat; disconnect thermostat cable from PCB (printed circuit board) and put a jump wire from terminal TRG to 24. The load active should now be lit and the system is on. The fault is in the thermostat cable or its connections.

2. Power Supply becomes hot:

a) Poor ventilation

- Power Supply should be mounted vertical for the cooling fins to extract heat from the enclosure and it must be placed in a well-ventilated area.

b) High voltage conditions

- A service technician can rewire Power Supply to accept higher voltage. Call customer service for guidance.

c) High ambient temperature

- Power supply must be de-rated; decrease load.

TROUBLESHOOTING

HEATING ELEMENTS

Problem:

1. Insufficient temperature:

- a)** Thermostat setting

- b)** Cold spots in the floor

- c)** Hot spots in the floor

- d)** Low supply voltage

Solution:

- Set temperature to desired level and leave it on day and night. This is the best energy saving mode. Temperature will build up in walls, floor and ceiling and the self-regulating heating elements will effortlessly maintain a warm comfortable environment.

- The most common cause is lack of insulation, humid or wet insulation or an air gap between flooring layers.
- Cold strips are also noticed between elements if they are spaced out too far.

- Hot water tubing and hot air ducts, etc., would contribute to hot spots. STEP[®] heating elements are self-regulating and cannot overheat by themselves.

- Some regions or locations may have a low supply voltage and some may take electricity from sub-panels with reduced voltage. This results in a proportionally lower heat output. It is possible to boost up the voltage so the elements can pull more amps but this requires engineering.