



ELECTRIC DUCT HEATERS

INSTALLATION, OPERATION
AND MAINTENANCE MANUAL

Stock ID: IOM-EDH

Reprinted June, 2001

©2001 Environmental Technologies, Inc.

Largo, FL • Part No. PX-00-0141

TABLE OF CONTENTS

DESCRIPTION	PAGE
Pre Start-Up	3
Receiving and Inspection	3
Unit Placement	3
Clearance	3
Electric Heater Warning Labels	4
Minimum Air Velocities	
<i>Open Coil Construction</i>	5
<i>Finned Tubular Construction</i>	5
Heater Installation Instructions	
<i>Side Slip-In</i>	6
<i>Insulated</i>	6
<i>Flanged</i>	7
<i>Round Duct</i>	7
<i>Remote Control Panel</i>	7
Minimum Wire Gauge	8
Field Wiring	8
Preventative Maintenance	8
Ampere Reading per kW	9
Airflow Switch Probe Reversal	9
Troubleshooting Guide	9
Sample Submittal Wiring Diagrams	10
Troubleshooting Guide, Proportional Heat Control (SSR)	12
Troubleshooting Guide, Vernier Heat Control	14
Replacement Parts	14
Important Safety Precautions	15

PRE START-UP

WARNING: Improper installation, adjustments, alterations, service or maintenance can cause injury and property damage, as well as possible voiding of factory warranty. For assistance or additional information, consult a qualified contractor and your local ENVIRO-TEC® representative.

RECEIVING AND INSPECTING

- Thoroughly examine the exterior and interior of all units for transportation damage. If damage is found, immediately file a claim with the carrier. Note the damage on the bill of lading when signing for the shipment.
- Check the bill of lading to verify that all items shown (including loose items) have been received. Notify the ENVIRO-TEC® representative of any shortages or items shipped in error.
- Do not handle the unit's heating elements, as permanent damage may occur.

UNIT PLACEMENT

CAUTION: Never energize a heater without proper airflow.

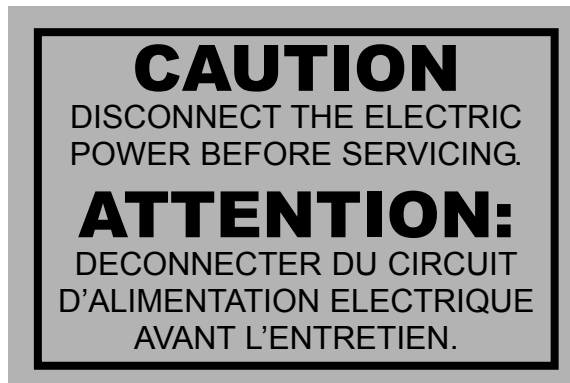
- Install ductwork to comply with ASHRAE Fundamentals Handbook, SMACNA, NFPA 90A and local code.
- ENVIRO-TEC® duct heaters are manufactured under ETL File #549556, or ETL File #548276, and must be installed in compliance with all National and Local Codes. Improper installation of these units can result in the removal of the Listing Label and/or voiding of the Warranty. Airflow and airflow patterns are important to the operation and life of the heater (see airflow graphs on page 5). Proper airflow will also prevent nuisance tripping of the thermal safety devices.
- Open coil duct heaters are certified for horizontal airflow in either direction, or for vertical up airflow. Some heaters may contain position sensitive devices (mercury contactors or Solid State Relays) and can only be mounted in their specific designed configuration. These heaters will be marked with specified mounting configuration labels. Do not install a slip-in or flanged heater intended for side mount on the top or bottom of horizontal duct. Do not install a heater marked for horizontal airflow in vertical duct or a vertical heater in horizontal duct.
- When an airflow switch is used as a fan interlock, the heater will contain an air pick-up probe. The pick-up probe contains a directional arrow and may be rotated on horizontal units only (see figure 6 on page 9).
- Install units in a section of duct with uniform air velocity across the full face area of the duct. For best performance, heaters should be mounted a minimum of 4 feet downstream of a heat pump, transition, air conditioner or other obstructions in the duct work. Per NEC Article 424-59, turning vanes, pressure plates or other devices may be used to ensure even air distribution if mounted less than 4 feet. Duct heaters for internally insulated ducts will be designed to accommodate insulation thickness.

CLEARANCE

- All electric heat units are ETL listed for zero clearance to combustibles. Therefore, the element frame height will be 1" less on uninsulated duct and the width will be 1/2" less.
- All electrical panels must have 36" working space in front of panel to meet NATIONAL ELECTRICAL CODE; however, local inspectors may waive this requirement if the hinged cover has a 90° free swing.

ELECTRIC HEAT WARNING LABELS

The labels shown below are located on the door of all electric heat units in compliance with our ETL listings to UL 1996 and CAN/CSA C22.2 No. 155. Adherence to these warning labels prevents possible injury or damage to equipment and/or property.



Disconnect Hazard Labels

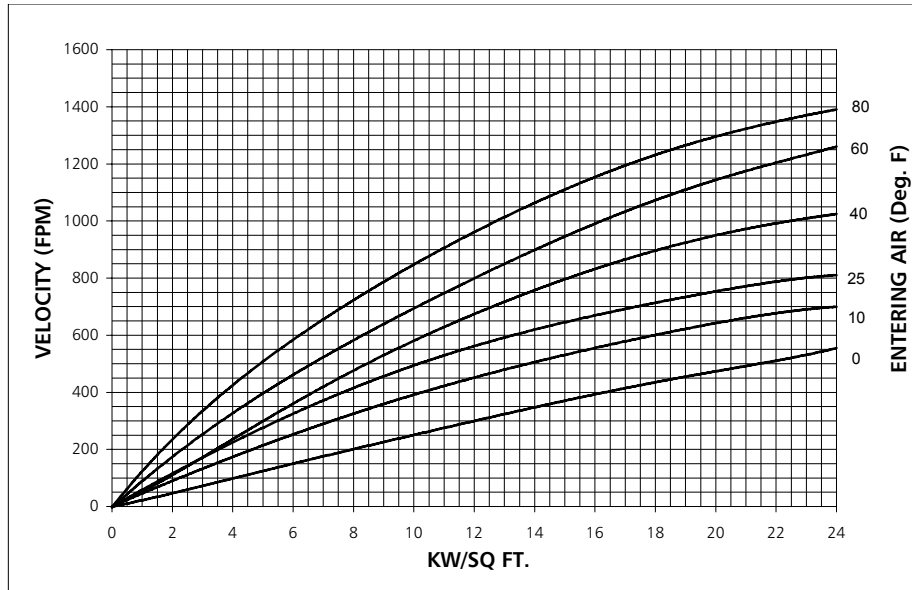
Ensure that all power has been disconnected prior to servicing equipment.



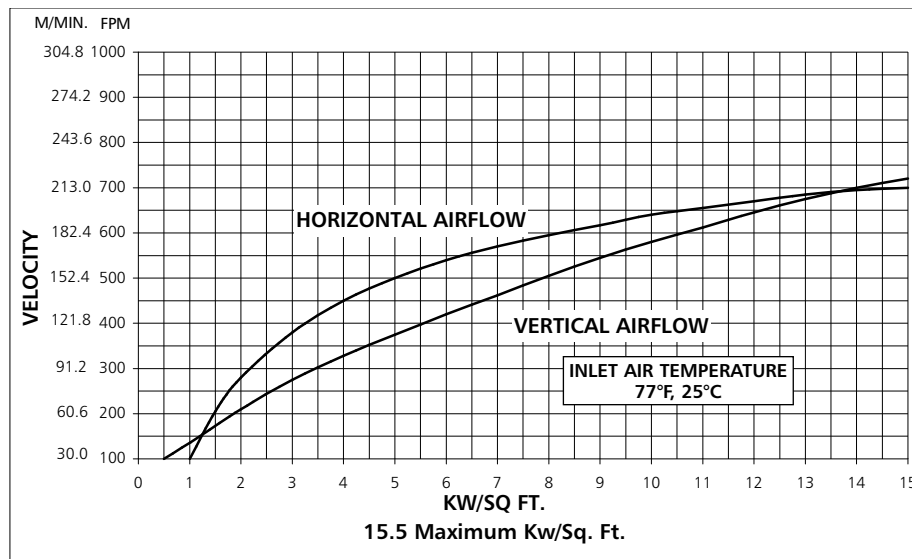
Start-Up Caution Label

Tighten all wiring lugs and terminals prior to connecting power to the unit, as they may loosen during transportation.

MINIMUM AIR VELOCITIES



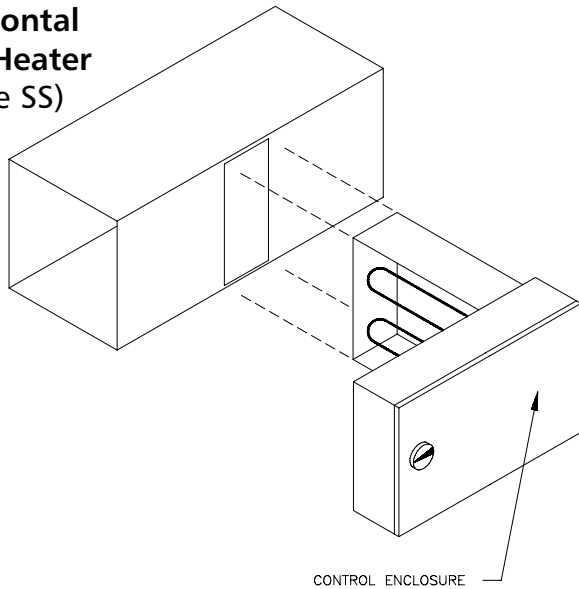
OPEN COIL CONSTRUCTION



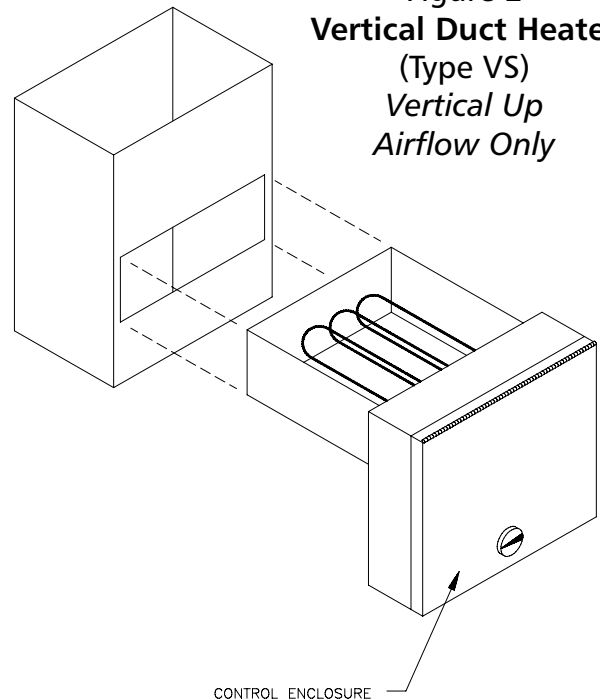
FINNED TUBULAR CONSTRUCTION

INSTALLATION INSTRUCTIONS

**Figure 1
Horizontal
Duct Heater
(Type SS)**



**Figure 2
Vertical Duct Heater
(Type VS)
Vertical Up
Airflow Only**



Model EDHSS (Side Slip-In, Vertical Slip-In)

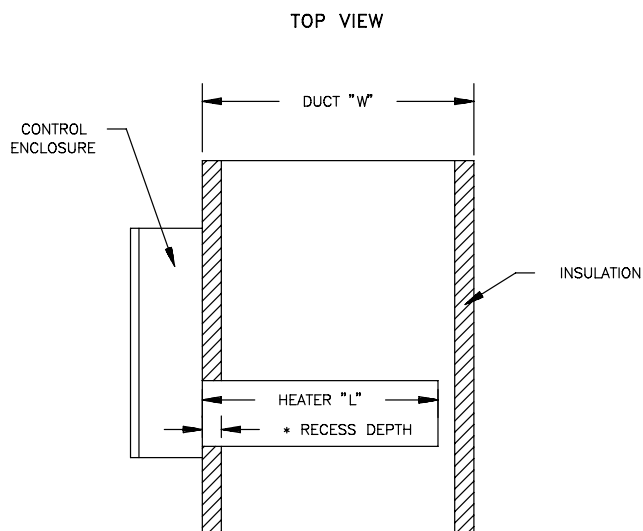
Installation of the slip-in heater consists of cutting an opening in the duct approximately 1/4" larger than the height and width of the heater element section. Insert heater and fasten to the duct using sheet metal screws through the control enclosure. Use extreme caution in protecting the electrical components, as metal chips lodged in the components can cause failure. Remove any metal chips that may be located in the electrical enclosure before connecting power.

NOTE: To prevent element section from moving inside duct, angle clips, brackets, or blank offs should be attached to frame.

**Figure 3
Insulated Duct Heater
(Type SS)**

NOTE: Heaters are designed to accommodate the insulation thickness.

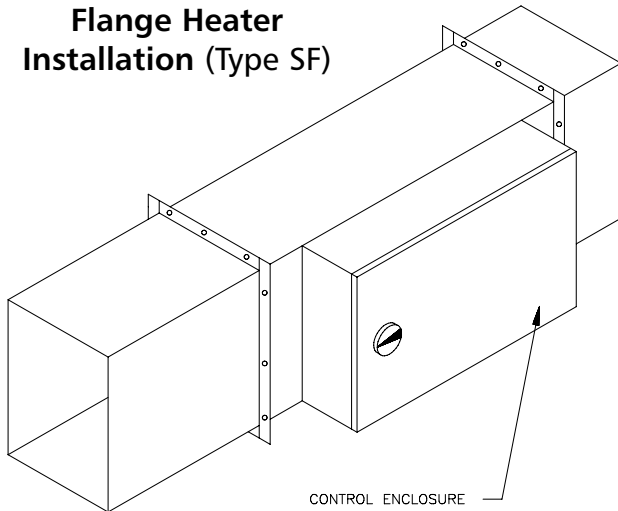
Mounting electric heater in insulated duct is the same as described above for SS type heaters.



* RECESS DEPTH EQUAL TO INSULATION THICKNESS.

INSTALLATION INSTRUCTIONS

Figure 4
Flange Heater
Installation (Type SF)



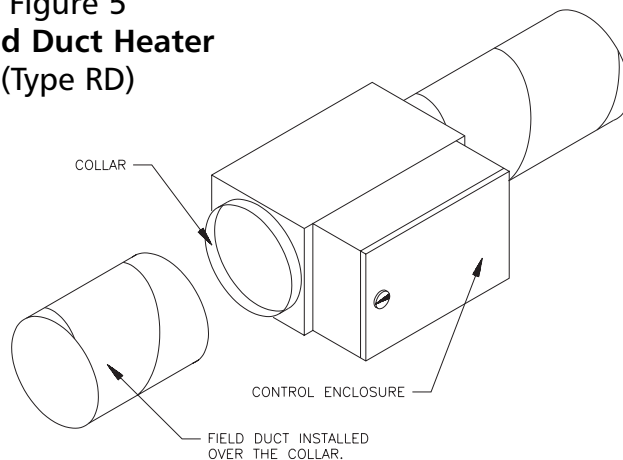
Model EDHSF (Flanged)

Flanged heaters are designed with the flanges turned out. Installation of the side flanged heater consists of inserting the flanged duct heater section into the duct and bolting in place.

Raintight

Heaters are sealed in a flanged section. Unit is mounted as above. A weatherproof seal must be made when mounting these units.

Figure 5
Round Duct Heater
(Type RD)



Installation of the round duct heater consists of attaching round duct to the inlet and outlet collars and bolting in place. Seal connection and duct joint.

Model RCMP (Remote Control Panel)

Install the control panel in a suitable location for the specified panel type. The wiring diagrams inside the heater door and the remote control panel door show point-to-point interconnecting wiring. Wiring must be letter to letter ("a" to "a") or number to number ("1" to "1"). Labels on each door specify the (heater/panel) configuration. **DO NOT** deviate from this label. Panels should be mounted in sight of unit, unless an additional disconnect is located at unit.

MINIMUM WIRE GAUGE (from Table 310-16 NEC 1996 wire rated 75°C)			
AMPERES	MINIMUM WIRE GAUGE	AMPERES	MINIMUM WIRE GAUGE
20	14 AWG	175	2/0 AWG
25	12 AWG	200	3/0 AWG
35	10 AWG	230	4/0 AWG
50	8 AWG	255	250 kcmil
65	6 AWG	285	300 kcmil
85	4 AWG	310	350 kcmil
100	3 AWG	335	400 kcmil
115	2 AWG	380	500 kcmil
130	1 AWG	420	600 kcmil
150	1/0 AWG		

POWER WIRING		CONTROL WIRING Stages		TRANSFORMER WIRING Primary Voltage (same as Power Wiring) SECONDARY			
L1	Black	Step 1	Red	24 Volt		277 & 120 Volt	
L2	Red	Step 2	Purple	Negative	Yellow	Negative	Red
L3	Blue	Step 3	Orange	Positive	Blue	Positive	Black
N	White	Step 4	Brown				
Ground	Green	Fan Output	Black				

NOTE: Units with wire gauges 8 and greater will be color coded with tape.

FIELD WIRING

NOTE: Prior to installing any wiring, check the unit name plate for main power voltage, control voltage and maximum overcurrent protection. Operating a heater at other than the specified voltage and phase can result in fire or electrical hazard. All field wiring must comply with NATIONAL ELECTRIC CODE and local code requirements. A point-to-point wiring diagram is located on the inside of the control panel door, which details wiring and field wire gauge.

- Use copper conductors only with a minimum of 75°C insulation.
- Tighten all wiring lugs and terminals prior to connecting power to the unit, as they may loosen during transportation.
- Connect the power lines to the power distribution terminals inside the control enclosure and tighten to 35 inch-pounds (.4kg meters). If a factory wired disconnect switch is installed, connect the power lines to the line side of the switch. The line block or disconnect is rated at 125% of nominal heater amperes based on 75°C wire.
- Mount and wire any field installed items as indicated on the factory supplied wiring diagram. When mounting field installed components, do not jumper out or rewire any factory wiring without written approval from Environmental Technologies, Inc. only. Violation will void warranty and listing.
- Energize unit and check all controls for proper operation. Do not operate unit without proper airflow.

ELECTRIC HEATER PREVENTATIVE MAINTENANCE CHECKS & SERVICE SCHEDULE

CAUTION!

DISCONNECT ALL POWER SOURCES BEFORE ATTEMPTING TO SERVICE OR CLEAN HEATER

Before, and at Midpoint of the Heating Season:

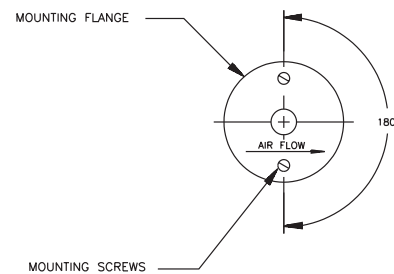
- Check all electrical connections for tightness and broken terminations.
- Check all wiring for deterioration or over heating.
- Check unit for dirt or dust, and wipe clean (except elements).
- Check the element section for obstructions and debris.
- Check all components for wear and physical damage.
- Check all safety devices for proper operation.
- Check temperature controls for proper operation.

CAUTION:

In the event of thermal protection failure, it is recommended that a qualified service person investigate the cause of failure prior to returning the heater to normal service.

AMPERE READING PER KW	
VOLTAGE/PHASE	AMPERES/KW
120 / 1	8.33
208 / 1	4.80
240 / 1	4.16
277 / 1	3.61
480 / 1	2.08
208 / 3	2.77
240 / 3	2.40
480 / 3	1.202

Figure 6
Airflow Switch Probe Reversal

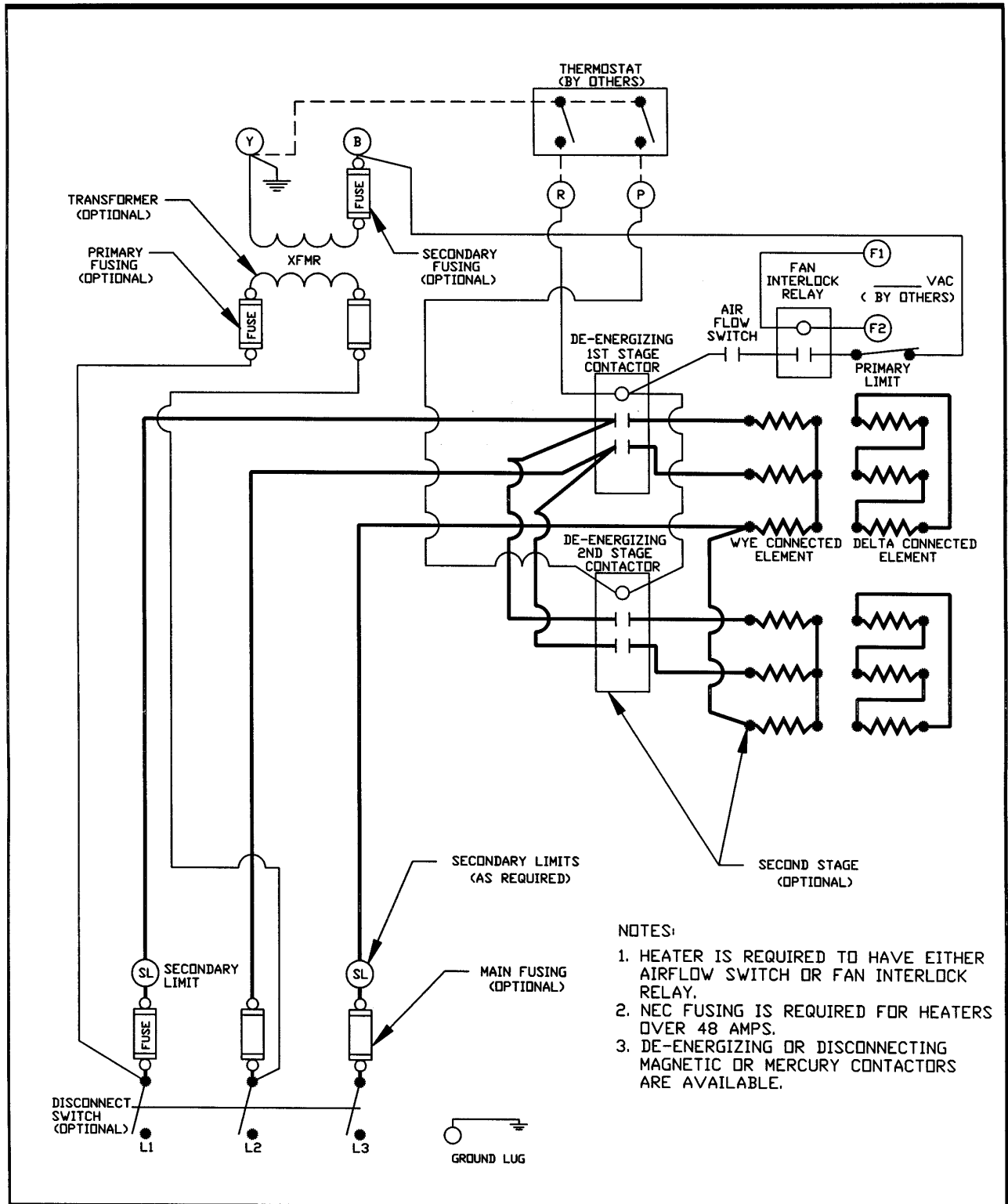


Airflow switch probe is installed in accordance with the specification. If application dictates opposite airflow, rotate the probe 180°. Directional arrow is stamped on airflow sensing probe. **DOES NOT APPLY TO VERTICAL UNITS.**


TROUBLESHOOTING

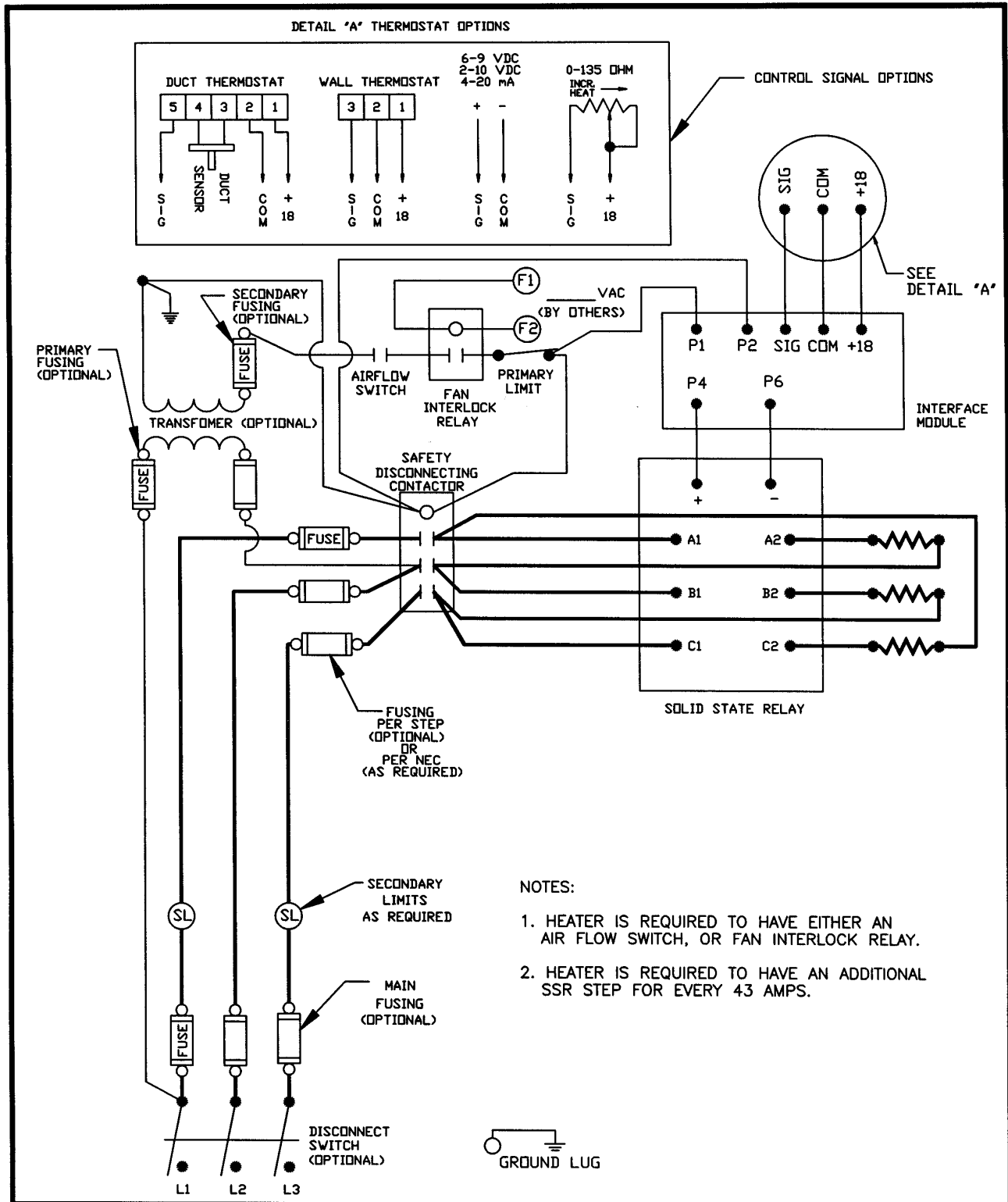
- Check installation instructions and wiring diagrams to ensure heater is wired and installed properly.

COMMON SYMPTOMS	POSSIBLE CAUSE	REMEDY
Heater Does Not Operate	No Power	<ul style="list-style-type: none"> • Check disconnect
	No Control Voltage	<ul style="list-style-type: none"> • Check control signal (i.e. 24volt) • Check transformer and transformer fusing (if applicable), replace if necessary
	Blown Fuse	<ul style="list-style-type: none"> • Replace fuse
	Open Limit (primary or secondary)	<ul style="list-style-type: none"> • Replace limits or reset as applicable • Check for continuity across limit to determine if open, replace as necessary
	Airflow Incorrect Direction	<ul style="list-style-type: none"> • Check sensing tube, rotate if needed (see Figure 6 above)
	Low Airflow Static Pressure	<ul style="list-style-type: none"> • Increase airflow
	Damaged Elements	<ul style="list-style-type: none"> • Check for open or damaged elements and replace as necessary
Low or High Temperature Rise	Incompatible Thermostat or Controller	<ul style="list-style-type: none"> • Check wiring • Check for compatibility
	Problems with Additional Stages	<ul style="list-style-type: none"> • Check location of thermostat; may be installed in a "too hot" or "too cold" location • Check contactors for open coil • Check for damaged elements
	Incorrect CFM	<ul style="list-style-type: none"> • Check for blocked duct or location of heater
Short Cycling	Improper Airflow	<ul style="list-style-type: none"> • Check for even airflow across the face of element section • Check for blocked duct • Check for dirty filters
	Low CFM	<ul style="list-style-type: none"> • See remedies for "Improper Airflow" • Check air velocity
Heater w/SSR Does Not Operate	Incorrect Signal Applied	<ul style="list-style-type: none"> • Verify signal input • See page 8 (Troubleshooting Guide)
	Interface Board Fuse Blown	<ul style="list-style-type: none"> • Replace fuse (See page 8 [Troubleshooting Guide] for correct size and type)



- NOTES:
1. HEATER IS REQUIRED TO HAVE EITHER AIRFLOW SWITCH OR FAN INTERLOCK RELAY.
 2. NEC FUSING IS REQUIRED FOR HEATERS OVER 48 AMPS.
 3. DE-ENERGIZING OR DISCONNECTING MAGNETIC OR MERCURY CONTACTORS ARE AVAILABLE.

	ENVIRONMENTAL TECHNOLOGIES, A CORPORATION		DRN BY: RJM	DATE: 04/30/97	SCALE: NTS
	TITLE: SUBMITTAL WIRING DIAGRAM		CKD BY: [Signature]	DATE: 5/19/97	REV: 00
			DWG NO. 19246		



	ENVIRONMENTAL TECHNOLOGIES, A CORPORATION	DRN BY: RJM	DATE: 05-19-97	SCALE: NTS
	TITLE: SUBMITTAL WIRING DIAGRAM WITH SOLID STATE RELAY	CKD BY: <i>SP</i>	DATE: 5/19/97	REV: 00
		DWG NO. 19247		

PROPORTIONAL HEAT CONTROL (SSR) TROUBLESHOOTING GUIDE

CAUTION: Lethal voltages are present in the heater control enclosure. Use extreme caution when taking measurements in these units. Always disconnect power before removing or re-applying any connections.

1. Before applying power, verify wiring matches diagram in cover of heater control enclosure, and that correct line voltage has been wired to heater line block.
2. Verify 24 VAC +15% or -10% between P1 and P2 of interface circuit board (ETPHCI, ETPHCT, etc., depending on input).
3. If the heat control is used with an ENVIRO-TEC® duct or wall stat, verify +18 VDC + or -0.5 VDC between the terminals labeled +18 and COM on the interface circuit board, and terminals 1 and 2 of the thermostat. If no voltage is present, check the fuse on the interface circuit board and, if good, replace the interface circuit board.
4. The table below lists responses to input signal by interface model as explained in step 5. If the voltages from an ENVIRO-TEC® thermostat listed in the table cannot be obtained, proceed to step 10. If any of the other inputs cannot be obtained, refer to the literature on the device which is supposed to provide the input. Otherwise, proceed to step 5.

INTERFACE MODEL	"PULSE" INPUT	FULL OFF INPUT	FULL ON INPUT
ETPHCI	12.0 mA	4.0 mA	20.0 mA
ETPHCT	9.1 VDC	8.4 VDC	9.9 VDC
ETPHCR	68 Ω	0 Ω	135 Ω
ETPHCV1	7.5 VDC	6.0 VDC	9.0 VDC
ETPHCV2	6.0 VDC	2.0 VDC	10.0 VDC

5. Apply Full Off Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is off. If the unit is single phase, measure voltage between P4 and P6 and verify 0.3 VDC + or - 0.3 VDC. Replace the interface circuit board if the voltage is higher than specified, or the LED is on.
6. Apply Full On Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is on. If the unit is single phase, measure voltage between P4 and P6 and verify between 3 and 5 VDC.
7. Apply "Pulse" Input per table above. If the unit is three phase, verify that the LED on the SSR (solid state relay) is flashing at an interval of about one second. If the unit is single phase, the voltage between P4 and P6 of the master circuit board should vary between the Full Off and Full On voltages in steps 5 and 6 in intervals of about one second. NOTE: Some voltmeters will not respond this quickly, so the value of the voltages may not appear to be correct; however, if the voltage appears to be changing at regular intervals, it may be assumed that this function is operating properly. This completes the low voltage portion of the unit test.

8. If the heater always remains energized when power is applied, remove the wire from P4 of the interface circuit board. If the heat remains on, there is a wiring error or the SSR is defective.

CAUTION: Remove Power From the Unit Before Proceeding With the Next Step.

9. If the heater is always de-energized when power is applied, remove the line and load connections to the proportional heat control and temporarily tie them together. If the system is a three phase arrangement, do the phases one at a time. (NOTE: **Always** remove power from the unit before moving to the next phase). Make sure there is no danger of the temporary connection shorting to another component or the chassis. Briefly reapply power. If the section of heat under test now energizes, the SSR is defective. If heater still will not energize, one of the heater safety devices (limits, safety contactor or airflow switch) or elements is defective.

THERMOSTAT

10. Make sure the temperature being sensed by the thermostat is within its control range:

MODEL	RANGE
ETSTAT4H	55° - 85° F
ETSTAT4H1	45° - 75° F
ETSTAT4H2	55° - 85° F
ETSTAT4H3	90° - 120° F
ETSTAT4H4	105° - 135° F

11. Set the thermostat setpoint to the temperature of the air being sensed. Read the voltage between terminals 3 (ETSTAT4H) or terminal 5 (all other models) and terminal 2, and verify voltage is between 7 and 9 VDC. If not, replace thermostat (and duct sensor, if applicable).
12. Turn thermostat setpoint up approximately 4°F and verify voltage in step 11 increases by about two volts. If not, replace thermostat (and duct sensor, if applicable).

VERNIER HEAT CONTROL TROUBLESHOOTING GUIDE

CAUTION: Lethal voltages are present in the heater control enclosure. Use extreme caution when taking measurements in these units. Always remove power before removing or re-applying any connections.

1. Before applying power, verify wiring matches diagram in cover of heater control enclosure, and that correct line voltage has been wired to heater line block. NOTE: Polarity of the 24 VAC signal is important. If incorrect, controller will not work, and, in some cases, may be damaged.
2. Verify 24 VAC +15% or 10% between terminals 15 and 16 of the vernier controller (ETGC8VP).
3. Verify +5V or 0.25V between the +5V and COM test loops on controller. These are located approximately in the center of the board. If zero, check fuse.
4. LED should be blinking in two second intervals (one second on, one second off). If LED stays on or off, controller is damaged and must be replaced.
5. If LED flashes rapidly (several times a second), non-volatile memory has been scrambled, causing the controller to shut down as a precautionary measure. The non-volatile memory (8 pin, socketed IC labeled 93C56) may be replaced by one programmed at the factory. Contact your ETI representative and order part number 13807. Make sure to relay all the information on the controllers identification tag, as this will be used to program the correct configuration.
6. The controller is set for direct acting, i.e., low signal is off, high signal is on. Apply low signal to J8, terminals 3 (+) and 4 (-), and verify heat is off. If SSR stage remains on, remove wires from J2. If SSR stays on refer to SSR Checkout List; otherwise, replace controller. If a relay stage stays on, remove wire for that stage from its terminal (7 through 14). If relay stays on, check heater wiring; otherwise, replace controller.
7. Apply high signal (e.g., 10 VDC, 20 mA, etc.) to J8, terminals 3 (+) and 4 (-), and verify all heat stages are on. If SSR stays off, refer to SSR Checkout List. If a relay stage stays off, remove wire for that stage from its terminal (7 through 14) and touch to terminal 15. If relay stays off, check heater wiring; otherwise, replace controller.

REPLACEMENT PARTS

- Replacement parts should be ordered from the local ENVIRO-TEC® representative. Factory replacement parts must be used to maintain agency listings. Any substitutions and/or modifications not authorized by the factory will void the unit warranty, the agency listing, and could result in personal injury and/or property damage.

When ordering parts, the following information must be supplied to ensure proper part identification:

- 1) Complete unit catalog number on unit label
- 2) Complete parts description, including any identification numbers

To find your nearest ENVIRO-TEC® representative, visit our web site at www.enviro-tec.com or contact the factory at 727-541-3531.

SAFETY CONSIDERATIONS

The equipment covered by this manual is designed for safe and reliable operation when installed and operated within its design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experienced personnel perform these functions using good judgement and safe practices. See the following cautionary statements.

DANGER

ELECTRICAL SHOCK HAZARDS. All power must be disconnected prior to installation and servicing this equipment. More than one source of power may be present. Disconnect all power sources to avoid electrocution or shock injuries.

HOT PARTS HAZARD. Electric Resistance heating elements must be disconnected prior to servicing. Electric Heaters may start automatically, disconnect all power and control circuits prior to servicing to avoid burns.

WARNING

Check that the unit assembly and component weights can be safely supported by rigging and lifting equipment.

All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its final location.

All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation and vibration.