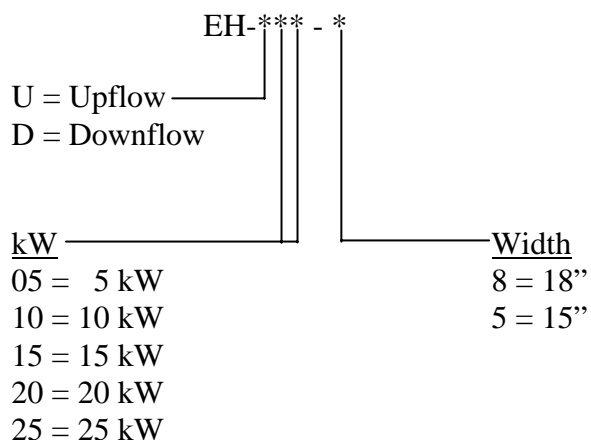


# HeatChoice™

## Electric Plenum Heater



U.S. and Canadian patent apply  
No. 4,593,176 and No. 1,177,512.

**NOTE:** This manual covers both upflow and downflow, study and follow the appropriate section.

### APPLICATION:

- DUAL HEAT – COMBINE THIS ELECTRIC PLENUM HEATER WITH STANDBY GAS OR OIL FURNACE
- WITH OR WITHOUT STANDARD AIR CONDITIONING
- STANDARD FURNACE BLOWER OR VARIABLE SPEED BLOWER
- NON-HEAT PUMP
- FURNACE FAN CENTER, WIRING BOARD EQUIVALENT, REQUIRED

This model is also the best choice for total electric conversion or wood furnace (see appropriate section in this installation manual).

Drawings: **EA107**  
**EA111**  
**EH101**  
**EC001**  
**ES201**



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# INTRODUCTION

The Power of Choice is encouraging many homeowners to build versatility and flexibility into their heating system. When used and controlled properly, electric heat can save you hundreds of dollars per year. To meet this Power of Choice need, this HeatChoice series plenum heater is very versatile with a variety of applications.

This is a prewired package for converting a new or existing oil, gas, or solid fuel furnace to a dual heat or total electric heating system. This is a complete package for standard air conditioning, utility load control, and optional DC drive variable speed furnace. There are **no** additional relays or option hardware needed for the outlined application. Also there will be no feedback to the air conditioning compressor unit with mechanical stat sub-base or digital room thermostats.

The utility load control receiver properly switches the heating mode **and** properly controls the air conditioning unit during summer heat load interrupt. The blower circuit and control is also designed for heating interrupt (blower handled by gas furnace only) **and** continuous operating blower during cooling peak load interrupt. Typically these controls and design features are only found in this product or its US made equivalents.

It is difficult to define each application. The first section of this installation manual covers basic dual heat for gas furnace only. The additional application section provides installation comments for oil furnace, wood furnace, and total electric (disable gas/oil burner).

This HeatChoice unit contains several patented mechanical, airflow, and electrical control features. The intent of these features is to reduce installation labor and add quality performance. Since these patented features cause this unit to be unique compared to other electric heating products, this installation manual must be studied and followed in detail.

The kWh capacity should match the heat requirement of the house or building. Do not oversize your installation. Sizing should be slightly smaller than the maximum requirement during the most severe coldest day of the year. This unit can and is designed for continuous run operation on the coldest day of the year. Undersizing is possible, see a special section using SOT transfer timeout device.

**Limited Warranty Statement and warranty return form/checkout** – within this package is a warranty certification and checkout procedure. This must be completed and returned for warranty coverage. It is important to verify proper airflow and maximum outlet temperature using the steps within this provided procedure.

Please read and understand conditions associated with proper installation, unauthorized changes, and POWER ON procedures.

For information, all units are rated at 240VAC. When operating at lower source voltage, the output will be reduced.

Example: 20 kW unit, assuming normal element tolerances

220VAC source - 16.8 kW, 76.4 amps

208VAC source - 15.1 kW, 72.3 amps

# INSTALLATION REQUIREMENTS

1. All installation work must be performed by trained/ qualified, contractors or technicians. Electro Industries, Inc., sponsors installation and service schools to assist the installer. **Visit our web site at [electromn.com](http://electromn.com) for upcoming service schools.**
2. All electrical wiring must be in accordance with National Electric Codes and local electric codes, ordinances, and regulations.
3. Observe electric polarity and wiring colors. Failure to observe could cause electric shock and/or damage to the equipment.
4. This unit can only be used for its intended design as described in this manual. Any internal wiring changes, modifications to the circuit board, modifications or bypass of any controls, or installation practices not according to the details of this manual will void the product warranty, the ARL certification label, and manufacturer product liability. Electro Industries, Inc., cannot be held responsible for field modifications, incorrect installation, and conditions which may bypass or compromise the built-in safety features and controls.

**SPECIFICATIONS - TABLE 1**

Model Number:	EH-*05-+	EH-*10-+	EH-*15-+	EH-*20-+	EH-*25-+
kW Rating	5	10	15	20	25
Voltage/Phase	240/1	240/1	240/1	240/1	240/1
Control Voltage	24 volts <sup>①</sup>	24 volts <sup>①</sup>	24 volts <sup>①</sup>	24 volts <sup>①</sup>	24 volts <sup>①</sup>
Circuit Breaker	-	1-60	1-45, 1-45	2-60	2-60, 1-30
Source Feed	1	1	2	2	3
Elements	2	4	6	8	10
Min. CFM	400	650	900	1200	1500
Max. Temp. Rise	50° F	50° F	50° F	50° F	50° F
Shipping Weight	30#	34#	36#	38#	42#

① Loaded or electric call for heat operating voltage must be between 23 and 32 volts, 60Hz.

② This table primarily lists the various specification information at each kW size. The model number shown is the marketing or catalog number. The inside nameplate may have a different manufacturer's model number (example – EH-U20-8 = EM-EU20218).

# MECHANICAL

The HeatChoice is designed to control or compensate for certain airflow problems inherent with tight spacing residential forced air furnace systems. However, the HeatChoice cannot produce airflow and cannot correct airflow problems inherent within the existing furnace system. The following eight items should be carefully considered and properly followed for all installations:

1. **EXAMINATION OF EXISTING FORCED AIR FURNACE** - Prior to starting this installation or furnace modification, examine the total furnace system and make necessary comments or recommendations to the homeowner. Remember, if a marginal condition exists within the existing forced air system, the installation of an HeatChoice will not necessarily cure PRE-EXISTING conditions. Consider such items as proper fossil fuel ignition, is the furnace cycling on hi-limit, filter, adequate cold air return, adequate supply duct and room register (1 register per 100 CFM) etc.
2. **FURNACE TYPE** – Determine UPFLOW or DOWNFLOW furnace type. You must use the correct model for appropriate furnace type. The DOWNFLOW can be used in horizontal applications, follow instructions and install loose supplied sensor. Do not turn the HeatChoice upside down or install this unit in the cold air return.
3. **HEATING CAPACITY** - Size the HeatChoice according to the normal heating requirements as the building exists today. Do not necessarily match to the existing furnace nameplate because it may be oversized. Do not oversize the HeatChoice.
4. **SUPPLY PLENUM** (this paragraph written **primarily for UPFLOW; however**, it also would apply to various DOWNFLOW or horizontal applications) - Carefully examine all sides of the plenum. Visualize an ideal location for the HeatChoice and follow all the details of the appropriate installation diagram. Verify all transitions have angles less than 30°, the HeatChoice is centered within the plenum, and there are no odd shaped angles or odd shaped transitions within the plenum. One or more of the following will apply:
  - a. No A-Coil – follow drawing EA107, ignore the sketched in “A-coil”. Notice all distribution ducts or pipes must be above HeatChoice elements with 1Ø" minimum clearance at top. If lots of height is available, center unit between furnace top and lowest take-off duct.
  - b. Air Conditioning A-Coil – follow Drawing EA107. The HeatChoice must be **above** A-coil and **parallel** to A-coil. Again, all distribution ducts must be above the HeatChoice.
  - c. Width or DEPTH, 16" Furnace – where possible use 15" model. If using 18" model, build out both sides or back with a 30° transition. Do not build out the HeatChoice mounting front. The build-out should be as high as possible so that the elements do not set in a pocket.

**NOTE:** Do **not** use a **15"** model in plenums larger than 18"x18". This is especially true when installing over an A-coil. The elements must be located at and close to the sides of the plenum.
  - d. Width or DEPTH greater than 19" – only use the 18" model and follow drawing EH101 (C-1 and C-2). Ideally all plenums should be built-in so that the HeatChoice is inserted into 19"x19" box. The mounting plate or control box of the HeatChoice must be flat with the existing plenum. If plenum is too wide, build-in must be on both sides, equally.

**NOTE:** Some plenums may require combinations such as a full vertical deflector, drawing EH1Ø1 (C-2) in the back and possibly a "V" deflector, EH1Ø1 (C-1) on each side.
  - e. Plenum access, hot objects – HeatChoice control box must be at least 12" from flue pipe or other hot objects.

5. **OTHER PLENUM EQUIPMENT** - Auxiliary equipment such as humidifiers, zone plenum dampers, etc., located within the plenum which may cause a non-uniform airflow will have to be removed. Zone dampers within the trunk line at least 12" from the HeatChoice typically are no problem. When horizontal zone dampers are involved, perform all check-out functions with smallest zone open first.
- Comment – zone dampers cause back pressure on the blower and overall reduced airflow. The HeatChoice elements should be staged according to the heating load required by the various zone combinations. The Electro Industries' WarmFlo series plenum heater is designed for zone systems and should be investigated for forced air zone applications.
6. **AIR CONDITIONING "W" OR "M" COILS** - These new coils represent a double "A" or an "A" with a third slanted side. The net result is the top point no longer lines up with the center deflector of the HeatChoice frame. The only known solution is adequate space between the coil top and the HeatChoice unit itself. Also we have no direct experience to know how much space is required, we are suggesting a requirement of at least 12" between the top points of these new coils and the bottom of the HeatChoice frame itself.
7. **INSUFFICIENT COLD AIR RETURN CAPACITY** - Installation experience indicates this is a major concern. In fact, it could represent a problem in as many as 60% of the installations, especially if there is a requirement to increase airflow with the existing blower and the existing cold air return capacity is already undersized or restricted. Check the static pressure within the return cabinet or the suction at the filter cabinet door. Do not assume because there is a register on the wall, the hole behind the register or the passageways are equal to this register. Sharp offsets and transitions in the cold air return system often cause severe restrictions. Expect to add additional registers or a relief register in the main cold air return duct.
8. **BLOWER CFM CAPACITY** - The furnace forced air system must have an airflow capacity larger than the minimum requirement on an HeatChoice specification sheet (see "SPECIFICATIONS - TABLE 1") or the HeatChoice nameplate. It is near impossible to correctly measure CFM airflow in an existing residential installation. Experience and rule of thumb indicators will have to be followed to determine the existing furnace CFM capacity. The following may be helpful:
- a. Existing furnace nameplate - Typically represents a high or optimistic rating and is a function of the systems static pressure. What changes have been made to the heating system since installation?
  - b. Blower motor size - Used only as a minimal guide.
    - 10 kW unit - 1/4 HP or larger
    - 15 kW unit - 1/3 HP or larger
    - 20 kW unit - 1/2 HP or larger
    - 25 kW unit - 3/4 HP or larger
  - c. Observe/examine airflow ducting system and design - Use duct sizing table (ECØØ1), or industry equivalent duct capacity airflow charts and determine if the system is capable of delivering the CFM required on the nameplate. Especially check the number of registers and the number of "6 inch rounds". The same would apply to cold air return duct capacity.
  - d. Calculated CFM - By measuring the temperature rise across the existing furnace (or this electric unit), the CFM can be approximated. The accuracy of this formula will depend upon the estimated or determined Btu output (actual heat energy across the furnace).

$$\text{CFM} = \frac{\text{Btuh (output)}}{\text{Temp. Rise} \times 1.08}$$

# MECHANICAL INSTALLATION STEPS

## UPFLOW

**NOTE:** For maximum performance and maximum element life, this unit must be installed in the furnace hot air plenum such that there is uniform airflow across each element and maximum airflow across the entire element surfaces.

If all the previous two pages have been verified the actual installation involves the following steps:

1. Cutting the correct hole size in the plenum – locate the supplied cutout template marked “UAI012”. Once placement of the HeatChoice is determined, tape all four corners of the template to the plenum. **Make sure that the template is square with the plenum before proceeding to the next step.** Using a utility knife cut out the appropriate dashed line on the template. Then use a marker to trace around the area cut out of the template. Remove the template from the plenum and proceed to cut the hole into the plenum.
2. Install the necessary deflectors or plenum build-in as outlined on previous page and as shown in C-1 and C-2 on drawing EH101.
3. Use a light or flashlight to check the top of the furnace, around the furnace heat exchanger, position of the A-coil, the cleanliness of the A-coil, and any conditions within the furnace system which would result in a non-uniform airflow at any of the electric elements.
4. If required, install plenum strengthening bars or S-clips. Verify there are no flanges or obstructions around the opening to prevent air from entering the HeatChoice double plate air cooler. If vertical strengthening bars are used they must be placed on the inside surface of the plenum.
5. Extend the HeatChoice "V" channel to butt against the plenum back surface or the installed deflector opposite the cut-in hole. After HeatChoice insertion, a sheet metal screw may be installed to attach the back plate of this “V” deflector channel.
6. When handling or inserting the actual HeatChoice unit, verify the element or the element fins do not become bent and the sensor probe is parallel with the top element. **This probe (blue end) must be approximately center between top element and 1½" from element fin. The capillary tube should have an upward angle.**
7. Insert the HeatChoice unit with the sensor probe at the top or above the element by hooking in the bottom mounting plate first. This should catch the bottom of the plenum hole opening and hold in place while starting the top screws (observe airflow arrow inside control box).
8. Verify that there is a tight air seal around the complete HeatChoice unit and there are no obstructions for airflow into the double plate cooling chamber.

**NOTE:** If the mechanical contractor has responsibility for this job (sold the unit), he must return to perform the POWER ON start-up test and fill out the warranty certification data sheet. The job is not complete until there is thorough verification of proper operation.

# MECHANICAL INSTALLATION STEPS

## DOWNFLOW

NOTE: Please refer to drawing EA104, revision E or newer for proper placement of the HeatChoice unit when an A/C coil is installed.

1. If the DOWNFLOW furnace is setting directly on the floor, the furnace will have to be raised for insertion of the HeatChoice unit. This will require a field designed and constructed plenum. This plenum must have sufficient strength to carry the weight of the existing furnace.
2. Depending upon model, the ideal plenum size for the HeatChoice is either 15" x 18" or 18"x18". Therefore, this base plenum should be sized according to the HeatChoice and the hot air discharge hole on the bottom of the furnace. It should NOT be sized according to the outer dimensions of the furnace (see drawing EA1Ø4).
3. Examine the hot air discharge hole in the bottom of the downflow furnace. Assuming 18" model, if it ranges between 18"x18" to 19"x19" (if 15" model adjust accordingly) the HeatChoice unit can be installed directly beneath the furnace if there is no A/C coil installed. This plenum need only be about 11" high. If the bottom hot air discharge hole is less than 18"x18", use 15" model or allow at least 6" between the bottom of the furnace and the top of the HeatChoice unit (see drawing EA1Ø4).
4. The HeatChoice is designed with a special double plate at the element mounting. Cool air from the bower must blow between these two plates. Therefore, the Elector-Mate must be inserted into the base plenum such that the mounting plate is even with the edge of the hot air outlet hole. Do not necessarily line up the HeatChoice control box with the furnace cabinet front. The concern is the hole in the bottom of the furnace mating with HeatChoice elements.
5. Cutting the correct hole size in the plenum – locate the supplied cutout template marked "UAI012". Once placement of the HeatChoice is determined, tape all four corners of the template to the plenum. **Make sure that the template is squared off to the plenum before proceeding to the next step.** Using a utility knife cut out the appropriate dashed line on the template. Then use a marker to trace around the area cut out of the template. Remove the template from the plenum and proceed to cut the hole into the plenum.
6. Extend the "V" channel to butt against the plenum surface opposite the 8"x18" hole. After HeatChoice insertion, a sheet metal screw may be installed to attach the back plate of this "V" deflector channel.
7. Insert the HeatChoice and properly screw to base plenum. If the base plenum is 15" or 18" wide, side supports will be needed on the side for proper attachment to the HeatChoice.
8. When using A-coil with a bottom discharge furnace note the vertical spacing requirements on drawing EA104. Allow as much separation as possible between HeatChoice unit and A-coil drip pan.

Also encourage using the 15" model and add baffle constructed as shown on drawing EH101.



## MECHANICAL INSTALLATION STEPS

### HORIZONTAL

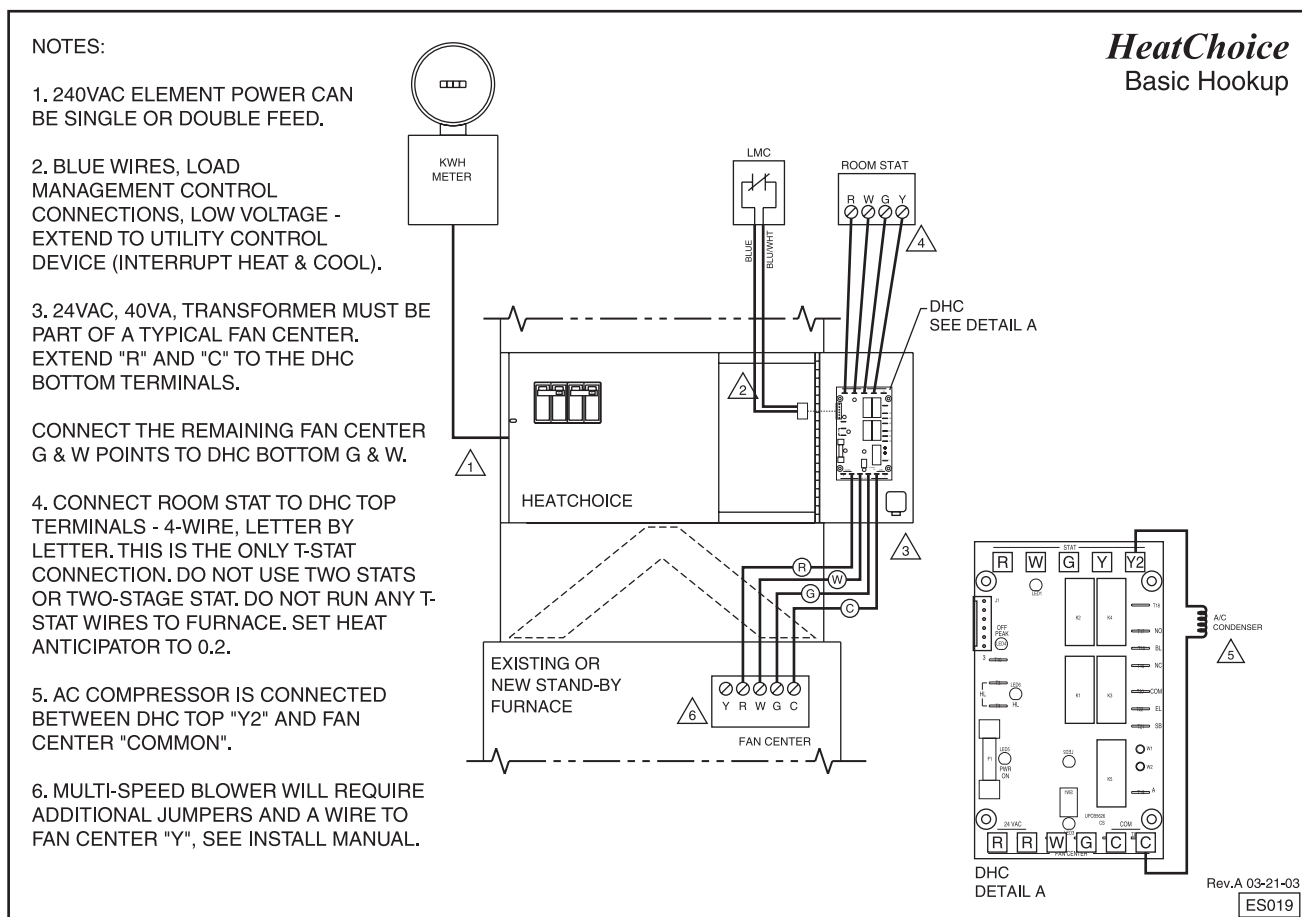
1. Basically this involves a downflow unit (EH-D\*\*\*) turned 90° with the plenum instruction and rules common to the upflow unit.
2. The key is to observe the “AIRFLOW” arrow and allowing for gravity temperature rise, making sure there is a probability for the hi-limits sensing at an upper point in case of airflow failure. Also, all airflow must pass uniformly through the elements. Feel free to call the factory for additional assistance with horizontal applications.
3. A majority of the items reviewed on pages 3 and 4 apply.
4. Reference previous page 3 and paragraph 4, all requirements for plenum sizing and deflectors apply. This installation could represent a 15” model or an 18” model, again apply the rules outlined on page 3.
5. Air conditioning coil, typically we are aware of three physical coil types – flat (90° to horizontal duct), slant coil, and A-coil turned 90° (with an extended drip pan at the bottom). With these three types, the HeatChoice is typically installed after the coil or on the “supply” side. Again top and bottom and backside deflectors may be required depending upon plenum size.
  - Flat coil – allow at least 8 inches between coil and HeatChoice.
  - Slant coil – installing the HeatChoice at the same angle as the coil is preferred, or insert the HeatChoice as close as possible to the horizontal plenum bottom (assuming this is the furthest distance between coil and HeatChoice).
  - Turned A-coil – similar to an upflow, the HeatChoice must be inserted in line with the A-coil, with the HeatChoice deflector centered on the inverted “A” and as close as possible to the coil inverted A “top”.
6. Cut the HeatChoice insert hole into the plenum at the predetermined location. The size of this hole will depend upon the HeatChoice model. The last digit of the model number indicates the width.
  - 15” model - 8”x15 ¼” hole
  - 18” model - 8”x18 ¼” hole
7. When handling or inserting the actual HeatChoice unit, verify the element or the element fins do not become bent and the sensor probe is parallel with the top element. **These probes must be approximately 1½” from element fin.**
8. Extend the “V” channel to butt against the plenum surface opposite the insert hole.
9. Insert the HeatChoice unit making sure the center deflector has its point toward the furnace. Verify that the unit is completely inserted so the air will flow between the element mounting plate and the front panel. Mount the unit to the plenum.
10. Verify that there is a tight air seal around the HeatChoice off-peak conversion unit and the plenum. Verify that the unit is rigidly supported and there is no vibration when the blower motor is operating.

**Note:** If the mechanical contractor has responsibility for this job (sold the unit), he must return to perform the POWER ON start-up test and fill out the certification data sheet. The job is not complete until there is a thorough verification of proper operation.

# ELECTRICAL HOOKUP

**Note:** All heat/cool functions for this dual heat system originate from a standard 4-wire (heat/cool) room thermostat. Do not install with a 2-stage heat/1-stage cool or a heat pump room thermostat. Also do not install using two individual thermostats.

1. **24Ø VOLT SOURCE** - Route and wire from the appropriate service entrance panel directly to the HeatChoice circuit breakers, use only **copper** connected to breakers. The service entrance disconnect and 24Ø volt wire shall be sized according to the HeatChoice nameplate rating. The circuit breakers within this unit qualify as the appropriate local disconnect.
  - If using single-feed wiring (15 or 20 kW), optional CB bus bars are available, order **EM-5716** (25 kW, EM-5717).
2. **GROUNDING** - Route and install the appropriate size conductor wire between the HeatChoice lug labeled "ground" and the building service entrance panel ground bus. Use NEC code requirements for grounding wire size. The conduit is not a sufficient ground conductor.



3. **CONTROL WIRING** (reference schematic ES201) – The section assumes gas furnace has an appropriate fan center or appropriate equivalent wiring terminals with 40VA or larger integral transformer and blower relay with "G" function.
  - a. Room thermostat – use only basic 4-wire, heat/cool type. Route the standard R, W, G, Y roomstat screw functions to the HeatChoice DHC control board top tab/screw terminal adapters. Use wire to wire same letter connection.
  - b. Air conditioning, outdoor unit – this should be a 2-wire hookup, typically represents the contactor coil. Connect one wire to the top "Y2" terminal and the second to a bottom "C" terminal.
  - c. Gas (or oil with fan center) furnace – the furnace should have a 4 or 5-wire terminal block and match the control board bottom four terminals – R, W, G, C.
    - The furnace may also contain a "Y" screw, this is only needed if it is a variable speed (DC

- drive) furnace, see next section.
- Depending upon furnace manufacturer, the common may have various letter terminology – C, B, X. “C” is 24-volt common for this product.
- d. Utility load control – extend the two blue wires to an appropriate set of wires or contact closure within the power company control receiver. For electric energy operation (off-peak) the two blue wires represent a contact closure as shipped. **Do not apply external voltage or external power to the blue wires, they are simply looking for a closed contact during off-peak.**
  - Optional – where load management interrupt does not apply simply leave the two blue wires tied together and wire nutted.
  - If load control reverse logic is required, call factory.
- 4. BLOWER CONTROL – this is handled within the 4 (or 5) wire connection between the DHC control board bottom and the gas furnace hookup. The HeatChoice DHC control board allows the blower to turn off and operate under the control of the gas furnace during standby or utility interrupt. During cooling the DHC logic keeps the blower running during utility air conditioning interrupt to circulate summer air.
  - a. Delay on/off – within the DHC logic, the blower turns on with an approximately 10 second delay. At the end of the thermostat heat cycle, the blower must continue to operate for at least 30 seconds to cool off the HeatChoice metal rod electric elements.
  - b. Purge cycles – effective version 2-03-05, there is a 1-minute delay before allowing a gas furnace W input in order to allow the furnace blower to cool off the HeatChoice elements. Also there is a built-in delay before turning on the electric elements after the gas furnace has been on.
  - c. Thermostat “G” function – do not connect the thermostat G wire directly to the gas furnace G screw. The thermostat G wire must pass through the HeatChoice DHC module from top point to the bottom point.
- 5. DOWNFLOW OR HORIZONTAL ONLY - HI-LIMIT PROBE EM5714 (shipped loose in control box cabinet) – Install probe as close as possible below Electro-Mate on the right side, see drawing EA104. Within the upper right portion of the main control box locate one of the two wire nuts that join a red wire from the right hi-limit probe to a red/white wire from the DFC wire harness, see drawing ES201. Remove wire nut, route, and connect in series to this additional hi-limit probe’s red wires.

## POWER ON, STARTUP

1. Use the airflow verification procedure within the attached warranty certification form. If you experience hi-limit cycling or plenum temperatures greater than specified, this must be corrected before leaving the site. Correction can include verification of proper placement within the plenum, plenum deflectors/baffles (previous diagrams), increasing overall furnace airflow capacity, enlarging furnace blower, **or** disconnecting lower elements to reduce the heating capacity. To disconnect elements, simply remove (starting with lower left element) the element wire going to the hi-limit. Tape off and protect both the element end and the removed wire.
2. Using general heating and utility load control experience, cycle the HeatChoice with the roomstat and load control receiver functions.
  - The blower must come on within 30 seconds and the blower will continue approximately 1 minute after termination of the heat cycle. The blower function from the HeatChoice will also terminate during load control. It is expected the gas furnace will do its own blower control during standby.
3. Check blower current, compare to nameplate reading and verify blower motor is not being overloaded.
4. Complete the warranty certification form and return to Electro Industries, address or fax shown.
5. Recheck all electrical connections and screws for tightness, including factory wiring.

## OPERATIONAL TIPS

1. **MANUAL HI-LIMIT RESET** – Located behind the hinged control board door is a 250°F manual reset. This breaks the circuit for all electric elements. However, connected in the same circuit loop is the automatic reset 170°F hi-limit. Normally the automatic reset should always take care of any overheat condition prior to popping the manual reset. Therefore, you should not experience a manual reset condition unless there has been a true hardware failure.

**Two exceptions** – a standby furnace (or wood furnace) having an outlet temperature greater than 250°F or cold startup without blower.

Because of the sensitivity of this capillary manual reset, anytime there is a blower failure when the elements come on you can expect a manual reset.

2. The front panel normal/standby switch allows the user to condition the system to select energy source. This can be used for repair or troubleshooting of the furnace or simply “Power of Choice” selection.

3. DHC module indicators

Front panel amber LED – illuminates during electric heating mode.

Green LED (inside, next to fuse) – indicates 24-volt source from furnace and non-blown fuse.

Red LED (inside top) – room thermostat call for heat.

Amber LED (inside, next to connect/harness) – illuminated when load management receiver is in electric or off-peak mode.

Red LED (inside bottom) – gas furnace W is receiving 24V.

Red LED (inside left, next to HL red/wht wires) – 160° hi-limit is open.

NOTE: The DHC control module contains a 2 amp fuse. Use AGS-2 or equivalent (UFUSE0440) for replacement.

4. **BLOWER RESPONSE** - The blower has an approximate 15 second turn-on delay and will continue from 45 seconds to one minute after electric element power is turned off via the room thermostat. This is necessary to properly cool off the elements.

5. **SYSTEM TEMPERATURE RISE** - The overall temperature rise (both sides of HeatChoice) must be within the maximum specification, see "SPECIFICATIONS - TABLE 1". If any portion of the plenum (above elements) is operating with an air temperature greater than 125°F, element life will be shortened.

- **CFM CALCULATIONS, THIS HEATCHOICE** - By measuring the temperature rise across the HeatChoice, the actual CFM can be quite accurately determined. If you are having difficulty sustaining hi-limit operation, it may be a good idea to calculate the CFM according to this formula. To arrive at a stable output temperature, you can turn off CB #2 and operate only as stage one. This will allow you to verify or calculate the CFM without reaching hi-limit cycling. The accuracy of this formula will depend upon uniform and average temperature rise plenum thermometer readings and the accuracy of both the clamp-on amp meter and AC voltmeter. NOTE: The volts x amps x 3.4 value is the same as Btuh output.

$$\text{CFM} = \frac{\text{Volts} \times \text{Amps} \times 3.4}{\text{Temperature Rise} \times 1.08}$$

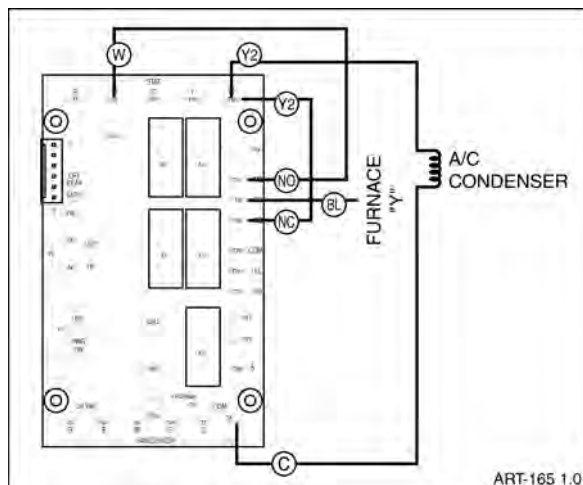
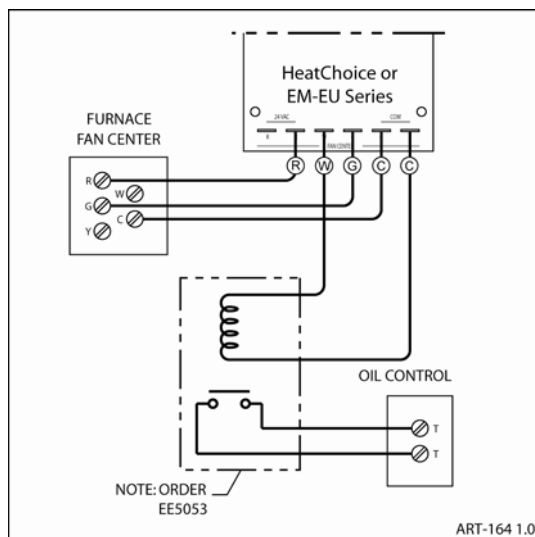
- **CALCULATED CFM, OIL/GAS FURNACE** - By measuring the temperature rise across the existing furnace, the CFM can be approximated. The accuracy of this formula will depend upon the estimated or determined Btuh output (actual heat energy across the furnace). You cannot use nameplate Btuh values. You must use a realistic estimated or measured true OUTPUT Btuh.

$$\text{CFM} = \frac{\text{Btuh (output)}}{\text{Temperature Rise} \times 1.08}$$

6. SPECIAL STANDBY FURNACE AND CERTAIN PLENUM WIDTH CONDITIONS - As we continue gathering installation experience, we are seeing several over temperature situations reoccurring. The intent of this paragraph is to provide additional help for four specific plenum conditions:
- Large burner pot oil furnace with the HeatChoice installed less than about 6" from the top of the heat exchanger/fire pot.
    - Install from either the back or front (inline with the flue or burner)
  - HeatChoice installed from either side of an oil furnace.
    - Locate as high as possible above the oil furnace, but realizing elements need to be inline or below take off ducts
  - Plenums width between 19" and 20½" without the use of side deflectors.
    - Add deflectors per drawing EH101, C-1
  - HeatChoice installed above an A-coil where the HeatChoice sits directly on top of the A-coil without side deflectors.
    - Add deflectors per drawing EH101, C-1

## ADDITIONAL APPLICATIONS

**Oil furnace** – isolation contacts are required at oil burner control “T and T” and terminals. If you do not have a fan center with proper isolated contact closure for “T and T”, you must add a relay as shown.



**Furnace variable speed blower** – a fifth wire connection may be needed to speed up the gas furnace blower for air conditioning and HeatChoice electric heating operation. Add jumper and the fifth wire to the gas furnace “Y” terminal as shown on the diagram.

**Note:** Connection wires shown are in addition to 4-wire thermostat and 4 wires to furnace.

Load Control, other Electro products – on HeatChoice control board, bottom right, connect blues to COM and EL.

**2-stage or variable burner gas** – most furnaces ignore or do not take W2 (or Rhuud “V”) action unless there is an input to W1. This means you can take a wire directly from 2-stage heat roomstat W2 to the furnace W2 and until the system is switched over to standby with the HeatChoice control board activating W1 there should be no furnace action.

**2-speed or 2-stage air conditioning** – load control action may be required with the outdoor unit Y2. This can be accomplished by routing the roomstat Y2 through a relay contact (onboard tabs) and the outdoor unit Y2.

- Roomstat Y2 – COM
- EL – outdoor unit Y2

**Wood furnace** – inlet air sensor required, must order and install EM5713 sensor for all non-automatic standby applications, reference drawing EH017. The heated air coming off of the wood furnace must be less than about 90° before the electric elements will activate.

**Large mass furnace heat exchanger, oil, etc.** – if there was an active standby heat call during the release of a load control back to electric, the heat build-up within the heat exchanger and the heating up of electric elements may initially produce an output temperature which exceeds the manual reset (250°). Normal tubular gas furnace heat exchanger should not be a problem because the electric element initial temperature delay is approximately 45 seconds. Adding EM5713 inlet air sensor (reference drawing EH017) between the heat exchanger and the HeatChoice unit will keep the electric elements off until the blower brings the heat exchanger down to approximately 90°.

**Fault sensor or automatic switchover, option** – a plug-in option, SOT-1, provides the standard 80-minute adjustable SOT and an interface relay with the necessary hookup drawing. This small plug-in device can automatically switch to standby furnace if there is a system fault associated with inadvertent circuit breaker, manual reset hi-limit, etc. If the HeatChoice unit is undersized (intentionally or unknown) this plug-in option will also automatically switch to standby heating if the HeatChoice electric unit cannot maintain temperature set point.

**Remote emergency or override switch** – a simple toggle switch can easily be remotely located and connected between the tabs marked “SB” and “C”. When this remote switch is closed, the system reverts to standby heating.

**Total electric** – in this case there probably is no utility load control receiver, simply keep the two blue wires shorted with wire nut and the furnace burner is probably disabled. The furnace is only used as a blower source. The 240 element power probably comes from the appropriate size CB breakers within the general service panel.

**Time-of-Use or Time-of-Day** – installation is basically the same as the previous dual heat/load management concept, except the 240 power source probably comes from CB’s within the single general service panel. The control for the blue wires can be an internal contact within the TOU meter or a user provided time clock with its time function coincident with the TOU on/off-peak time.

**Note 1:** When using an external time clock make sure the blue wires go to an isolated contact and make sure the time clock is not inadvertently providing line voltage to one of the blue wires. Line voltage will result in instant circuit board failure.

**Note 2:** Some TOU or limited off-peak internal control contacts (Xcel, Wisconsin) have N.O. = off-peak logic. In this case use an interposing relay to reverse logic (order EE5053). Application drawing AA009 provides this hookup.

**Heat pump** – this HeatChoice DHC control board has **no** provisions for heat pump operation or wiring. Typically if there is a heat pump involved with this system, this is the wrong plenum heater product. Contact factory or your local distributor for information on other models that include heat pump intelligent systems.

Notes:

1. If horizontal distribution is not equal, increase to 14".

2. Electro-Mate hole opening - 8" x 15" or 8" x 18".

3. Plenum size - if larger see figure C-1 or C-2.

	WIDTH	DEPTH
15" MODEL	15-17.5"	17.5-19"
18" MODEL	18-19"	17.5-19"

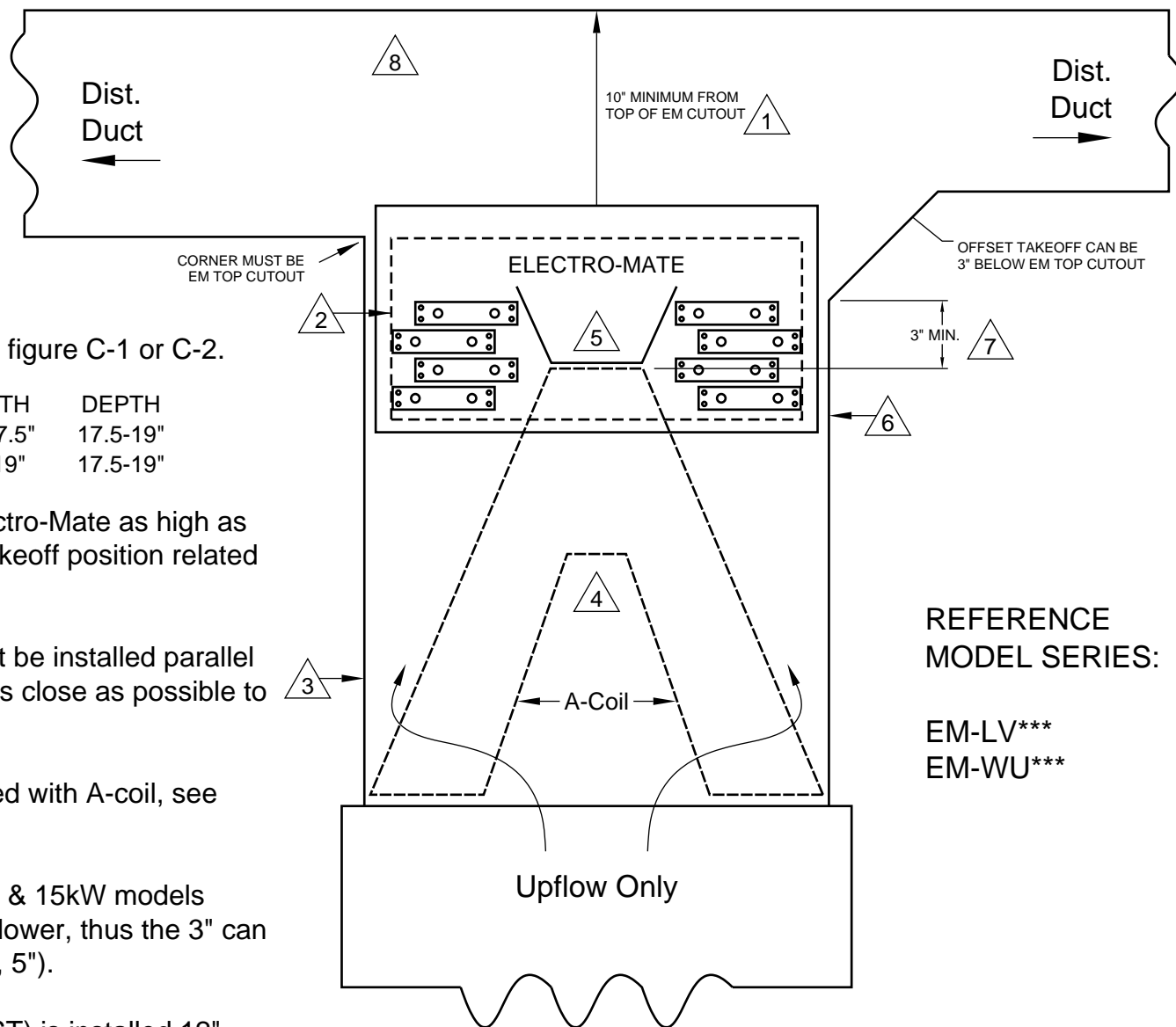
4. Without A-coil, install Electro-Mate as high as possible but maintain side takeoff position related to the elements.

5. The Electro-Mate "V" must be installed parallel to "A" frame of the coil and as close as possible to the A-coil top.

6. Side deflectors are required with A-coil, see figure C-1 and C-2.

7. Shown is 20kW model. 10 & 15kW models have the element stack 1.5" lower, thus the 3" can be considered 1" min (25kW, 5").

8. WarmFlo supply sensor (ST) is installed 12" above Electro-Mate enclosure, directly above elements.

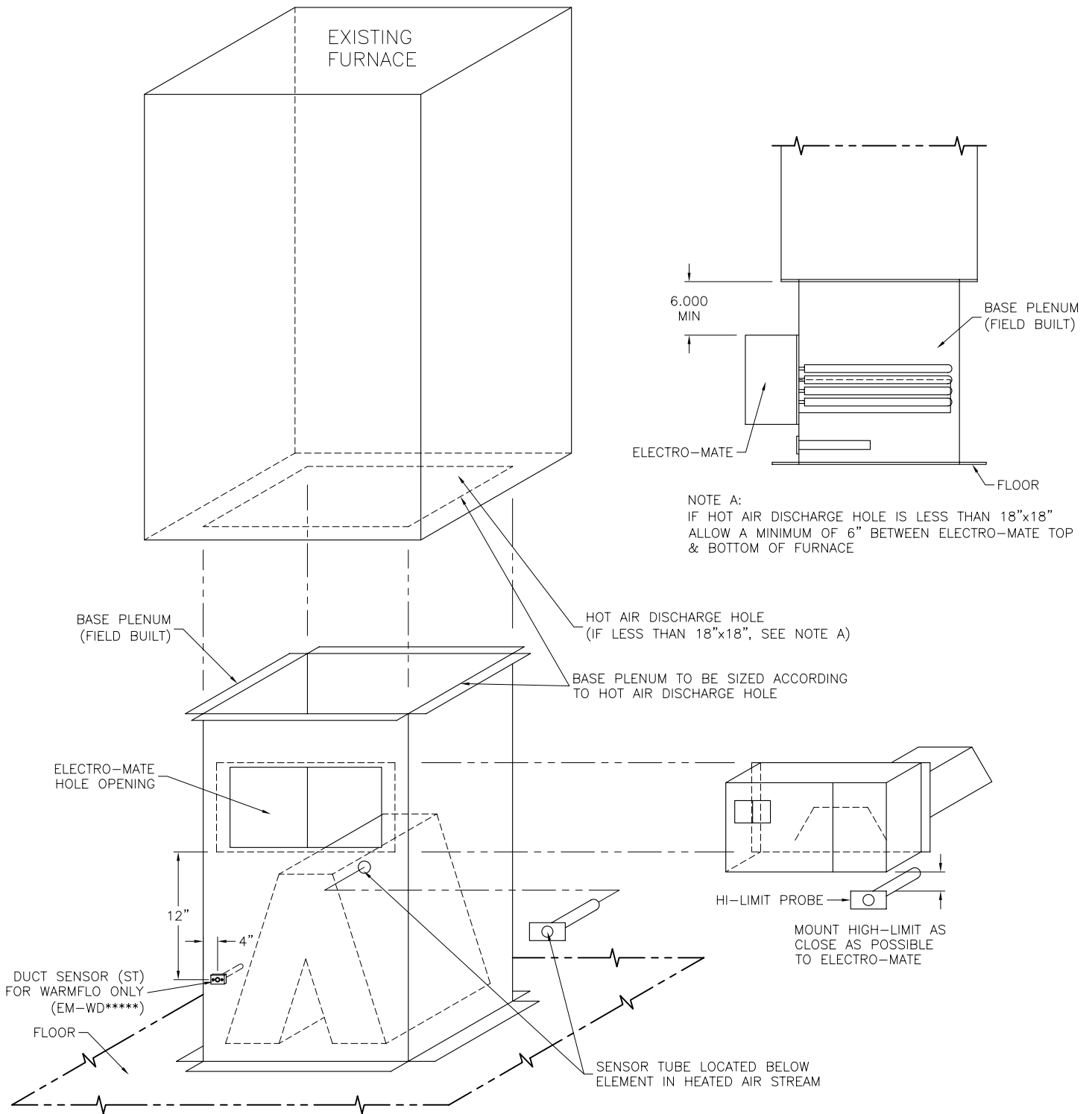


REFERENCE  
MODEL SERIES:

EM-LV\*\*\*  
EM-WU\*\*\*

$$CFM = \frac{AMPS \times VOLTS \times 3.414}{1.08 \times TEMP. DIFF.}$$

# ELECTRO-MATE DOWNFLOW INSTALLATION (NON - HEAT PUMP)



H:\Drawings\EA\EA111.dwg - 12/23/2004 7:25:35 AM

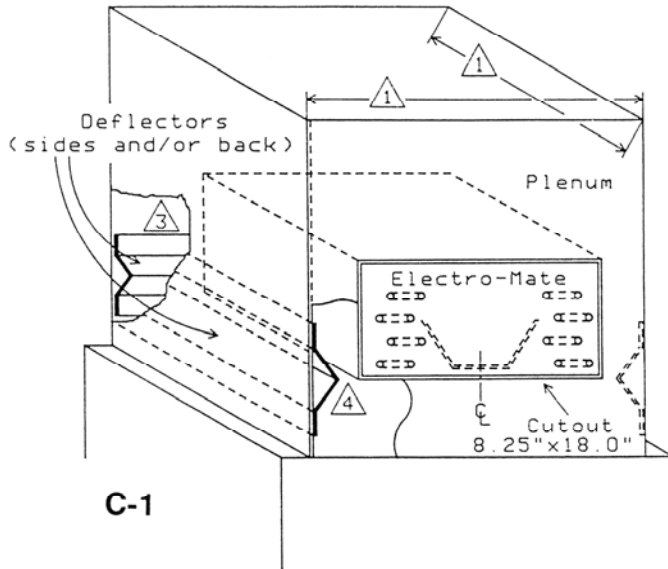


ELECTRO INDUSTRIES, INC.  
MONTICELLO, MN 55362

EA111  
12-23-04



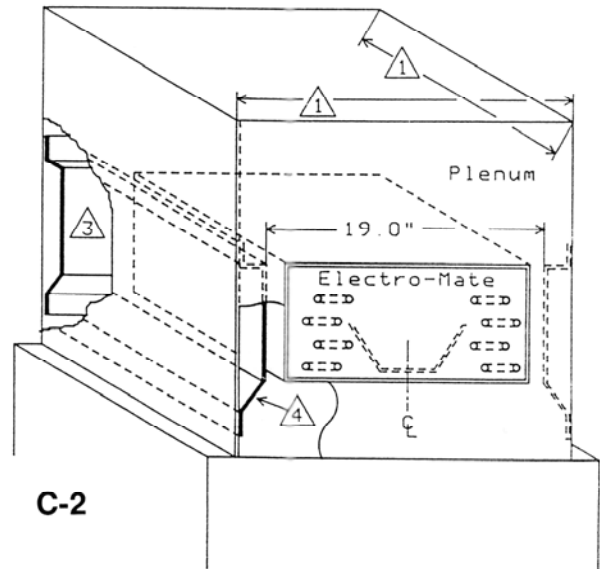
**Figure C — LARGE PLENUMS, REQUIRED BAFFLING**



**C-1**

**NOTES:**

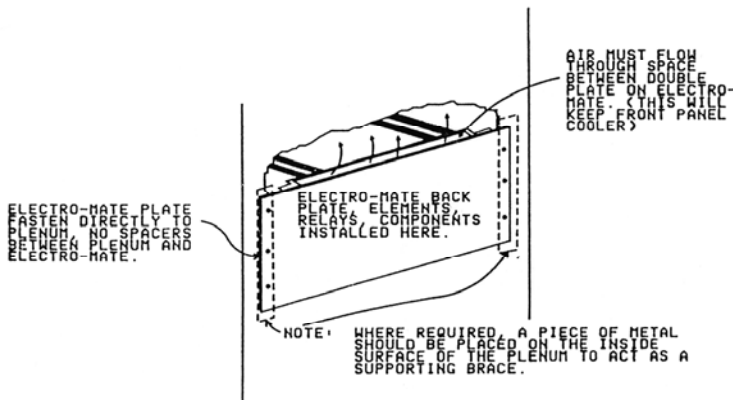
1. Any plenum larger than 19" (width or depth) require special deflectors. Use the following:
  - A. Any side 19 to 20½, use kit A, P/N EM5750.
  - B. Any side 21 to 22½, use kit B, P/N EM5751.
  - C. Any side larger than 23, refer to C-2.
2. Side deflectors are extremely important for A-coil installations.
3. Space behind the elements must be closed.
4. Deflector points to bottom element.



**C-2**

**NOTES:**

1. Any plenum larger than 23" (width or depth) require special deflectors. These must be field constructed to provide an internal 19 x 19 box.
2. Side deflectors are extremely important for A-coil installations.
3. Space behind the elements must be closed.
4. Note angled slope (45°).



**Figure D — DOUBLE WALL COOLING CHAMBER**

Cool air from the blower must enter and pass between the two plates.

A = 02-13-97

Electro Industries, Inc. Monticello, MN 55362			
Date 11-24-87	Revision A	Drawn By	Approved
Description: Deflector requirements			EII Part # --
4044 & 4045			Drawing # EH101

# DUCT SIZING TABLE

DUCT CAP. CFM	DUCT DIAM IN.	Equivalent Friction Rectangular Ducts (In.)								
1	2	3	4	5	6	7	8	9	10	11
80	5.3	5x5	6x4	9x3						
100	5.8	6x5	7x4	10x3						
125	6.3	6x6	7x5	9x4	12x3					
150	6.8	7x6	8x5	10x4	15x3					
175	7.2	7x6	9x5	11x4	17x3					
200	7.5	7x7	8x6	10x5	13x4	19x3				
225	7.9	8x7	9x6	11x5	14x4	21x3				
250	8.2	8x7	10x6	12x5	16x4	23x3				
275	8.5	8x8	9x7	10x6	13x6	17x4	25x3			
300	8.8	8x8	9x7	11x6	14x5	18x4	27x3			
350	9.3	9x8	11x7	13x6	16x5	21x4	32x3			
400	9.8	9x9	10x8	12x7	14x6	18x5	24x4	36x3		
450	10.2	10x9	11x8	13x7	15x6	19x5	26x4	40x3		
500	10.7	10x10	11x9	12x8	14x7	17x6	21x5	28x4	44x3	
550	11.0	10x10	11x9	13x8	15x7	18x6	23x5	32x4	48x3	
600	11.4	11x10	12x9	14x8	16x7	20x6	25x5	35x4	52x3	
650	11.8	11x11	12x10	13x9	15x8	17x7	21x6	27x5	37x4	
700	12.1	11x11	12x10	14x9	16x8	18x7	22x6	29x5	40x4	
750	12.3	12x11	13x10	15x9	17x8	20x7	24x6	30x5	42x4	
800	12.7	12x11	14x10	15x9	18x8	21x7	25x6	32x5	45x4	
850	13.0	12x12	13x11	14x10	16x9	18x8	21x7	26x6	35x5	
900	13.2	12x12	14x11	15x10	17x9	19x8	23x7	28x6	36x5	
950	13.6	13x12	14x11	16x10	18x9	20x8	24x7	30x6	38x5	
1000	13.9	13x12	15x11	16x10	18x9	21x8	25x7	31x6	40x5	
1100	14.3	13x13	14x12	16x11	18x10	20x9	23x8	27x7	33x6	43x5
1200	14.8	14x13	15x12	17x11	19x10	21x9	25x8	29x7	36x6	47x5
1300	15.2	14x14	15x13	16x12	18x11	20x10	23x9	26x8	31x7	39x6
1400	15.7	15x14	16x13	17x12	19x11	21x10	24x9	28x8	34x7	41x6

## NOTE:

If sizing is in question, always go to the larger duct for CFM in question.

Grilles and registers shall be sized according to manufacturers performance data capable of handling the CFM of the duct at a throw based on room dimensions. Return air registers should be selected to provide for 450 FPM face velocity.

The above capacities assume individual duct static pressures of less than about 0.1. If the static pressure is higher, assume considerably reduced CFM.

## EVALUATING AND SIZING DUCT WORK SYSTEMS

### Quickie Method

- The trunkline duct work off of the plenum should have 70 square inches per ton for the supply side
- The return air plenum should have 80 square inches per ton

### Standards Used

- Heat pumps require 400 CFM to 450 CFM per ton to operate
- Use a friction per 100 ft. of duct of .08 when sizing or evaluating supply duct work
- Use a friction per 100 ft. of duct of .06 when sizing or evaluating return air duct work
- Duct work is manufactured in 8 ft. lengths
- Rectangular duct work is normally 8 inches tall
- Return air grills are normally 8 inches high and the width of one or two joist spaces
- 7 inch round pipe will handle approximately 150 CFM
- 6 inch round pipe will handle approximately 100 CFM

### Tips

- Never go larger than a 3 to 1 ratio on rectangular duct work width to height when figuring a duct work system
- Common branch duct round pipe is either 6 inch or 7 inch
- Never use branch duct piping smaller than 6 inch round pipe when using a heat pump system
- Normal practice when sizing new duct work is to use a friction per 100 ft. of duct of .08 for the supply line duct work and .06 for the return line duct work
- When doing a retrofit job you will more likely have problems with the distribution of air to the rooms than the size of the duct work

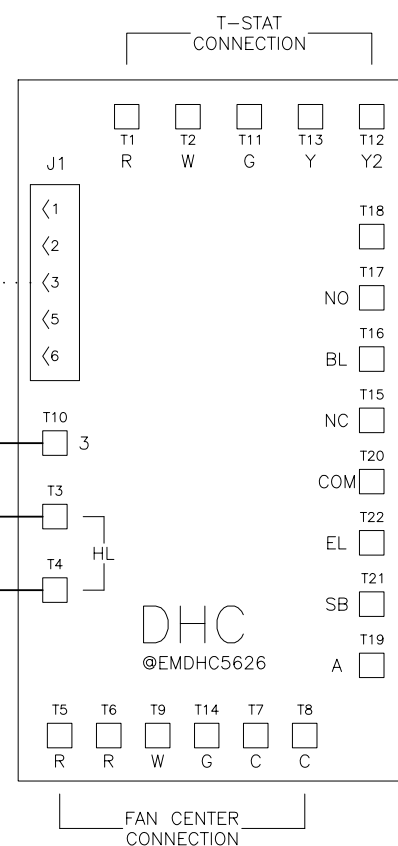
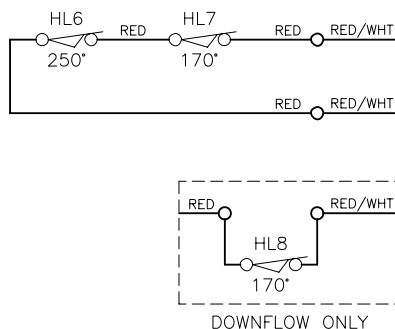
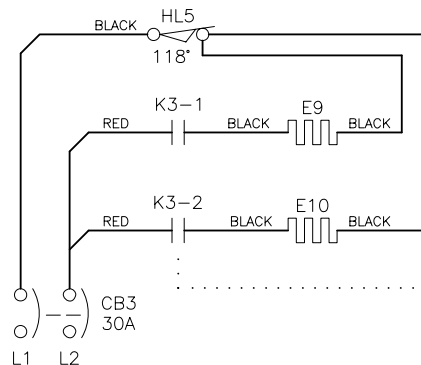
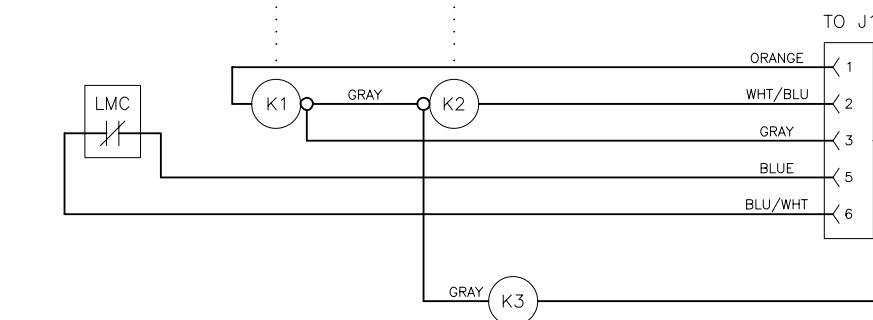
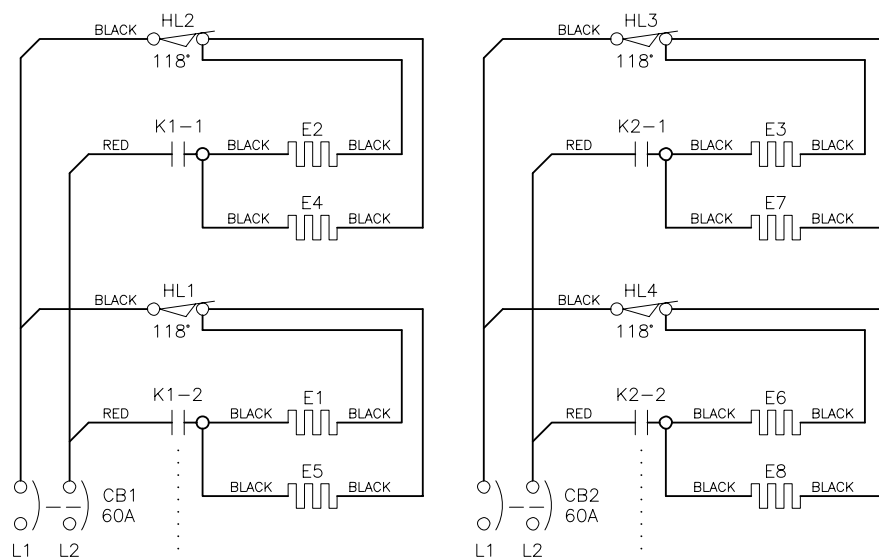
### Evaluating Existing Duct Work

1. Perform a heat loss/gain calculation on the structure and obtain the size system needed and the CFM needed per room.
2. Figure the total CFM needed for the system room by room or: 400 CFM minimum to 450 CFM maximum x heat pump system tonnage.
3. Figure the CFM that can be supplied with each trunkline leaving the plenum using the duct calculator with a friction per 100 ft. of duct of .08.
4. The total CFM that the trunkline(s) can handle must equal or exceed the CFM required by the heat pump system. If it is not, the duct work will have to be replaced or changed.
5. If the trunkline is large enough, subtract the heat loss/gain CFM (whichever is larger) needed per room, fed by the first section of trunkline from the total provided. Then figure the size of the next piece of trunkline for the remaining CFM.
6. The return air duct work must handle the CFM put out by the supply side of the system. Using the duct calculator, figure the amount of air that can be handled by the existing system. Use a friction per 100 ft. of duct of .06. Figure the trunklines first, then branch ducts.

ELECTRO INDUSTRIES, INC.  
2150 WEST RIVER STREET, P.O. BOX 538  
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(763) 295-4138

SYMBOL LEGEND

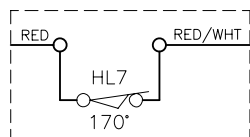
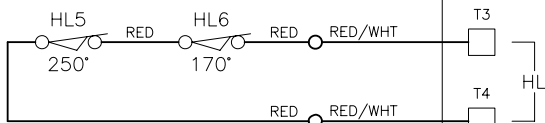
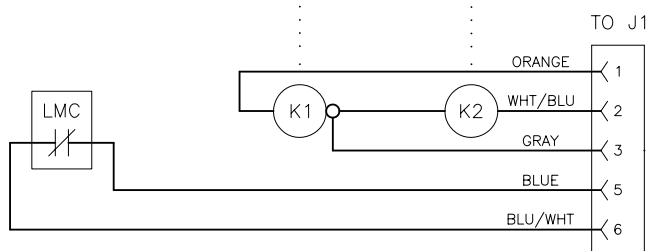
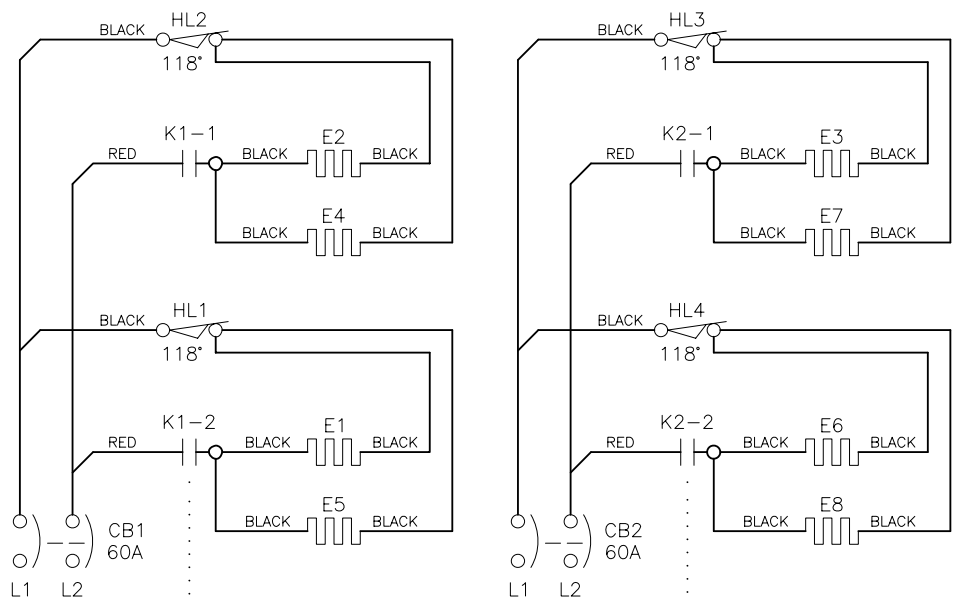
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Rev.A 10-19-05: Updated hi-limit temperature values.

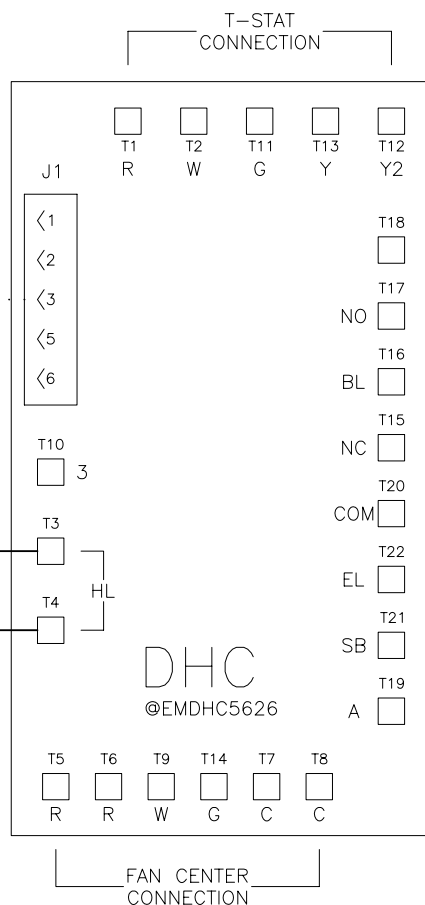
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EH-U25-8



DOWNFLOW ONLY

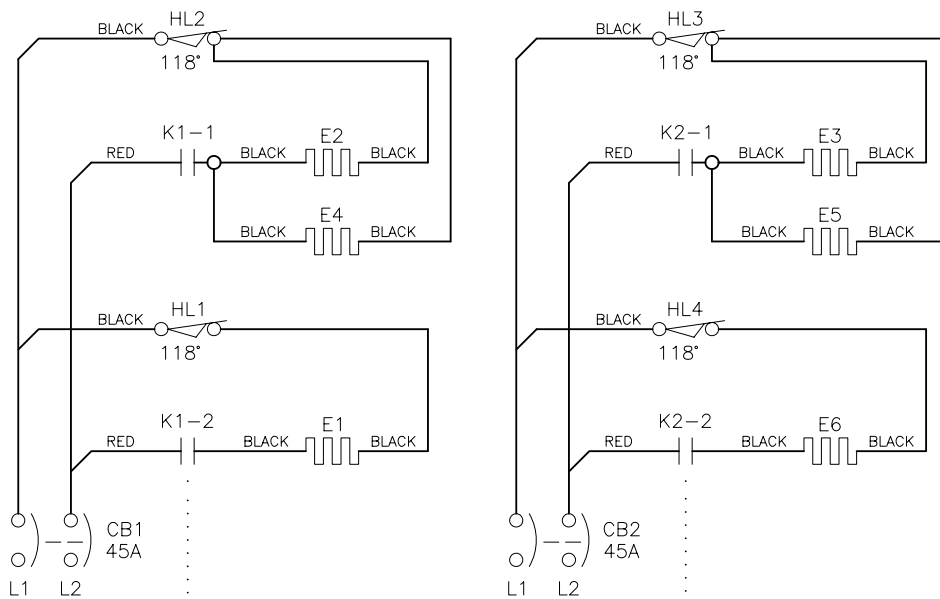
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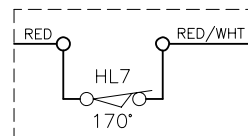
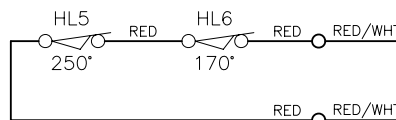
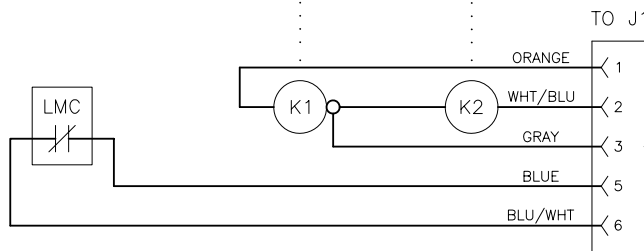
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Rev.A 10-19-05: Updated hi-limit temperature values.

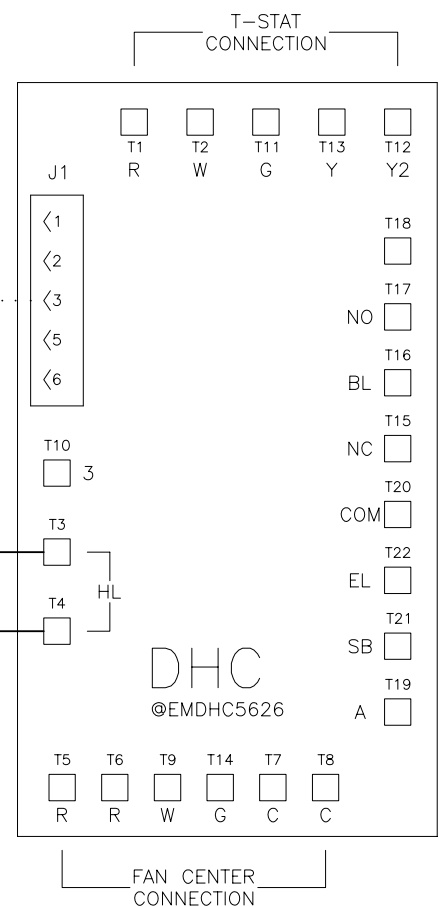
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	RELAY (COIL)
	TAB (CIRCUIT BOARD)



DOWNFLOW ONLY

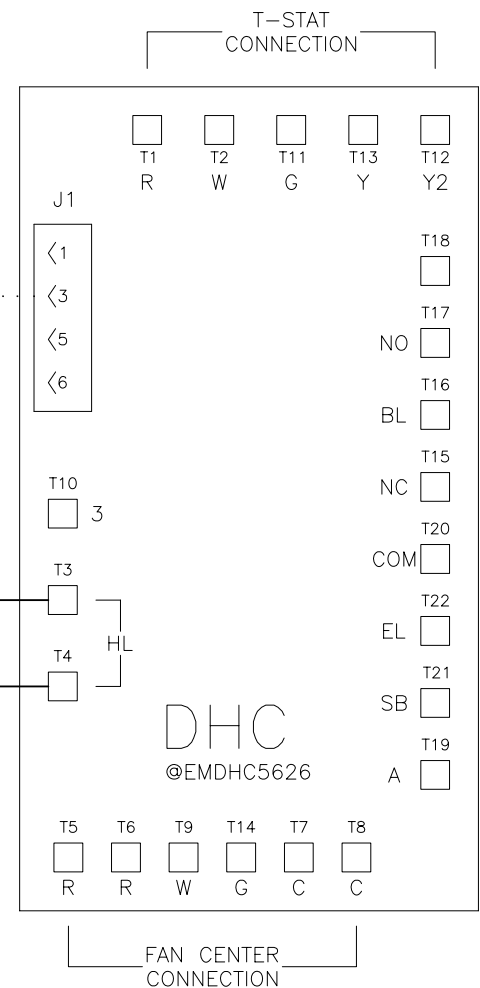
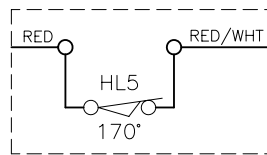
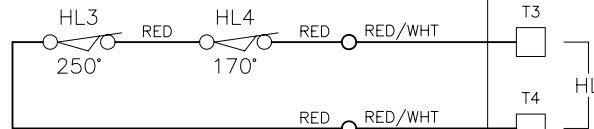
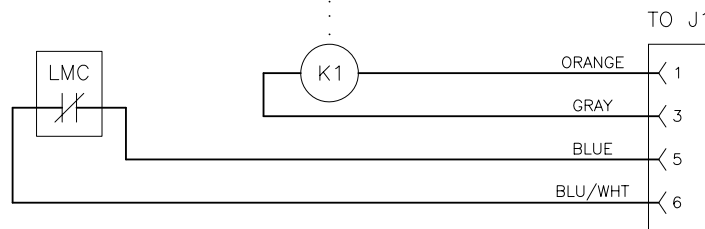
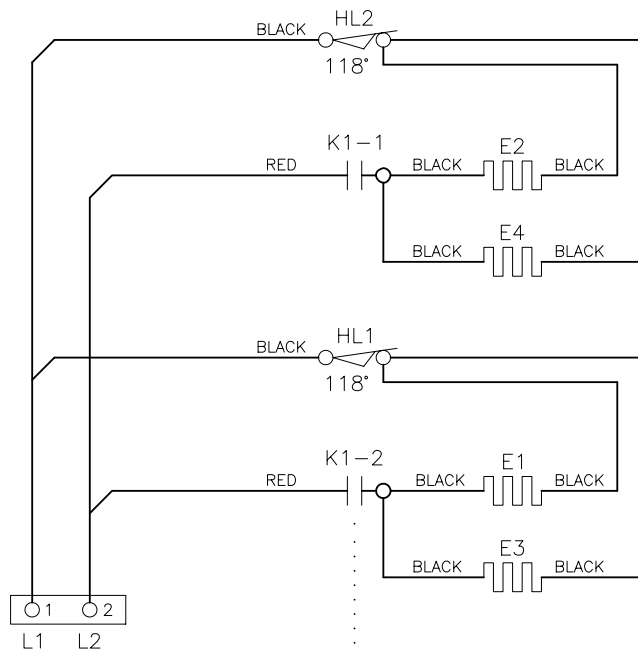


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Rev.A 10-19-05: Updated hi-limit temperature values.

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TB# 	TERMINAL BLOCK








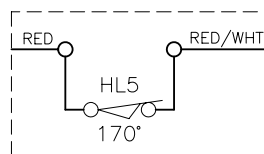
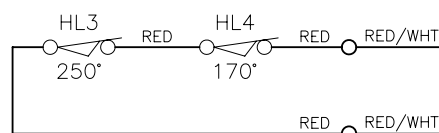
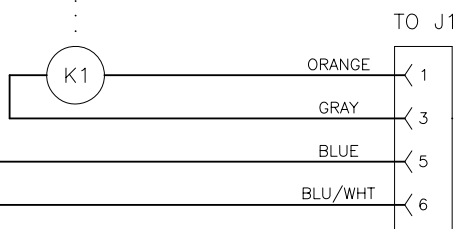
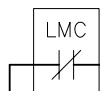
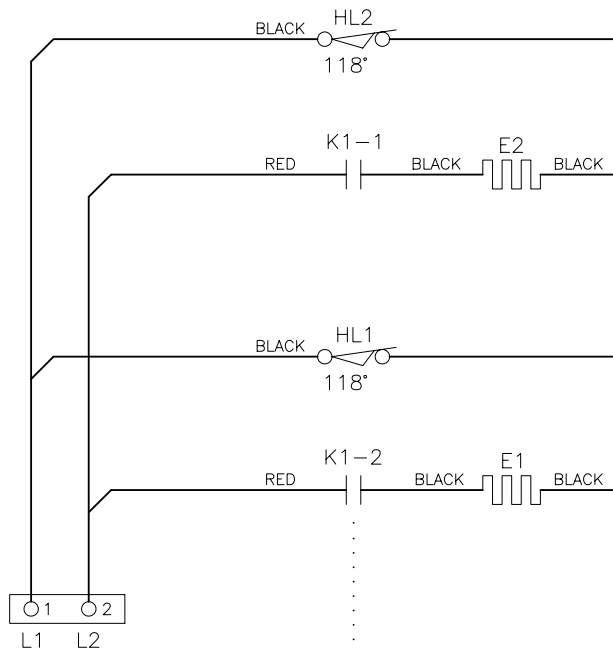
Rev.A 10-19-05: Updated hi-limit temperature values.

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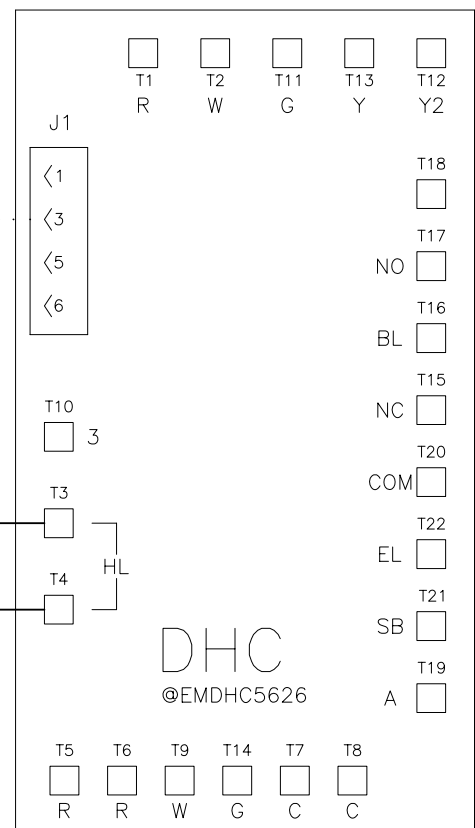
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K# K# 	RELAY (CONTACTS)
K# 	RELAY (COIL)
T# 	TAB (CIRCUIT BOARD)
TB# 	TERMINAL BLOCK



DOWNFLOW ONLY


T-STAT CONNECTION



FAN CENTER CONNECTION

EH-D05-5  
EH-D05-8  
EH-U05-5  
EH-U05-8

Rev.A 10-19-05: Updated hi-limit temperature values.

A10-19-05 REVISED		ELECTRO INDUSTRIES, INC. MONTICELLO, MN 55362		DESCRIPTION DIAGRAM, EH-*05-* WIRING SCHEMATIC	
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# **Electro Industries, Inc. Limited Product Warranty**

**Effective October 1, 2007**

Electro Industries, Inc. warrants to the original owner, at the original installation site, for a period of two (2) years from date of installation, that the product and product parts manufactured by Electro Industries are free from manufacturing defects in materials and workmanship, when used under normal conditions and when such product has not been modified or changed in any manner after leaving the plant of Electro Industries. If any product or product parts manufactured by Electro Industries are found to have manufacturing defects in materials or workmanship, such will be repaired or replaced by Electro Industries. Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Electro Industries may request that the materials be returned to Electro Industries at the owner's expense for factory inspection. The determination as to whether product or product parts shall be repaired, or in the alternative replaced, shall be made by Electro Industries or its authorized representative. Electro Industries will cover reasonable labor costs to repair defective product or product parts for ninety (90) days after installation.

## **TWENTY YEAR (20) LIMITED WARRANTY ON BOILER ELEMENTS AND VESSELS**

Electro Industries, Inc. warrants that the boiler elements and vessels of its products are free from defects in materials and workmanship through the twentieth year following date of installation. If any boiler elements or vessels are found to have a manufacturing defect in materials or workmanship, Electro Industries will replace them.

## **TWENTY YEAR (20) LIMITED WARRANTY ON SPIN FIN ELEMENTS**

Electro Industries, Inc. warrants that the spin fin elements of its products are free from defects in materials and workmanship through the twentieth year following date of installation. If any spin fin elements are found to have a manufacturing defect in materials or workmanship, Electro Industries will replace them.

## **FIVE YEAR (5) LIMITED WARRANTY ON OPEN WIRE ELEMENTS**

Electro Industries, Inc. warrants that the open wire elements of its products are free from defects in materials and workmanship through the fifth year following date of installation. If any open wire elements are found to have a manufacturing defect in materials or workmanship, Electro Industries will replace them.



**ELECTRO INDUSTRIES, INC.**

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## **THESE WARRANTIES DO NOT COVER:**

1. Costs for labor for removal and reinstallation of an alleged defective product or product parts, transportation to Electro Industries, and any other materials necessary to perform the exchange, except as stated in this warranty. Replacement material will be invoiced to the distributor in the usual manner and will be subject to adjustment upon verification of defect.
2. Any product that has been damaged as a result of being improperly serviced or operated, including, but not limited to, the following: operated with insufficient water or airflow, allowed to freeze, subjected to flood conditions, subjected to improper voltages or power supplies, operated with airflow or water conditions and/or fuels or additives which cause unusual deposits or corrosion in or on the product, chemical or galvanic erosion, improper maintenance or subject to any other abuse or negligence.
3. Any product that has been damaged as a result of natural disasters, including, but not limited to, the following: lightning, fire, earthquake, hurricanes, tornadoes or floods.
4. Any product that has been damaged as a result of shipment or handling by the freight carrier. It is the receiver's responsibility to claim and process freight damage with the carrier.
5. Any product that has been defaced, abused, or suffered unusual wear and tear as determined by Electro Industries or its authorized representative.
6. Workmanship of any installer of the product. This warranty does not assume any liability of any nature for unsatisfactory performance caused by improper installation.
7. Transportation charges for any replacement part or component, service calls, normal maintenance; replacement of fuses, filters, refrigerant, etc.

## **CONDITIONS AND LIMITATIONS:**

1. If at the time of a request for service the original owner cannot provide an original sales receipt or a warranty card registration then the warranty period for the product will have deemed to begin thirty (30) days after the date of manufacture and **NOT** the date of installation.
2. The product must have been sold and installed by a licensed electrical contractor, a licensed plumbing contractor, or a licensed heating contractor.
3. The application and installation of the product must be in compliance with Electro Industries' specifications as stated in the installation and instruction manual, and all state and federal codes and statutes. If not, the warranty will be null and void.
4. The purchaser shall have maintained the product in accordance with the manual that accompanies the unit. Annually, a qualified and licensed contractor must inspect the product to assure it is in proper working condition.
5. All related heating components must be maintained in good operating condition.
6. All lines must be checked to confirm that all condensation drains properly from the unit.
7. Replacement of a product or product part under this limited warranty does not extend the warranty term or period.
8. Before warranty claims will be honored, Electro Industries shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Remedies under this warranty are limited to repairing or replacing alleged defective product or product parts. The decision whether to repair or, in the alternative replace, products or product parts shall be made by Electro Industries or its authorized representative.

**THESE WARRANTIES DO NOT EXTEND TO ANYONE EXCEPT THE ORIGINAL PURCHASER AT RETAIL AND ONLY WHEN THE PRODUCT IS IN THE ORIGINAL INSTALLATION SITE. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.**

**ALL IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED WITH RESPECT TO ALL PURCHASERS OR OWNERS. ELECTRO INDUSTRIES, INC. IS NOT BOUND BY PROMISES MADE BY OTHERS BEYOND THE TERMS OF THESE WARRANTIES. FAILURE TO RETURN THE WARRANTY CARD SHALL HAVE NO EFFECT ON THE DISCLAIMER OF THESE IMPLIED WARRANTIES.**

**ALL EXPRESS WARRANTIES SHALL BE LIMITED TO THE DURATION OF THIS EXPRESS LIMITED WARRANTIES SET FORTH HEREIN AND EXCLUDE ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM THE BREACH THEREOF. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. PRODUCTS OR PARTS OF OTHER MANUFACTURERS ATTACHED ARE SPECIFICALLY EXCLUDED FROM THE WARRANTY.**

**THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS WHICH VARY UNDER THE LAWS OF EACH STATE. IF ANY PROVISION OF THIS WARRANTY IS PROHIBITED OR INVALID UNDER APPLICABLE STATE LAW, THAT PROVISION SHALL BE INEFFECTIVE TO THE EXTENT OF THE PROHIBITION OR INVALIDITY WITHOUT INVALIDATING THE REMAINDER OF THE AFFECTED PROVISION OR THE OTHER PROVISIONS OF THIS WARRANTY.**