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# RT Models Split System Water-to-Air Heat Pumps: Engineering Data and Installation Manual

**Rev.: 21 May 2012D**
**P/N:** **20D085-01NN**

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## Revision Table:

| Date | By | Page | Note |
|---|---|---|---|
| 22 Oct 2012 | GT | 35 - 38 | Updated Solenoid Coil |
| 21 May 2012 | DS | 61 - 65 | Updated Troubleshooting Data |
| 15 May 2012 | DS | 51 | Updated Wiring Diagram |
| 27 Apr 2012 | DS | All | First published |

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**⚠ NOTICE ⚠**

**VERY IMPORTANT WARRANTY REGISTRATION INFORMATION LOCATED ON THE BACK COVER.**

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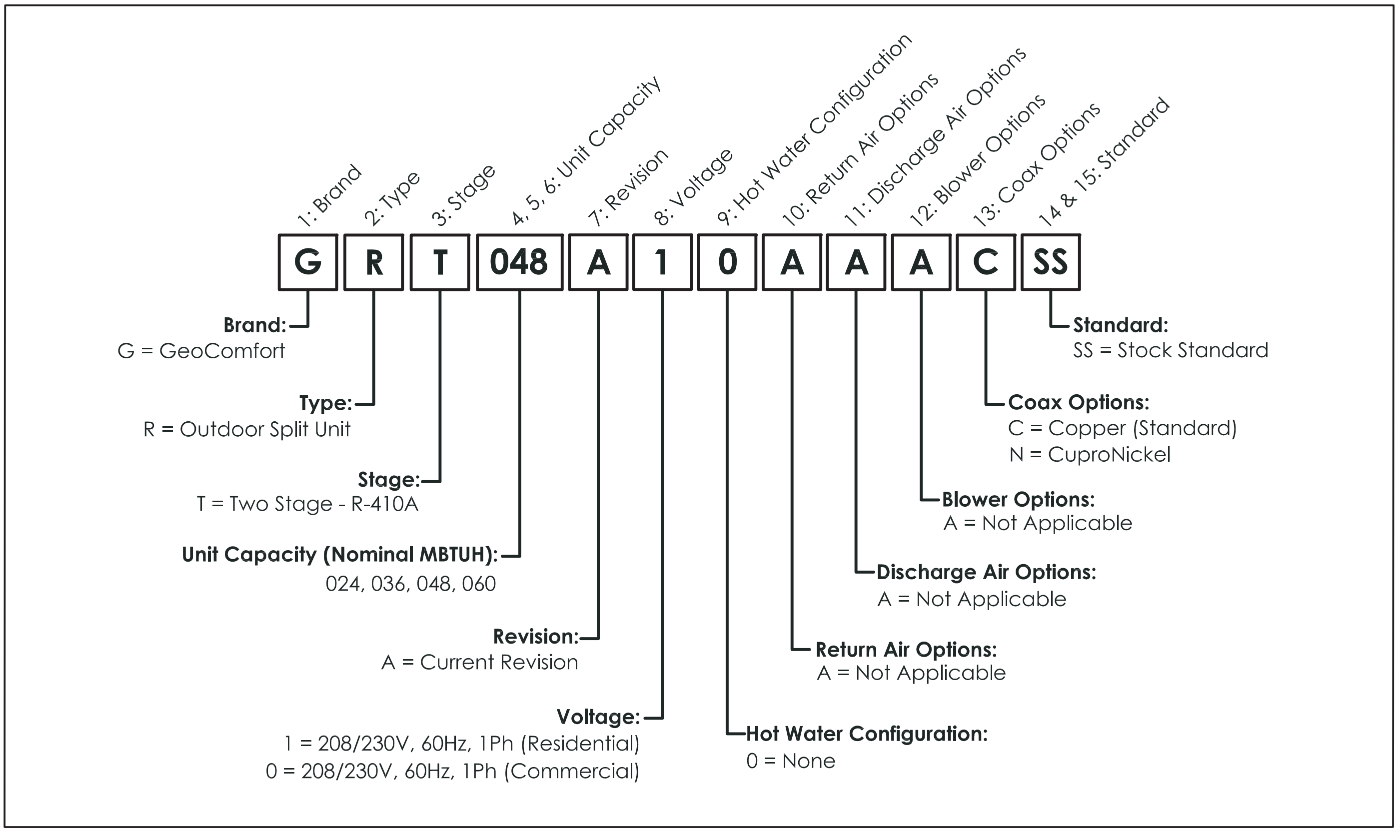
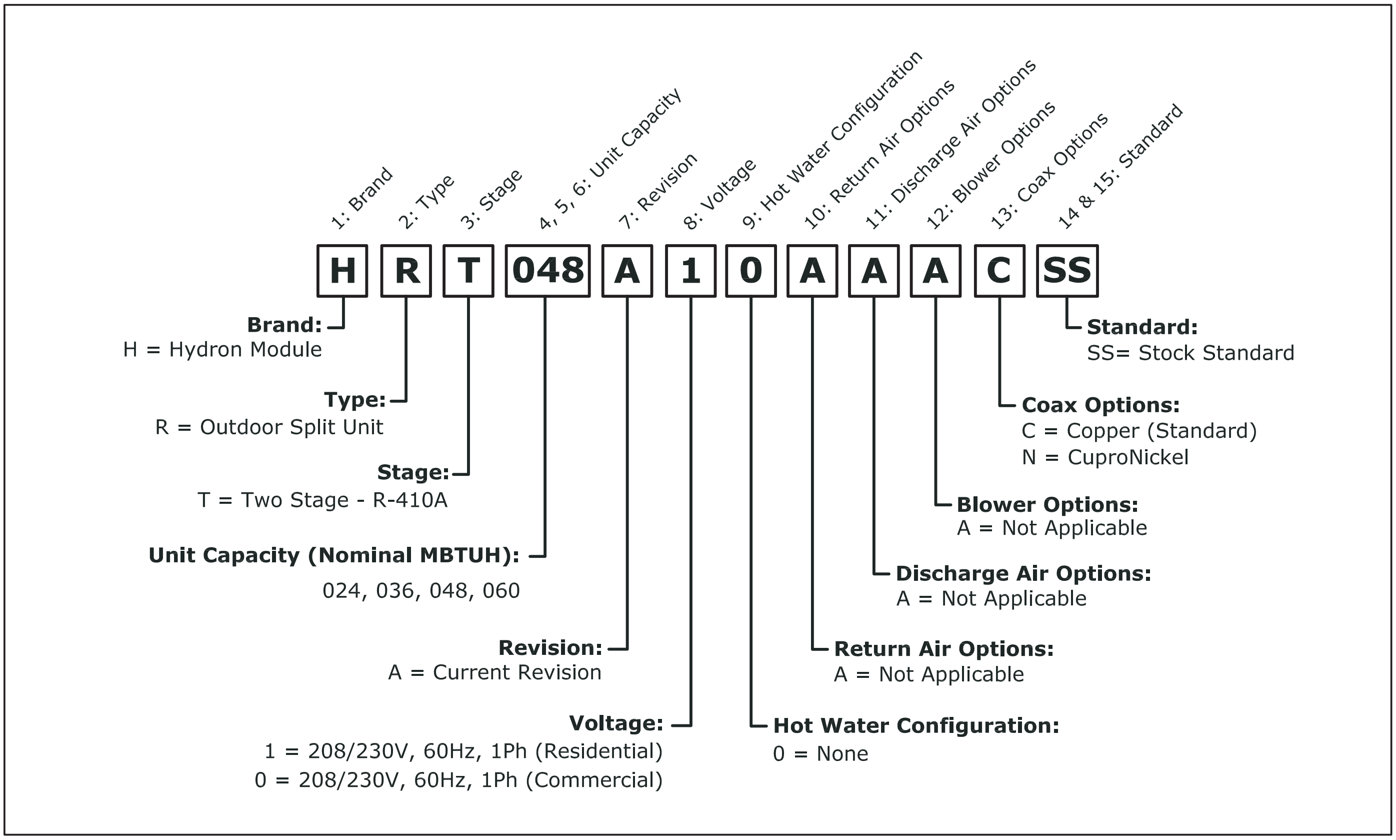
## Section 1a: GeoComfort® Model Nomenclature



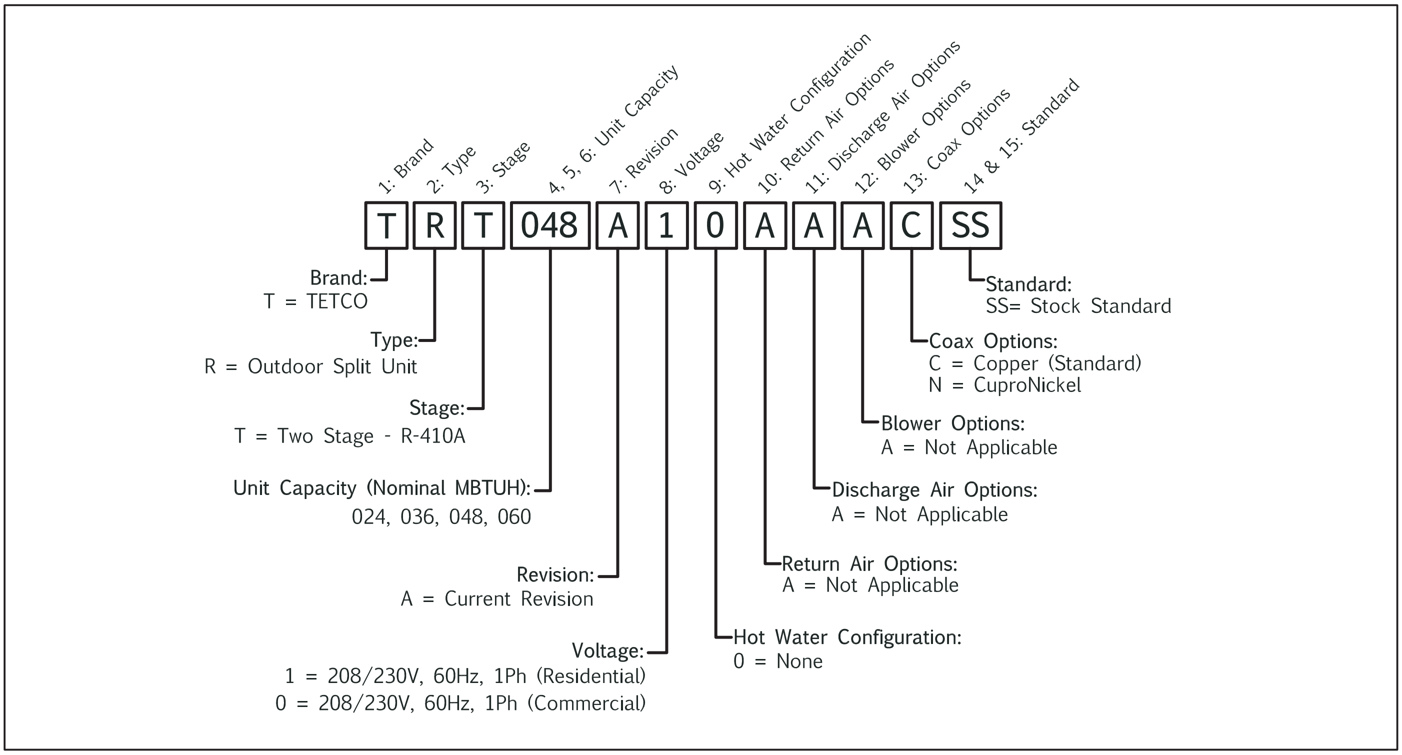

Rev.: 26 Oct. 2012E

## Section 1b: Hydron Module® Model Nomenclature




Rev.: 26 Oct. 2012E

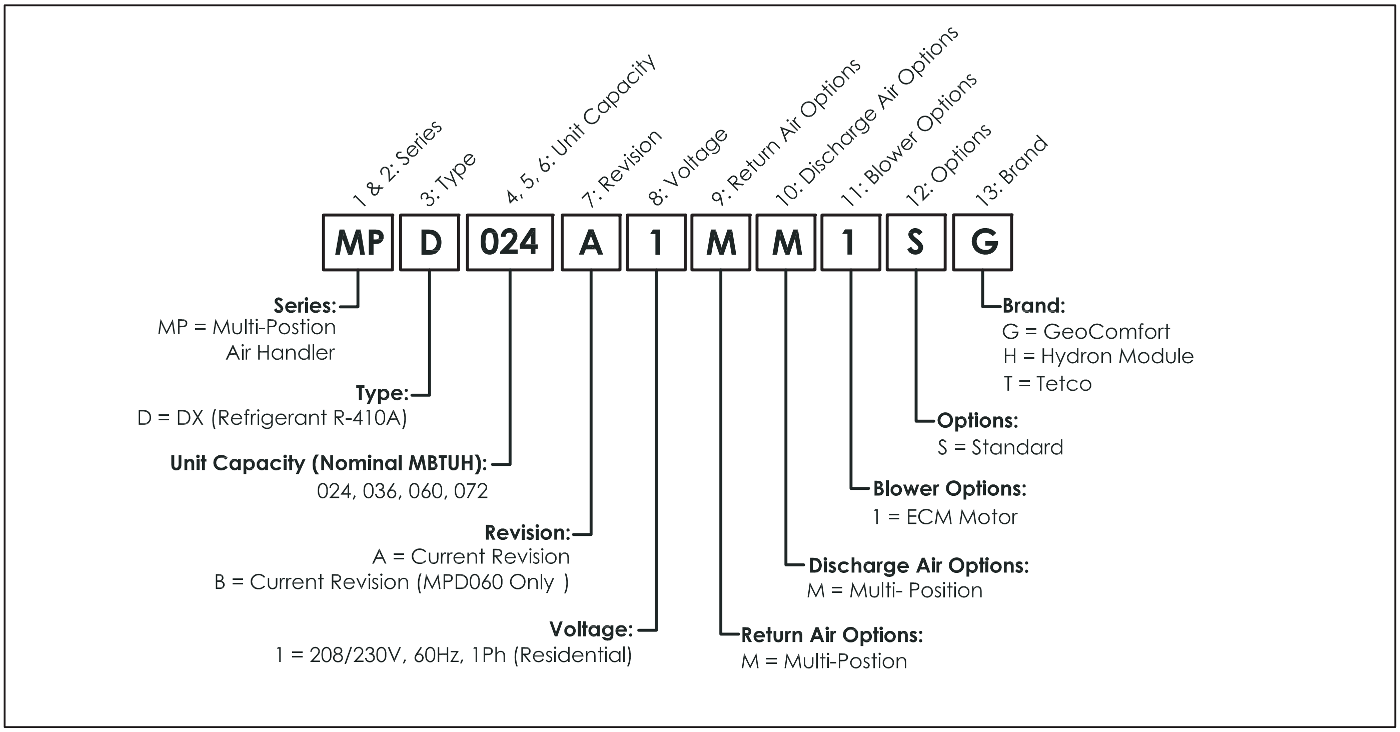
## Section 1c: TETCO® Model Nomenclature




Rev.: 26 Oct. 2012E

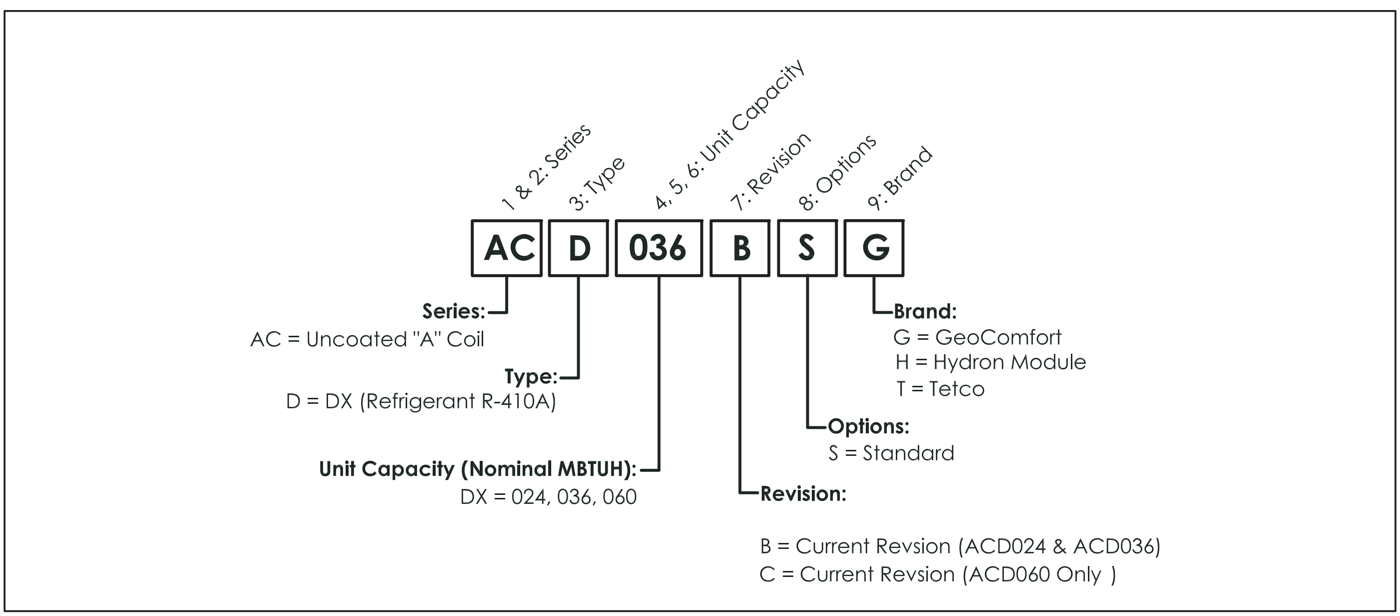
## Section 1d: Air Handler/"A" Coil Model Nomenclature

### Air Handlers




Rev.: 11 Oct. 2011E

### "A" Coils




Rev.: 14 Sep. 2011E

## Section 2: AHRI Performance Data

### Ground Loop Heat Pump

| MODEL | CAPACITY | HEATING | | COOLING | |
|---|---|---|---|---|---|
| | | Btu/hr | COP | Btu/hr | EER |
| RT024 | Full Load | 17,800 | 3.4 | 24,600 | 15.9 |
| | Part Load | 14,700 | 3.9 | 19,600 | 23.7 |
| RT036 | Full Load | 27,200 | 3.8 | 36,000 | 16.7 |
| | Part Load | 21,700 | 4.2 | 27,800 | 25.3 |
| RT048 | Full Load | 36,400 | 3.9 | 50,800 | 18.0 |
| | Part Load | 29,800 | 4.4 | 39,000 | 25.4 |
| RT060 | Full Load | 45,600 | 3.5 | 61,500 | 17.2 |
| | Part Load | 37,000 | 4.1 | 47,900 | 24.1 |

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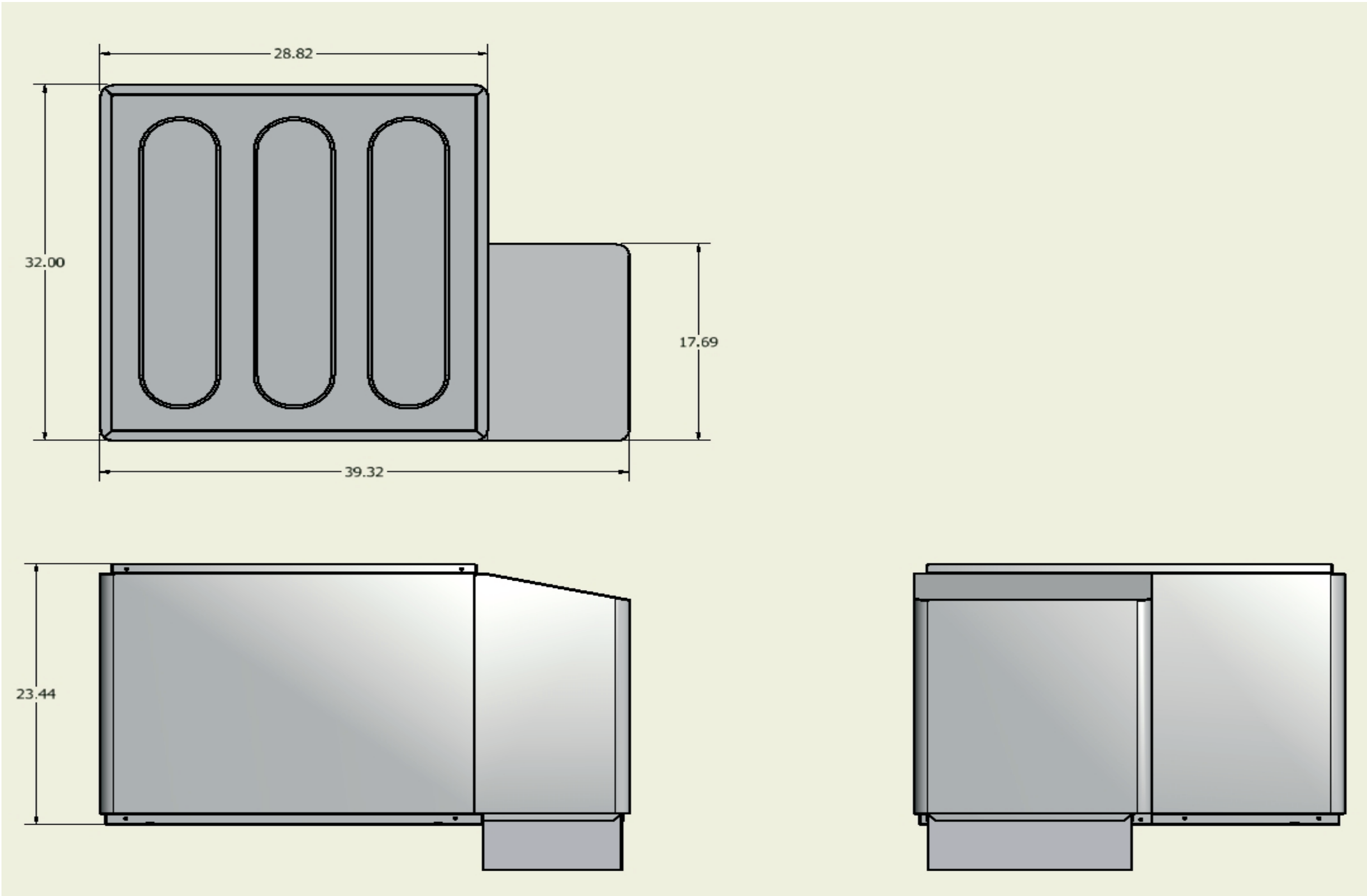
Note:
Rated in accordance with ISO Standard 13256-1 which includes Pump Penalties.
Heating capacities based on 68.0°F DB, 59.0°F WB entering air temperature.
Cooling capacities based on 80.6°F DB, 66.2°F WB entering air temperature.
Entering water temperatures Full Load: 32°F heating / 77°F cooling.
Entering water temperatures Part Load: 41°F heating / 68°F cooling.

## Section 3a: Unit Dimensional and Physical Data




| Model | Dimensional Data | | | Refrigeration Connection | | Water Loop* | | Unit Weight (Pounds) |
|---|---|---|---|---|---|---|---|---|
| | Height | Width | Depth | Liquid | Suction | IN | OUT | |
| 024 | 23.4 | 32.0 | 28.8 | 3/8” | 7/8” | 1” Double O-Ring | | 180 |
| 036 | 23.4 | 32.0 | 28.8 | 3/8” | 7/8” | | | 225 |
| 048 | 23.4 | 32.0 | 28.8 | 3/8” | 7/8” | | | 270 |
| 060 | 23.4 | 32.0 | 28.8 | 1/2” | 1-1/8” | | | 270 |

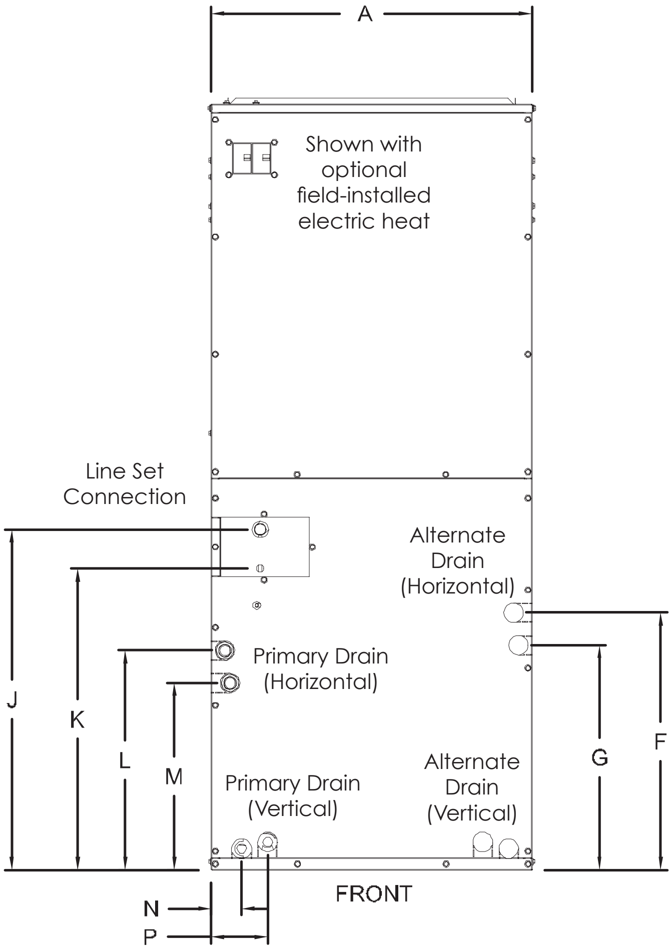
## AHRI Air Handler and “A” Coil Matches

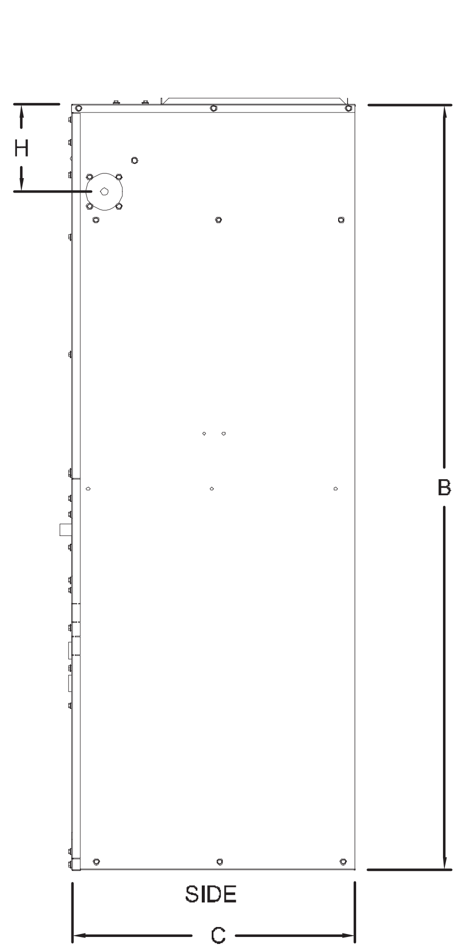
| Compressor Section | Air Handler Match | “A” Coil Match |
|---|---|---|
| 024 | MPD024A | ACD024B |
| 036 | MPD036A | ACD036B |
| 048 | MPD060B | ACD060C |
| 060 | MPD060B | ACD060C |

**⚠ NOTICE ⚠**

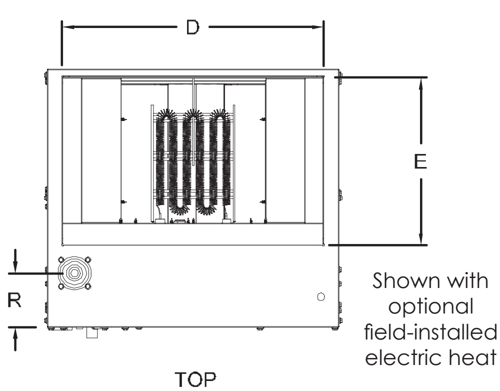
**WHEN MATCHING AN RT048 OR RT060 WITH AN MPD060B, REFER TO THE CFM CHART ON PAGE 50 FOR THE PROPER AIRFLOW JUMPER SETTINGS.**

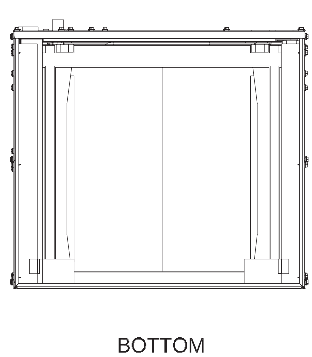
## Section 3b: Air Handler Dimensional and Physical Data



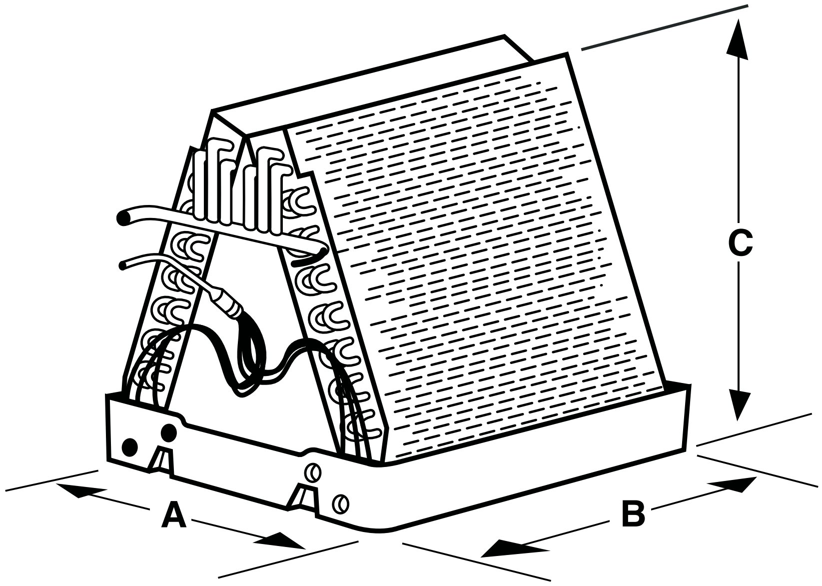

| Model | Size (tons) | All Dimensions in Inches | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | J | K | L | M | N | P | R |
| MPD024A | 2 | 17 5/8 | 43 | 21 | 15 5/8 | 12 1/2 | 13 1/2 | 11 | 6 3/4 | 16 3/4 | 14 | 11 | 10 3/4 | 2 | 1 1/2 | 5 |
| MPD036A | 3 | 21 1/8 | 48 | 21 | 19 | 12 1/2 | 14 1/2 | 13 | 6 3/4 | 20 | 17 | 12 3/4 | 10 1/4 | 2 1/4 | 4 3/8 | 5 |
| MPD060B | 4 - 5 | 24 5/8 | 58 7/8 | 21 3/4 | 22 1/4 | 14 1/4 | 19 3/4 | 17 1/4 | 6 3/4 | 26 | 23 | 16 3/4 | 14 3/8 | 4 1/4 | 4 3/8 | 4 1/2 |




| Return Air Opening | | |
|---|---|---|
| Model | Width | Depth |
| MPD024A | 15 1/2 | 19 3/4 |
| MPD036A | 19 3/4 | 19 3/4 |
| MPD060B | 23 1/2 | 20 3/4 |

## Section 3c: "A" Coil Dimensional and Physical Data




| Model | Size (tons) | All Dimensions in Inches | | | | |
|---|---|---|---|---|---|---|
| | | A | B | C | Liquid | Suction |
| ACD024B | 2 | 16 5/8 | 19 | 14 1/2 | 3/8 | 3/4 |
| ACD036B | 3 | 19 5/8 | 19 | 18 1/2 | 3/8 | 3/4 |
| ACD060C | 4 - 6 | 23 3/4 | 20 1/2 | 27 7/8 | 3/8 | 7/8 |

NOTES:
1. The AC series coils are designed as high efficiency "A" coils to be installed on new and existing indoor furnaces. These coils may be used in upflow and downflow applications.
2. Coils are ETL and CSA approved.
3. Primary and secondary drain connections are available on the LH or RH side of the drain pan, and are 3/4" FPT. Center line of drains located from pan corner, 1 1/2" for primary and 3 1/2" for secondary.
4. Drain pan is injection molded high temperature UL approved plastic.
5. All coils are equipped with factory-installed TXV, 15% bleed type.

**⚠ WARNING ⚠**

**IF USING A DUAL FUEL APPLICATION, "A" COIL MUST BE INSTALLED ON THE OUTLET OF THE FURNACE. INSTALLATION ON THE RETURN COULD CAUSE FURNACE HEAT EXCHANGER FAILURE, AND MAY VOID FURNACE WARRANTY.**

## Section 4a: Unit Electrical Data

| Model | Voltage Code | 60Hz Power | | Compressor | | Ext Loop Pump FLA* | Total Unit FLA | Min Circuit AMPS | Max Fuse HACR | Min AWG | Max Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | Phase | LRA | RLA | | | | | | |
| 024 | 0 | 208/230 | 1 | 58.3 | 11.7 | 4.0 | 15.7 | 18.6 | 30 | 14 | 41 |
| | 1 | 208/230 | 1 | 58.3 | 11.7 | 4.0 | 15.7 | 18.6 | 30 | 14 | 41 |
| 036 | 0 | 208/230 | 1 | 83.0 | 15.3 | 4.0 | 19.3 | 23.1 | 35 | 12 | 51 |
| | 1 | 208/230 | 1 | 83.0 | 15.3 | 4.0 | 19.3 | 23.1 | 35 | 12 | 51 |
| 048 | 0 | 208/230 | 1 | 104.0 | 21.2 | 5.5 | 26.7 | 32.0 | 50 | 8 | 96 |
| | 1 | 208/230 | 1 | 104.0 | 21.2 | 5.5 | 26.7 | 32.0 | 50 | 8 | 96 |
| 060 | 0 | 208/230 | 1 | 152.9 | 27.1 | 5.5 | 32.6 | 39.4 | 60 | 8 | 78 |
| | 1 | 208/230 | 1 | 152.9 | 27.1 | 5.5 | 32.6 | 39.4 | 60 | 8 | 78 |

Notes:
1. All line and low voltage wiring must adhere to the National Electrical Code and Local Codes, whichever is the most stringent.
2. Wire length based on a one way measurement with a 2% voltage drop.
3. Wire size based on 60°C copper conductor and minimum circuit ampacity.
3. All fuses class RK-5
4. Min/Max Voltage: 208/230/60/1 = 187/252
* The external loop pump FLA is based on a maximum of three UP26-116F-230V pumps (1/2hp) for 048 - 062 and two pumps for 024 - 038

## NOTE: Proper Power Supply Evaluation

When any compressor bearing unit is connected to a weak power supply, starting current will generate a significant “sag” in the voltage which reduces the starting torque of the compressor motor and increases the start time. This will influence the rest of the electrical system in the building by lowering the voltage to the lights. This momentary low voltage causes “light dimming”. The total electrical system should be evaluated with an electrician and HVAC technician. The evaluation should include all connections, sizes of wires, and size of the distribution panel between the unit and the utility’s connection. The transformer connection and sizing should be evaluated by the electric utility provider.

## Section 4b: Air Handler Section Unit Electrical Data

| Model | 60 HZ Power | | Field-Installed Elect Heat | | Motor Amps / HP | Minimum Circuit Ampacity[2] | Maximum Fuse Size[2] |
|---|---|---|---|---|---|---|---|
| | Volts | Phase | # Circuits | kW[1] | | | |
| MPD024A | 208/230 | 1 | None | 0 | 2.8 / 0.33 | 3.5 | 10 |
| | | | 1 | 10 | | 54.9 | 60 |
| MPD036A | 208/230 | 1 | None | 0 | 4.3 / 0.50 | 5.4 | 10 |
| | | | 1 | 10 | | 56.4 | 60 |
| | | | 2 | 15 | | 30.3 / 56.4 | 40 / 70 |
| MPD060B | 208/230 | 1 | None | 0 | 6.8 / 1.0 | 8.5 | 15 |
| | | | 1 | 10 | | 58.9 | 70 |
| | | | 2 | 15 | | 32.8 / 58.9 | 40 / 70 |
| | | | 2 | 20 | | 58.9 / 58.9 | 70 / 70 |

Notes:
1. Nominal kW at 240V. Derate 25% for 208V.
2. Units with field-installed electric heat 15kW and larger have two circuits. Data shown as “XX/XX” refers to circuit 1 before the “/” and circuit 2 after the “/”
3. Always refer to unit nameplate data prior to installation

# Section 5: Specification Glossary & Calculations

## Glossary of Terms

| | |
|---|---|
| CFM = Airflow, Cubic Feet/Minute | HR = Total Heat Of Rejection, Btu/hr |
| COP = Coefficient of Performance = BTU Output / BTU Input | KW = Total Power Unit Input, Kilowatts |
| EAT = Entering Air Temperature, Fahrenheit (Dry Bulb/Wet Bulb) | LAT = Leaving Air Temperature, Fahrenheit |
| EER = Energy Efficiency Ratio = BTU output/Watts input | LC = Latent Cooling Capacity, Btu/hr |
| EWT = Entering Source Water Temperature, Fahrenheit | SC = Sensible Cooling Capacity, Btu/hr |
| ELT = Entering Load Water Temperature, Fahrenheit | LWT = Leaving Source Water Temperature, Fahrenheit |
| GPM = Water Flow, Gallons Per Minute | LLT = Leaving Load Water Temperature, Fahrenheit |
| HC = Total Heating Capacity, Btu/hr | TC = Total Cooling Capacity, Btu/hr |
| HE = Total Heat Of Extraction, Btu/hr | WPD = Water Pressure Drop, PSI & Feet of Water |

## Heating & Cooling Calculations

| Heating | Cooling |
|---|---|
| $LAT = EAT + \frac{HC}{CFM \times 1.08}$ | $LAT\ (DB) = EAT\ (DB) - \frac{SC}{CFM \times 1.08}$ |
| $LWT = EWT - \frac{HE}{GPM \times 500}$ | $LWT = EWT + \frac{HR}{GPM \times 500}$ |
| LC = TC - SC | |

# Section 5: Water Flow Selection

## Water Flow Selection

Proper flow rate is crucial for reliable operation of geothermal heat pumps. The performance data shows three flow rates for each entering water temperature (EWT column). The general “rule of thumb” when selecting flow rates is the following:

Top flow rate: Reference low flow rate.
Middle flow rate: Minimum closed loop system flow rate (2.25 to 2.50 gpm/ton)
Bottom flow rate: Nominal (optimum) closed loop system flow rate (3.0 gpm/ton)

Although the “rule of thumb” is adequate in most areas of North America, it is important to consider the application type before applying this “rule of thumb.” Antifreeze is generally required for all closed loop (geothermal) applications. Extreme Southern U.S. locations are the only exception. Open loop (well water) systems cannot use antifreeze, and must have enough flow rate in order to avoid freezing conditions at the Leaving Source Water Temperature (LWT) connection.

Calculations must be made for all systems without antifreeze to determine if the top flow rate is adequate to prevent LWT at or near freezing conditions. The following steps should taken in making this calculation:

Determine minimum EWT based upon your geographical area.
Go to the performance data table for the heat pump model selected and look up the the Heat of Extraction (HE) at the “rule of thumb” water flow rate (GPM) and at the design Entering Air Temperature (EAT).

Calculate the temperature difference (TD) based upon the HE and GPM of the model (step 4).
TD = HE / (GPM x 500).
Calculate the LWT (step 6).
LWT = EWT - TD.

If the LWT is below 35-38°F, there is potential for freezing conditions if the flow rate or water temperature is less than ideal conditions, and the flow rate must be increased.

**Example 1:**
EWT = 50°F.
3-Ton Model, high capacity. Flow rate = 6.8 GPM. HE = 26,300 Btuh.
TD = 26,300 / (6.8 x 500) = 7.7°F
LWT = 50 - 7.7 = 42.3°F
Water flow rate should be adequate under these conditions.

**Example 2:**
EWT = 40°F.
3-Ton Model, high capacity. Flow rate = 6.8 GPM. HE = 22,700 Btuh.
TD = 22,700 / (6.8 x 500) = 6.7°F
LWT = 40 - 6.7 = 33.3°F
Water flow rate must be increased.

## Performance Data Notes

1. Capacity data is based upon 15% (by volume) methanol antifreeze solution.
2. Interpolation between above categories is permissible; extrapolation is not.
3. See Flow Rate Selection above for proper application.

## Section 6a: Model 024 with MPD024A Performance Data: 2.0 Ton, Full Load, 900 CFM Cooling / 900 CFM Heating

| | | | | Heating | | | | | | Cooling | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWT °F | Flow GPM | WPD PSI | WPD FT | Aiflow CFM | HC MBtuh | HE MBtuh | LAT °F | kW | COP W/W | Aiflow CFM | TC MBtuh | SC MBtuh | S/T | HR MBtuh | kW | EER Btuh/W |
| 25 | 6.0 | 3.7 | 8.6 | 900 | 16.3 | 11.8 | 86.8 | 1.31 | 3.64 | | | | | | | |
| | | | | 800 | 16.2 | 11.5 | 88.7 | 1.36 | 3.48 | | | | | | | |
| 30 | 3.0 | 1.4 | 3.1 | 900 | 16.2 | 11.8 | 86.7 | 1.29 | 3.68 | | | | | | | |
| | | | | 800 | 16.1 | 11.5 | 88.7 | 1.34 | 3.51 | | | | | | | |
| | 4.5 | 2.3 | 5.4 | 900 | 17.0 | 12.5 | 87.5 | 1.31 | 3.79 | | | | | | | |
| | | | | 800 | 16.9 | 12.2 | 89.6 | 1.37 | 3.62 | | | | | | | |
| | 6.0 | 3.6 | 8.4 | 900 | 17.8 | 13.2 | 88.3 | 1.34 | 3.90 | Operation Not Recommended | | | | | | |
| | | | | 800 | 17.7 | 13.0 | 90.5 | 1.39 | 3.73 | | | | | | | |
| 40 | 3.0 | 1.2 | 2.8 | 900 | 19.2 | 14.6 | 89.8 | 1.35 | 4.17 | | | | | | | |
| | | | | 800 | 19.1 | 14.3 | 92.1 | 1.40 | 3.99 | | | | | | | |
| | 4.5 | 2.2 | 5.1 | 900 | 20.0 | 15.3 | 90.6 | 1.37 | 4.27 | | | | | | | |
| | | | | 800 | 19.9 | 15.0 | 93.1 | 1.43 | 4.09 | | | | | | | |
| | 6.0 | 3.5 | 8.1 | 900 | 20.8 | 16.0 | 91.4 | 1.40 | 4.37 | | | | | | | |
| | | | | 800 | 20.7 | 15.8 | 94.0 | 1.45 | 4.19 | | | | | | | |
| 50 | 3.0 | 1.1 | 2.5 | 900 | 22.2 | 17.4 | 92.8 | 1.42 | 4.58 | 900 | 28.4 | 19.9 | 0.70 | 33.5 | 1.50 | 18.9 |
| | | | | 800 | 22.1 | 17.1 | 95.6 | 1.47 | 4.39 | 800 | 28.0 | 18.8 | 0.67 | 33.2 | 1.53 | 18.3 |
| | 4.5 | 2.0 | 4.7 | 900 | 23.0 | 18.1 | 93.7 | 1.44 | 4.67 | 900 | 28.4 | 19.9 | 0.70 | 33.3 | 1.43 | 19.9 |
| | | | | 800 | 22.9 | 17.8 | 96.5 | 1.50 | 4.48 | 800 | 28.1 | 18.8 | 0.67 | 33.1 | 1.46 | 19.2 |
| | 6.0 | 3.4 | 7.8 | 900 | 23.8 | 18.8 | 94.5 | 1.47 | 4.75 | 900 | 28.5 | 19.8 | 0.70 | 33.2 | 1.36 | 20.9 |
| | | | | 800 | 23.7 | 18.5 | 97.4 | 1.52 | 4.57 | 800 | 28.2 | 18.8 | 0.67 | 32.9 | 1.39 | 20.2 |
| 60 | 3.0 | 1.0 | 2.4 | 900 | 25.1 | 20.0 | 95.9 | 1.50 | 4.90 | 900 | 27.5 | 19.6 | 0.71 | 32.9 | 1.58 | 17.4 |
| | | | | 800 | 25.0 | 19.7 | 99.0 | 1.56 | 4.72 | 800 | 27.1 | 18.6 | 0.68 | 32.6 | 1.61 | 16.9 |
| | 4.5 | 1.8 | 4.2 | 900 | 25.9 | 20.7 | 96.7 | 1.53 | 4.98 | 900 | 27.6 | 19.6 | 0.71 | 32.7 | 1.51 | 18.3 |
| | | | | 800 | 25.8 | 20.4 | 99.9 | 1.58 | 4.80 | 800 | 27.2 | 18.5 | 0.68 | 32.5 | 1.54 | 17.7 |
| | 6.0 | 2.8 | 6.6 | 900 | 26.7 | 21.4 | 97.5 | 1.55 | 5.06 | 900 | 27.7 | 19.6 | 0.71 | 32.6 | 1.44 | 19.2 |
| | | | | 800 | 26.6 | 21.2 | 100.8 | 1.60 | 4.87 | 800 | 27.3 | 18.5 | 0.68 | 32.3 | 1.47 | 18.6 |
| 70 | 3.0 | 0.9 | 2.1 | 900 | 28.0 | 22.6 | 98.9 | 1.60 | 5.15 | 900 | 26.5 | 19.3 | 0.73 | 32.3 | 1.71 | 15.5 |
| | | | | 800 | 27.9 | 22.3 | 102.3 | 1.65 | 4.97 | 800 | 26.1 | 18.2 | 0.70 | 32.0 | 1.73 | 15.1 |
| | 4.5 | 1.7 | 3.9 | 900 | 28.8 | 23.3 | 99.7 | 1.62 | 5.22 | 900 | 26.6 | 19.2 | 0.72 | 32.2 | 1.64 | 16.2 |
| | | | | 800 | 28.7 | 23.0 | 103.3 | 1.67 | 5.04 | 800 | 26.2 | 18.2 | 0.69 | 31.9 | 1.67 | 15.7 |
| | 6.0 | 2.7 | 6.2 | 900 | 29.6 | 24.0 | 100.5 | 1.64 | 5.29 | 900 | 26.7 | 19.2 | 0.72 | 32.0 | 1.57 | 17.0 |
| | | | | 800 | 29.5 | 23.7 | 104.2 | 1.69 | 5.11 | 800 | 26.3 | 18.1 | 0.69 | 31.8 | 1.60 | 16.5 |
| 80 | 3.0 | 0.8 | 1.8 | 900 | 30.9 | 25.1 | 101.8 | 1.70 | 5.33 | 900 | 25.3 | 18.9 | 0.74 | 31.8 | 1.88 | 13.5 |
| | | | | 800 | 30.8 | 24.8 | 105.7 | 1.75 | 5.15 | 800 | 25.0 | 17.8 | 0.71 | 31.5 | 1.91 | 13.1 |
| | 4.5 | 1.5 | 3.6 | 900 | 31.7 | 25.8 | 102.6 | 1.72 | 5.40 | 900 | 25.4 | 18.8 | 0.74 | 31.6 | 1.81 | 14.0 |
| | | | | 800 | 31.6 | 25.5 | 106.6 | 1.77 | 5.22 | 800 | 25.1 | 17.7 | 0.71 | 31.3 | 1.84 | 13.6 |
| | 6.0 | 2.6 | 5.9 | 900 | 32.5 | 26.5 | 103.4 | 1.74 | 5.46 | 900 | 25.5 | 18.8 | 0.74 | 31.5 | 1.74 | 14.6 |
| | | | | 800 | 32.4 | 26.3 | 107.5 | 1.80 | 5.28 | 800 | 25.1 | 17.7 | 0.70 | 31.2 | 1.77 | 14.2 |
| 90 | 3.0 | 0.6 | 1.5 | 900 | 33.7 | 27.5 | 104.7 | 1.81 | 5.45 | 900 | 24.0 | 18.4 | 0.76 | 31.2 | 2.11 | 11.4 |
| | | | | 800 | 33.6 | 27.3 | 108.9 | 1.87 | 5.28 | 800 | 23.7 | 17.3 | 0.73 | 30.9 | 2.14 | 11.1 |
| | 4.5 | 1.4 | 3.2 | 900 | 34.5 | 28.3 | 105.5 | 1.84 | 5.51 | 900 | 24.1 | 18.3 | 0.76 | 31.1 | 2.04 | 11.8 |
| | | | | 800 | 34.4 | 28.0 | 109.8 | 1.89 | 5.34 | 800 | 23.7 | 17.2 | 0.73 | 30.8 | 2.07 | 11.5 |
| | 6.0 | 2.4 | 5.6 | 900 | 35.3 | 29.0 | 106.3 | 1.86 | 5.57 | 900 | 24.2 | 18.3 | 0.76 | 30.9 | 1.97 | 12.3 |
| | | | | 800 | 35.2 | 28.7 | 110.8 | 1.91 | 5.40 | 800 | 23.8 | 17.2 | 0.72 | 30.6 | 2.00 | 11.9 |
| 100 | 3.0 | 0.5 | 1.2 | | | | | | | 900 | 22.6 | 17.8 | 0.79 | 30.7 | 2.38 | 9.5 |
| | | | | | | | | | | 800 | 22.2 | 16.7 | 0.75 | 30.4 | 2.41 | 9.2 |
| | 4.5 | 1.3 | 2.9 | | | | | | | 900 | 22.6 | 17.7 | 0.78 | 30.5 | 2.31 | 9.8 |
| | | | | | | | | | | 800 | 22.3 | 16.7 | 0.75 | 30.3 | 2.34 | 9.5 |
| | 6.0 | 2.3 | 5.3 | | | | | | | 900 | 22.7 | 17.7 | 0.78 | 30.4 | 2.24 | 10.1 |
| | | | | Operation Not Recommended | | | | | | 800 | 22.4 | 16.6 | 0.74 | 30.1 | 2.27 | 9.8 |
| 110 | 3.0 | 0.4 | 0.8 | | | | | | | 900 | 20.9 | 17.1 | 0.82 | 30.2 | 2.70 | 7.7 |
| | | | | | | | | | | 800 | 20.6 | 16.1 | 0.78 | 29.9 | 2.73 | 7.5 |
| | 4.5 | 1.1 | 2.6 | | | | | | | 900 | 21.0 | 17.1 | 0.81 | 30.0 | 2.64 | 8.0 |
| | | | | | | | | | | 800 | 20.7 | 16.0 | 0.78 | 29.8 | 2.66 | 7.8 |
| | 6.0 | 2.2 | 5.0 | | | | | | | 900 | 21.1 | 17.1 | 0.81 | 29.9 | 2.57 | 8.2 |
| | | | | | | | | | | 800 | 20.7 | 16.0 | 0.77 | 29.6 | 2.59 | 8.0 |

Heating data based on 70F EAT; Cooling data based on 80/67F EAT. See Correction Factors on page 19 for different conditions.

## Section 6b: Model 036 with MPD036A Performance Data: 3.0 Ton, Full Load, 1200 CFM Cooling / 1200 CFM Heating

| EWT | Flow | WPD | | Heating | | | | | | Cooling | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWT °F | Flow GPM | WPD PSI | WPD FT | Aiflow CFM | HC MBtuh | HE MBtuh | LAT °F | kW | COP W/W | Aiflow CFM | TC MBtuh | SC MBtuh | S/T | HR MBtuh | kW | EER Btuh/W |
| 25 | 9.0 | 3.5 | 8.1 | 1200 | 26.1 | 18.1 | 90.1 | 2.35 | 3.25 | Operation Not Recommended | | | | | | |
| | | | | 1050 | 25.9 | 17.6 | 92.9 | 2.44 | 3.11 | | | | | | | |
| 30 | 4.5 | 1.4 | 3.1 | 1200 | 26.1 | 18.1 | 90.1 | 2.34 | 3.27 | | | | | | | |
| | | | | 1050 | 25.9 | 17.6 | 92.8 | 2.42 | 3.13 | | | | | | | |
| | 6.8 | 2.2 | 5.2 | 1200 | 27.1 | 19.0 | 90.9 | 2.37 | 3.36 | | | | | | | |
| | | | | 1050 | 26.9 | 18.5 | 93.7 | 2.45 | 3.21 | | | | | | | |
| | 9.0 | 3.4 | 7.9 | 1200 | 28.1 | 20.0 | 91.7 | 2.39 | 3.44 | | | | | | | |
| | | | | 1050 | 27.9 | 19.5 | 94.6 | 2.48 | 3.30 | | | | | | | |
| 40 | 4.5 | 1.2 | 2.8 | 1200 | 30.1 | 21.8 | 93.2 | 2.43 | 3.63 | | | | | | | |
| | | | | 1050 | 29.9 | 21.3 | 96.4 | 2.52 | 3.48 | | | | | | | |
| | 6.8 | 2.1 | 4.9 | 1200 | 31.1 | 22.7 | 94.0 | 2.46 | 3.71 | | | | | | | |
| | | | | 1050 | 30.9 | 22.2 | 97.3 | 2.55 | 3.56 | | | | | | | |
| | 9.0 | 3.3 | 7.7 | 1200 | 32.1 | 23.7 | 94.8 | 2.49 | 3.79 | | | | | | | |
| | | | | 1050 | 32.0 | 23.2 | 98.2 | 2.57 | 3.64 | | | | | | | |
| 50 | 4.5 | 1.1 | 2.5 | 1200 | 34.1 | 25.4 | 96.3 | 2.54 | 3.93 | 1200 | 35.0 | 23.1 | 0.66 | 42.4 | 2.19 | 16.0 |
| | | | | 1050 | 33.9 | 24.9 | 99.9 | 2.63 | 3.78 | 1050 | 34.6 | 22.1 | 0.64 | 42.0 | 2.16 | 16.0 |
| | 6.8 | 2.0 | 4.6 | 1200 | 35.1 | 26.3 | 97.1 | 2.57 | 4.01 | 1200 | 34.8 | 22.9 | 0.66 | 41.9 | 2.09 | 16.6 |
| | | | | 1050 | 34.9 | 25.9 | 100.8 | 2.65 | 3.85 | 1050 | 34.4 | 21.8 | 0.63 | 41.5 | 2.07 | 16.7 |
| | 9.0 | 3.2 | 7.4 | 1200 | 36.1 | 27.3 | 97.9 | 2.60 | 4.08 | 1200 | 34.6 | 22.6 | 0.65 | 41.4 | 2.00 | 17.3 |
| | | | | 1050 | 36.0 | 26.8 | 101.7 | 2.68 | 3.93 | 1050 | 34.2 | 21.6 | 0.63 | 41.0 | 1.97 | 17.3 |
| 60 | 4.5 | 1.1 | 2.6 | 1200 | 38.1 | 29.0 | 99.4 | 2.66 | 4.19 | 1200 | 36.3 | 24.3 | 0.67 | 44.1 | 2.29 | 15.8 |
| | | | | 1050 | 37.9 | 28.5 | 103.4 | 2.75 | 4.03 | 1050 | 35.9 | 23.3 | 0.65 | 43.7 | 2.26 | 15.9 |
| | 6.8 | 1.8 | 4.2 | 1200 | 39.1 | 29.9 | 100.2 | 2.69 | 4.25 | 1200 | 36.1 | 24.1 | 0.67 | 43.6 | 2.20 | 16.4 |
| | | | | 1050 | 38.9 | 29.4 | 104.3 | 2.78 | 4.10 | 1050 | 35.7 | 23.0 | 0.64 | 43.1 | 2.17 | 16.5 |
| | 9.0 | 2.7 | 6.3 | 1200 | 40.1 | 30.8 | 101.0 | 2.72 | 4.32 | 1200 | 35.9 | 23.8 | 0.67 | 43.0 | 2.10 | 17.0 |
| | | | | 1050 | 39.9 | 30.3 | 105.2 | 2.81 | 4.17 | 1050 | 35.5 | 22.8 | 0.64 | 42.6 | 2.08 | 17.1 |
| 70 | 4.5 | 1.0 | 2.2 | 1200 | 42.0 | 32.4 | 102.4 | 2.81 | 4.39 | 1200 | 36.8 | 25.1 | 0.68 | 45.1 | 2.44 | 15.0 |
| | | | | 1050 | 41.8 | 31.9 | 106.9 | 2.89 | 4.24 | 1050 | 36.4 | 24.1 | 0.66 | 44.7 | 2.42 | 15.1 |
| | 6.8 | 1.7 | 3.9 | 1200 | 43.0 | 33.4 | 103.2 | 2.83 | 4.45 | 1200 | 36.6 | 24.9 | 0.68 | 44.6 | 2.35 | 15.5 |
| | | | | 1050 | 42.9 | 32.9 | 107.8 | 2.92 | 4.30 | 1050 | 36.2 | 23.8 | 0.66 | 44.2 | 2.32 | 15.6 |
| | 9.0 | 2.6 | 6.0 | 1200 | 44.1 | 34.3 | 104.0 | 2.86 | 4.51 | 1200 | 36.3 | 24.6 | 0.68 | 44.1 | 2.26 | 16.1 |
| | | | | 1050 | 43.9 | 33.8 | 108.7 | 2.95 | 4.36 | 1050 | 36.0 | 23.6 | 0.65 | 43.6 | 2.23 | 16.1 |
| 80 | 4.5 | 0.8 | 1.9 | 1200 | 45.9 | 35.8 | 105.5 | 2.96 | 4.54 | 1200 | 36.5 | 25.4 | 0.70 | 45.5 | 2.65 | 13.7 |
| | | | | 1050 | 45.8 | 35.3 | 110.3 | 3.05 | 4.40 | 1050 | 36.1 | 24.4 | 0.68 | 45.1 | 2.63 | 13.8 |
| | 6.8 | 1.5 | 3.5 | 1200 | 47.0 | 36.8 | 106.2 | 2.99 | 4.60 | 1200 | 36.2 | 25.2 | 0.70 | 45.0 | 2.56 | 14.2 |
| | | | | 1050 | 46.8 | 36.3 | 111.3 | 3.08 | 4.45 | 1050 | 35.9 | 24.1 | 0.67 | 44.6 | 2.53 | 14.2 |
| | 9.0 | 2.4 | 5.7 | 1200 | 48.0 | 37.7 | 107.0 | 3.02 | 4.66 | 1200 | 36.0 | 24.9 | 0.69 | 44.5 | 2.47 | 14.6 |
| | | | | 1050 | 47.8 | 37.2 | 112.2 | 3.11 | 4.51 | 1050 | 35.7 | 23.9 | 0.67 | 44.0 | 2.44 | 14.6 |
| 90 | 4.5 | 0.7 | 1.5 | 1200 | 49.9 | 39.2 | 108.5 | 3.14 | 4.66 | 1200 | 35.3 | 25.3 | 0.72 | 45.3 | 2.91 | 12.1 |
| | | | | 1050 | 49.7 | 38.7 | 113.8 | 3.22 | 4.52 | 1050 | 35.0 | 24.3 | 0.69 | 44.9 | 2.88 | 12.1 |
| | 6.8 | 1.4 | 3.2 | 1200 | 50.9 | 40.1 | 109.3 | 3.16 | 4.71 | 1200 | 35.1 | 25.1 | 0.71 | 44.8 | 2.82 | 12.5 |
| | | | | 1050 | 50.7 | 39.6 | 114.7 | 3.25 | 4.57 | 1050 | 34.8 | 24.0 | 0.69 | 44.3 | 2.79 | 12.5 |
| | 9.0 | 2.3 | 5.3 | 1200 | 51.9 | 41.0 | 110.1 | 3.19 | 4.76 | 1200 | 34.9 | 24.8 | 0.71 | 44.2 | 2.73 | 12.8 |
| | | | | 1050 | 51.7 | 40.5 | 115.6 | 3.28 | 4.62 | 1050 | 34.6 | 23.8 | 0.69 | 43.8 | 2.70 | 12.8 |
| 100 | 4.5 | 0.5 | 1.2 | Operation Not Recommended | | | | | | 1200 | 33.4 | 24.8 | 0.74 | 44.4 | 3.22 | 10.4 |
| | | | | | | | | | | 1050 | 33.1 | 23.7 | 0.72 | 44.0 | 3.20 | 10.4 |
| | 6.8 | 1.2 | 2.9 | | | | | | | 1200 | 33.2 | 24.5 | 0.74 | 43.9 | 3.13 | 10.6 |
| | | | | | | | | | | 1050 | 32.9 | 23.5 | 0.71 | 43.5 | 3.10 | 10.6 |
| | 9.0 | 2.2 | 5.0 | | | | | | | 1200 | 33.0 | 24.3 | 0.74 | 43.4 | 3.04 | 10.9 |
| | | | | | | | | | | 1050 | 32.7 | 23.2 | 0.71 | 43.0 | 3.01 | 10.9 |
| 110 | 4.5 | 0.4 | 0.9 | | | | | | | 1200 | 30.7 | 23.8 | 0.77 | 43.0 | 3.59 | 8.6 |
| | | | | | | | | | | 1050 | 30.4 | 22.8 | 0.75 | 42.6 | 3.56 | 8.5 |
| | 6.8 | 1.1 | 2.5 | | | | | | | 1200 | 30.5 | 23.6 | 0.77 | 42.5 | 3.49 | 8.7 |
| | | | | | | | | | | 1050 | 30.2 | 22.5 | 0.75 | 42.0 | 3.47 | 8.7 |
| | 9.0 | 2.0 | 4.6 | | | | | | | 1200 | 30.3 | 23.3 | 0.77 | 41.9 | 3.40 | 8.9 |
| | | | | | | | | | | 1050 | 30.0 | 22.3 | 0.74 | 41.5 | 3.37 | 8.9 |

Heating data based on 70F EAT; Cooling data based on 80/67F EAT. See Correction Factors on page 19 for different conditions.

## Section 6c: Model 048 with MPD060B Performance Data: 4.0 Ton, Full Load, 1650 CFM Cooling / 1600 CFM Heating

| EWT | Flow | WPD | | Heating | | | | | | Cooling | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWT °F | Flow GPM | PSI | FT | Aiflow CFM | HC MBtuh | HE MBtuh | LAT °F | kW | COP W/W | Aiflow CFM | TC MBtuh | SC MBtuh | S/T | HR MBtuh | kW | EER Btuh/W |
| 25 | 12.0 | 5.5 | 12.7 | 1600 | 33.8 | 23.7 | 89.6 | 2.94 | 3.36 | Operation Not Recommended | | | | | | |
| | | | | 1350 | 33.5 | 23.0 | 93.0 | 3.07 | 3.19 | | | | | | | |
| 30 | 6.0 | 2.0 | 4.6 | 1600 | 34.5 | 24.4 | 90.0 | 2.95 | 3.43 | | | | | | | |
| | | | | 1350 | 34.2 | 23.7 | 93.5 | 3.08 | 3.26 | | | | | | | |
| | 9.0 | 3.5 | 8.1 | 1600 | 35.7 | 25.6 | 90.7 | 2.98 | 3.51 | | | | | | | |
| | | | | 1350 | 35.4 | 24.8 | 94.3 | 3.10 | 3.34 | | | | | | | |
| | 12.0 | 5.4 | 12.6 | 1600 | 36.9 | 26.7 | 91.4 | 3.00 | 3.60 | | | | | | | |
| | | | | 1350 | 36.6 | 25.9 | 95.1 | 3.13 | 3.43 | | | | | | | |
| 40 | 6.0 | 1.9 | 4.3 | 1600 | 40.1 | 29.7 | 93.2 | 3.06 | 3.84 | | | | | | | |
| | | | | 1350 | 39.8 | 28.9 | 97.3 | 3.19 | 3.66 | | | | | | | |
| | 9.0 | 3.3 | 7.7 | 1600 | 41.3 | 30.8 | 93.9 | 3.09 | 3.92 | | | | | | | |
| | | | | 1350 | 41.0 | 30.0 | 98.1 | 3.21 | 3.74 | | | | | | | |
| | 12.0 | 5.3 | 12.2 | 1600 | 42.5 | 31.9 | 94.6 | 3.11 | 4.01 | | | | | | | |
| | | | | 1350 | 42.2 | 31.2 | 98.9 | 3.24 | 3.82 | | | | | | | |
| 50 | 6.0 | 1.7 | 3.9 | 1600 | 44.9 | 34.1 | 96.0 | 3.15 | 4.17 | 1650 | 55.6 | 39.0 | 0.70 | 64.9 | 2.74 | 20.3 |
| | | | | 1350 | 44.6 | 33.4 | 100.6 | 3.28 | 3.98 | 1400 | 54.2 | 36.1 | 0.67 | 63.6 | 2.74 | 19.8 |
| | 9.0 | 3.2 | 7.4 | 1600 | 46.1 | 35.3 | 96.7 | 3.18 | 4.25 | 1650 | 55.9 | 38.9 | 0.70 | 64.9 | 2.62 | 21.3 |
| | | | | 1350 | 45.8 | 34.5 | 101.4 | 3.30 | 4.06 | 1400 | 54.6 | 36.1 | 0.66 | 63.5 | 2.62 | 20.8 |
| | 12.0 | 5.1 | 11.9 | 1600 | 47.3 | 36.4 | 97.4 | 3.21 | 4.32 | 1650 | 56.3 | 38.9 | 0.69 | 64.8 | 2.49 | 22.5 |
| | | | | 1350 | 47.0 | 35.6 | 102.2 | 3.33 | 4.13 | 1400 | 54.9 | 36.1 | 0.66 | 63.4 | 2.49 | 22.0 |
| 60 | 6.0 | 1.7 | 3.9 | 1600 | 48.8 | 37.8 | 98.3 | 3.23 | 4.42 | 1650 | 54.2 | 38.4 | 0.71 | 64.0 | 2.88 | 18.8 |
| | | | | 1350 | 48.5 | 37.0 | 103.3 | 3.36 | 4.23 | 1400 | 52.9 | 35.6 | 0.67 | 62.7 | 2.88 | 18.4 |
| | 9.0 | 3.0 | 6.9 | 1600 | 50.0 | 38.9 | 99.0 | 3.26 | 4.50 | 1650 | 54.6 | 38.4 | 0.70 | 64.0 | 2.75 | 19.8 |
| | | | | 1350 | 49.7 | 38.1 | 104.1 | 3.38 | 4.30 | 1400 | 53.2 | 35.5 | 0.67 | 62.6 | 2.75 | 19.3 |
| | 12.0 | 4.6 | 10.7 | 1600 | 51.2 | 40.0 | 99.6 | 3.28 | 4.57 | 1650 | 54.9 | 38.3 | 0.70 | 63.9 | 2.63 | 20.9 |
| | | | | 1350 | 50.9 | 39.3 | 104.9 | 3.41 | 4.37 | 1400 | 53.6 | 35.5 | 0.66 | 62.5 | 2.63 | 20.4 |
| 70 | 6.0 | 1.6 | 3.7 | 1600 | 51.9 | 40.6 | 100.0 | 3.30 | 4.61 | 1650 | 52.5 | 37.7 | 0.72 | 63.1 | 3.09 | 17.0 |
| | | | | 1350 | 51.6 | 39.9 | 105.4 | 3.42 | 4.41 | 1400 | 51.2 | 34.8 | 0.68 | 61.7 | 3.09 | 16.6 |
| | 9.0 | 2.9 | 6.7 | 1600 | 53.1 | 41.8 | 100.7 | 3.33 | 4.68 | 1650 | 52.9 | 37.6 | 0.71 | 63.0 | 2.97 | 17.8 |
| | | | | 1350 | 52.8 | 41.0 | 106.2 | 3.45 | 4.48 | 1400 | 51.5 | 34.8 | 0.68 | 61.7 | 2.97 | 17.4 |
| | 12.0 | 4.5 | 10.5 | 1600 | 54.3 | 42.9 | 101.4 | 3.35 | 4.75 | 1650 | 53.2 | 37.6 | 0.71 | 62.9 | 2.85 | 18.7 |
| | | | | 1350 | 54.0 | 42.1 | 107.0 | 3.48 | 4.55 | 1400 | 51.9 | 34.8 | 0.67 | 61.6 | 2.84 | 18.2 |
| 80 | 6.0 | 1.5 | 3.5 | 1600 | 54.1 | 42.7 | 101.3 | 3.35 | 4.73 | 1650 | 50.5 | 36.8 | 0.73 | 62.1 | 3.39 | 14.9 |
| | | | | 1350 | 53.8 | 41.9 | 106.9 | 3.48 | 4.53 | 1400 | 49.2 | 34.0 | 0.69 | 60.8 | 3.39 | 14.5 |
| | 9.0 | 2.8 | 6.5 | 1600 | 55.3 | 43.8 | 102.0 | 3.38 | 4.80 | 1650 | 50.9 | 36.8 | 0.72 | 62.0 | 3.27 | 15.6 |
| | | | | 1350 | 55.0 | 43.0 | 107.7 | 3.50 | 4.60 | 1400 | 49.5 | 33.9 | 0.68 | 60.7 | 3.27 | 15.2 |
| | 12.0 | 4.5 | 10.3 | 1600 | 56.5 | 44.9 | 102.7 | 3.40 | 4.87 | 1650 | 51.2 | 36.7 | 0.72 | 61.9 | 3.15 | 16.3 |
| | | | | 1350 | 56.2 | 44.2 | 108.5 | 3.53 | 4.67 | 1400 | 49.9 | 33.9 | 0.68 | 60.6 | 3.14 | 15.9 |
| 90 | 6.0 | 1.4 | 3.3 | 1600 | 55.5 | 43.9 | 102.1 | 3.39 | 4.80 | 1650 | 48.2 | 35.8 | 0.74 | 61.1 | 3.78 | 12.8 |
| | | | | 1350 | 55.2 | 43.2 | 107.8 | 3.51 | 4.60 | 1400 | 46.9 | 33.0 | 0.70 | 59.8 | 3.78 | 12.4 |
| | 9.0 | 2.7 | 6.3 | 1600 | 56.7 | 45.1 | 102.8 | 3.41 | 4.87 | 1650 | 48.5 | 35.8 | 0.74 | 61.0 | 3.65 | 13.3 |
| | | | | 1350 | 56.4 | 44.3 | 108.7 | 3.54 | 4.67 | 1400 | 47.2 | 32.9 | 0.70 | 59.7 | 3.65 | 12.9 |
| | 12.0 | 4.4 | 10.1 | 1600 | 57.9 | 46.2 | 103.5 | 3.44 | 4.93 | 1650 | 48.9 | 35.7 | 0.73 | 60.9 | 3.53 | 13.9 |
| | | | | 1350 | 57.6 | 45.4 | 109.5 | 3.56 | 4.73 | 1400 | 47.5 | 32.9 | 0.69 | 59.6 | 3.53 | 13.5 |
| 100 | 6.0 | 1.3 | 3.1 | Operation Not Recommended | | | | | | 1650 | 45.6 | 34.7 | 0.76 | 60.0 | 4.24 | 10.7 |
| | | | | | | | | | | 1400 | 44.2 | 31.8 | 0.72 | 58.7 | 4.24 | 10.4 |
| | 9.0 | 2.6 | 6.1 | | | | | | | 1650 | 45.9 | 34.6 | 0.75 | 60.0 | 4.12 | 11.1 |
| | | | | | | | | | | 1400 | 44.6 | 31.8 | 0.71 | 58.6 | 4.12 | 10.8 |
| | 12.0 | 4.3 | 9.9 | | | | | | | 1650 | 46.2 | 34.6 | 0.75 | 59.9 | 3.99 | 11.6 |
| | | | | | | | | | | 1400 | 44.9 | 31.7 | 0.71 | 58.5 | 3.99 | 11.2 |
| 110 | 6.0 | 1.2 | 2.9 | | | | | | | 1650 | 42.6 | 33.4 | 0.78 | 59.0 | 4.79 | 8.9 |
| | | | | | | | | | | 1400 | 41.3 | 30.5 | 0.74 | 57.6 | 4.79 | 8.6 |
| | 9.0 | 2.5 | 5.9 | | | | | | | 1650 | 42.9 | 33.3 | 0.78 | 58.9 | 4.67 | 9.2 |
| | | | | | | | | | | 1400 | 41.6 | 30.5 | 0.73 | 57.5 | 4.66 | 8.9 |
| | 12.0 | 4.2 | 9.7 | | | | | | | 1650 | 43.3 | 33.3 | 0.77 | 58.8 | 4.54 | 9.5 |
| | | | | | | | | | | 1400 | 41.9 | 30.4 | 0.73 | 57.4 | 4.54 | 9.2 |

Heating data based on 70F EAT; Cooling data based on 80/67F EAT. See Correction Factors on page 19 for different conditions.

## Section 6d: Model 060 with MPD060B Performance Data: 5.0 Ton, Full Load, 1950 CFM Cooling / 1900 CFM Heating

| EWT | Flow | WPD | | Heating | | | | | | Cooling | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | GPM | PSI | FT | Aiflow CFM | HC MBtuh | HE MBtuh | LAT °F | kW | COP W/W | Aiflow CFM | TC MBtuh | SC MBtuh | S/T | HR MBtuh | kW | EER Btuh/W |
| 25 | 15.0 | 9.8 | 22.7 | 1900 | 43.5 | 30.1 | 91.2 | 3.92 | 3.25 | Operation Not Recommended | | | | | | |
| | | | | 1800 | 43.2 | 29.6 | 92.2 | 3.99 | 3.17 | | | | | | | |
| 30 | 7.5 | 3.4 | 7.8 | 1900 | 43.7 | 30.4 | 91.3 | 3.90 | 3.28 | | | | | | | |
| | | | | 1800 | 43.4 | 29.9 | 92.3 | 3.97 | 3.20 | | | | | | | |
| | 11.3 | 6.1 | 14.0 | 1900 | 45.3 | 31.9 | 92.1 | 3.94 | 3.37 | | | | | | | |
| | | | | 1800 | 45.0 | 31.4 | 93.2 | 4.01 | 3.29 | | | | | | | |
| | 15.0 | 9.7 | 22.4 | 1900 | 46.9 | 33.4 | 92.9 | 3.97 | 3.46 | | | | | | | |
| | | | | 1800 | 46.6 | 32.9 | 94.0 | 4.04 | 3.38 | | | | | | | |
| 40 | 7.5 | 3.1 | 7.2 | 1900 | 50.3 | 36.6 | 94.5 | 4.01 | 3.68 | | | | | | | |
| | | | | 1800 | 50.0 | 36.1 | 95.7 | 4.08 | 3.59 | | | | | | | |
| | 11.3 | 5.8 | 13.3 | 1900 | 51.9 | 38.1 | 95.3 | 4.04 | 3.76 | | | | | | | |
| | | | | 1800 | 51.6 | 37.6 | 96.5 | 4.12 | 3.67 | | | | | | | |
| | 15.0 | 9.4 | 21.7 | 1900 | 53.5 | 39.6 | 96.1 | 4.08 | 3.84 | | | | | | | |
| | | | | 1800 | 53.2 | 39.0 | 97.4 | 4.15 | 3.76 | | | | | | | |
| 50 | 7.5 | 2.8 | 6.6 | 1900 | 56.4 | 42.3 | 97.5 | 4.13 | 4.00 | 1950 | 67.4 | 46.0 | 0.68 | 79.4 | 3.50 | 19.3 |
| | | | | 1800 | 56.1 | 41.8 | 98.9 | 4.20 | 3.91 | 1800 | 66.5 | 44.3 | 0.67 | 78.5 | 3.50 | 19.0 |
| | 11.3 | 5.5 | 12.7 | 1900 | 58.0 | 43.8 | 98.3 | 4.17 | 4.08 | 1950 | 67.5 | 46.0 | 0.68 | 79.0 | 3.36 | 20.1 |
| | | | | 1800 | 57.7 | 43.3 | 99.7 | 4.24 | 3.99 | 1800 | 66.7 | 44.3 | 0.66 | 78.1 | 3.36 | 19.9 |
| | 15.0 | 9.1 | 21.1 | 1900 | 59.6 | 45.3 | 99.1 | 4.20 | 4.16 | 1950 | 67.7 | 46.0 | 0.68 | 78.7 | 3.22 | 21.0 |
| | | | | 1800 | 59.4 | 44.8 | 100.5 | 4.28 | 4.07 | 1800 | 66.8 | 44.3 | 0.66 | 77.8 | 3.21 | 20.8 |
| 60 | 7.5 | 2.6 | 6.0 | 1900 | 62.1 | 47.5 | 100.3 | 4.27 | 4.26 | 1950 | 66.1 | 45.5 | 0.69 | 78.5 | 3.64 | 18.2 |
| | | | | 1800 | 61.8 | 47.0 | 101.8 | 4.34 | 4.17 | 1800 | 65.3 | 43.8 | 0.67 | 77.7 | 3.63 | 18.0 |
| | 11.3 | 4.9 | 11.3 | 1900 | 63.7 | 49.0 | 101.1 | 4.31 | 4.34 | 1950 | 66.3 | 45.6 | 0.69 | 78.2 | 3.49 | 19.0 |
| | | | | 1800 | 63.4 | 48.5 | 102.6 | 4.38 | 4.25 | 1800 | 65.4 | 43.8 | 0.67 | 77.3 | 3.49 | 18.7 |
| | 15.0 | 8.0 | 18.5 | 1900 | 65.3 | 50.5 | 101.8 | 4.34 | 4.41 | 1950 | 66.4 | 45.6 | 0.69 | 77.9 | 3.35 | 19.8 |
| | | | | 1800 | 65.1 | 50.0 | 103.5 | 4.41 | 4.32 | 1800 | 65.6 | 43.9 | 0.67 | 77.0 | 3.35 | 19.6 |
| 70 | 7.5 | 2.5 | 5.7 | 1900 | 67.4 | 52.3 | 102.8 | 4.42 | 4.46 | 1950 | 64.4 | 44.9 | 0.70 | 77.6 | 3.86 | 16.7 |
| | | | | 1800 | 67.1 | 51.7 | 104.5 | 4.49 | 4.37 | 1800 | 63.5 | 43.2 | 0.68 | 76.7 | 3.86 | 16.5 |
| | 11.3 | 4.8 | 11.1 | 1900 | 69.0 | 53.8 | 103.6 | 4.46 | 4.53 | 1950 | 64.5 | 44.9 | 0.70 | 77.2 | 3.72 | 17.3 |
| | | | | 1800 | 68.7 | 53.2 | 105.3 | 4.53 | 4.44 | 1800 | 63.7 | 43.2 | 0.68 | 76.4 | 3.72 | 17.1 |
| | 15.0 | 7.9 | 18.2 | 1900 | 70.6 | 55.3 | 104.4 | 4.50 | 4.60 | 1950 | 64.7 | 44.9 | 0.69 | 76.9 | 3.58 | 18.1 |
| | | | | 1800 | 70.3 | 54.7 | 106.2 | 4.57 | 4.51 | 1800 | 63.8 | 43.2 | 0.68 | 76.0 | 3.58 | 17.8 |
| 80 | 7.5 | 2.3 | 5.4 | 1900 | 72.2 | 56.5 | 105.2 | 4.59 | 4.61 | 1950 | 62.2 | 44.0 | 0.71 | 76.5 | 4.19 | 14.9 |
| | | | | 1800 | 71.9 | 56.0 | 107.0 | 4.66 | 4.52 | 1800 | 61.3 | 42.2 | 0.69 | 75.6 | 4.18 | 14.7 |
| | 11.3 | 4.7 | 10.8 | 1900 | 73.8 | 58.0 | 106.0 | 4.63 | 4.67 | 1950 | 62.3 | 44.0 | 0.71 | 76.1 | 4.04 | 15.4 |
| | | | | 1800 | 73.5 | 57.5 | 107.8 | 4.70 | 4.59 | 1800 | 61.4 | 42.3 | 0.69 | 75.2 | 4.04 | 15.2 |
| | 15.0 | 7.8 | 17.9 | 1900 | 75.4 | 59.5 | 106.8 | 4.66 | 4.74 | 1950 | 62.4 | 44.0 | 0.70 | 75.8 | 3.90 | 16.0 |
| | | | | 1800 | 75.1 | 59.0 | 108.7 | 4.73 | 4.65 | 1800 | 61.6 | 42.3 | 0.69 | 74.9 | 3.90 | 15.8 |
| 90 | 7.5 | 2.2 | 5.1 | 1900 | 76.6 | 60.3 | 107.3 | 4.77 | 4.70 | 1950 | 59.5 | 42.8 | 0.72 | 75.2 | 4.60 | 12.9 |
| | | | | 1800 | 76.3 | 59.8 | 109.3 | 4.84 | 4.62 | 1800 | 58.6 | 41.1 | 0.70 | 74.3 | 4.60 | 12.7 |
| | 11.3 | 4.6 | 10.5 | 1900 | 78.2 | 61.8 | 108.1 | 4.81 | 4.77 | 1950 | 59.6 | 42.8 | 0.72 | 74.8 | 4.46 | 13.4 |
| | | | | 1800 | 77.9 | 61.3 | 110.1 | 4.88 | 4.68 | 1800 | 58.7 | 41.1 | 0.70 | 73.9 | 4.46 | 13.2 |
| | 15.0 | 7.6 | 17.6 | 1900 | 79.8 | 63.3 | 108.9 | 4.85 | 4.83 | 1950 | 59.7 | 42.8 | 0.72 | 74.5 | 4.32 | 13.8 |
| | | | | 1800 | 79.5 | 62.8 | 110.9 | 4.92 | 4.74 | 1800 | 58.9 | 41.1 | 0.70 | 73.6 | 4.32 | 13.6 |
| 100 | 7.5 | 2.1 | 4.9 | Operation Not Recommended | | | | | | 1950 | 56.3 | 41.4 | 0.74 | 73.7 | 5.11 | 11.0 |
| | | | | | | | | | | 1800 | 55.4 | 39.7 | 0.72 | 72.8 | 5.11 | 10.8 |
| | 11.3 | 4.4 | 10.2 | | | | | | | 1950 | 56.4 | 41.4 | 0.73 | 73.4 | 4.97 | 11.4 |
| | | | | | | | | | | 1800 | 55.5 | 39.7 | 0.72 | 72.5 | 4.96 | 11.2 |
| | 15.0 | 7.5 | 17.4 | | | | | | | 1950 | 56.5 | 41.5 | 0.73 | 73.0 | 4.83 | 11.7 |
| | | | | | | | | | | 1800 | 55.7 | 39.7 | 0.71 | 72.1 | 4.82 | 11.5 |
| 110 | 7.5 | 2.0 | 4.6 | | | | | | | 1950 | 52.6 | 39.8 | 0.76 | 72.1 | 5.71 | 9.2 |
| | | | | | | | | | | 1800 | 51.7 | 38.1 | 0.74 | 71.2 | 5.71 | 9.1 |
| | 11.3 | 4.3 | 10.0 | | | | | | | 1950 | 52.7 | 39.8 | 0.76 | 71.7 | 5.57 | 9.5 |
| | | | | | | | | | | 1800 | 51.8 | 38.1 | 0.73 | 70.8 | 5.57 | 9.3 |
| | 15.0 | 7.4 | 17.1 | | | | | | | 1950 | 52.9 | 39.8 | 0.75 | 71.4 | 5.43 | 9.7 |
| | | | | | | | | | | 1800 | 52.0 | 38.1 | 0.73 | 70.5 | 5.42 | 9.6 |

Heating data based on 70F EAT; Cooling data based on 80/67F EAT. See Correction Factors on page 19 for different conditions.

## Section 6k: Performance Data Correction Factors

### Heating Correction Factors

| EAT °F | HC | HE | kW |
|---|---|---|---|
| 50 | 1.0450 | 1.1136 | 0.8208 |
| 55 | 1.0347 | 1.0893 | 0.8567 |
| 60 | 1.0260 | 1.0640 | 0.9019 |
| 65 | 1.0089 | 1.0270 | 0.9497 |
| 70 | 1.0000 | 1.0000 | 1.0000 |
| 75 | 0.9924 | 0.9741 | 1.0527 |
| 80 | 0.9870 | 0.9653 | 1.0522 |

### Cooling Correction Factors

| EAT (WB) °F | TC | HR | kW |
|---|---|---|---|
| 55 | 0.8215 | 0.8293 | 0.8635 |
| 60 | 0.8955 | 0.9001 | 0.9205 |
| 63 | 0.9404 | 0.9431 | 0.9547 |
| 65 | 0.9701 | 0.9715 | 0.9774 |
| 67 | 1.0000 | 1.0000 | 1.0000 |
| 70 | 1.0446 | 1.0425 | 1.0335 |
| 75 | 1.1179 | 1.1124 | 1.0878 |

### Sensible Cooling Correction Factors

| EAT (WB) °F | EAT (DB) °F | | | | |
|---|---|---|---|---|---|
| | 70 | 75 | 80 | 85 | 90 |
| 55 | 1.201 | 1.289 | | | |
| 60 | 0.943 | 1.067 | 1.192 | | |
| 63 | 0.852 | 0.995 | 1.138 | | |
| 65 | 0.797 | 0.952 | 1.106 | 1.261 | |
| 67 | 0.624 | 0.812 | 1.000 | 1.188 | 1.343 |
| 70 | | 0.697 | 0.820 | 0.944 | 1.067 |
| 75 | | | 0.637 | 0.817 | 0.983 |

## Section 7: Installation Introduction

**INTRODUCTION**
This geothermal heat pump provides forced air heating and cooling. Engineering and quality control is built into every geothermal unit. Good performance depends on proper application and correct installation.

**Notices, Cautions, Warnings, & Dangers**

**"NOTICE"** Notification of installation, operation or maintenance information which is important, but which is NOT hazard-related.

**"CAUTION"** Indicates a potentially hazardous situation or an unsafe practice which, if not avoided, COULD result in minor or moderate injury or product or property damage.

**"WARNING"** Indicates potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

**"DANGER"** Indicates an immediate hazardous situation which, if not avoided, WILL result in death or serious injury.

**Inspection**
Upon receipt of any geothermal equipment, carefully check the shipment against the packing slip and the freight company bill of lading. Verify that all units and packages have been received. Inspect the packaging of each package and each unit for damages. Insure that the carrier makes proper notation of all damages or shortage on all bill of lading papers. Concealed damage should be reported to the freight company within 15 days. If not filed within 15 days the freight company can deny all claims.

***Note:*** Notify Enertech Global's shipping department of all damages within 15 days. It is the responsibility of the purchaser to file all necessary claims with the freight company.

**Unit Protection**
Protect units from damage and contamination due to plastering (spraying), painting and all other foreign materials that may be used at the job site. Keep all units covered on the job site with either the original packaging or equivalent protective covering. Cap or recap unit connections and all piping until unit is installed. Precautions must be taken to avoid physical damage and contamination which may prevent proper start-up and may result in costly equipment repair.

**⚠ CAUTION ⚠**

**DO NOT OPERATE THE GEOTHERMAL HEAT PUMP UNIT DURING BUILDING CONSTRUCTION PHASE.**

**Storage**
All geothermal units should be stored inside in the original packaging in a clean, dry location. Units should be stored in an upright position at all times. Units should not be stacked unless specially noted on the packaging.

**⚠ WARNING ⚠**

**FAILURE TO FOLLOW THIS CAUTION MAY RESULT IN PERSONAL INJURY. USE CARE AND WEAR APPROPRIATE PROTECTIVE CLOTHING, SAFETY GLASSES AND PROTECTIVE GLOVES WHEN SERVICING UNIT AND HANDLING PARTS.**

## Section 7: Installation Introduction

***Consumer Instructions:*** Dealer should instruct the consumer in proper operation, maintenance, filter replacements, thermostat and indicator lights. Also provide the consumer with the manufacturer's Owner's Manual for the equipment being installed.

***Enertech Global D-I-Y Policy:*** Enertech Global's geothermal heat pumps and system installations may include electrical, refrigerant and/or water connections. Federal, state and local codes and regulations apply to various aspects of the installation. Improperly installed equipment can lead to equipment failure and health/safety concerns. For these reasons, only qualified technicians should install a Enertech Global built geothermal system.

Because of the importance of proper installation, Enertech Global does not sell equipment direct to homeowners. Internet websites and HVAC outlets may allow for purchases directly by homeowners and do-it-yourselfers, but Enertech Global offers no warranty on equipment that is purchased via the internet or installed by persons without proper training.

Enertech Global has set forth this policy to ensure installations of Enertech Global geothermal systems are done safely and properly. The use of well-trained, qualified technicians helps ensure that your system provides many years of comfort and savings.

***Equipment Installation:*** Special care should be taken in locating the unit. All units should be placed on a formed plastic air pad, or a high density pad slightly larger than the base of the unit.

***Electrical:*** All wiring, line and low voltage, should comply with the manufacturer's recommendations, The National Electrical Code, and all local codes and ordinances.

***Thermostat:*** Thermostats should be installed approximately 54 inches off the floor on an inside wall in the return air pattern and where they are not in direct sunlight at anytime.

***Loop Pumping Modules:*** Must be wired to the heat pump's electric control box. A special wiring whip is provided to connect the Pump Module wiring.

### Components

***Master Contactor:*** Energizes Compressor and optional Hydronic Pump package.

***Logic Board:*** Logic Board operates the compressor and protects unit by locking out when safety switches are engaged. It also provides fault indicator(s).

***Terminal Strip:*** Provides connection to the thermostat or other accessories to the low voltage circuit.

***Transformer:*** Converts incoming (source) voltage to 24V AC.

***Low Voltage Breaker:*** Attached directly to transformer, protects the transformer and low voltage circuit.

***Reversing Valve:*** Controls the cycle of the refrigerant system (heating or cooling). Energized in cooling mode.

***High Pressure Switch:*** Protects the refrigerant system from high refrigerant pressure, by locking unit out if pressure exceeds setting.

***Low Pressure Switch:*** Protects the refrigerant system from low suction pressure, if suction pressure falls below setting.

***Flow Switch (Freeze Protection Device):*** Protects the water heat exchanger from freezing, by shutting down compressor if water flow decreases.

***Compressor (Copeland Scroll):*** Pumps refrigerant through the heat exchangers and pressurizes the refrigerant, which increases the temperature of the refrigerant.

## Section 7: Installation Introduction

**Pre-Installation**

Special care should be taken in locating the geothermal unit. Installation location chosen should include adequate service clearance around the unit.

**Pre-Installation Steps:**

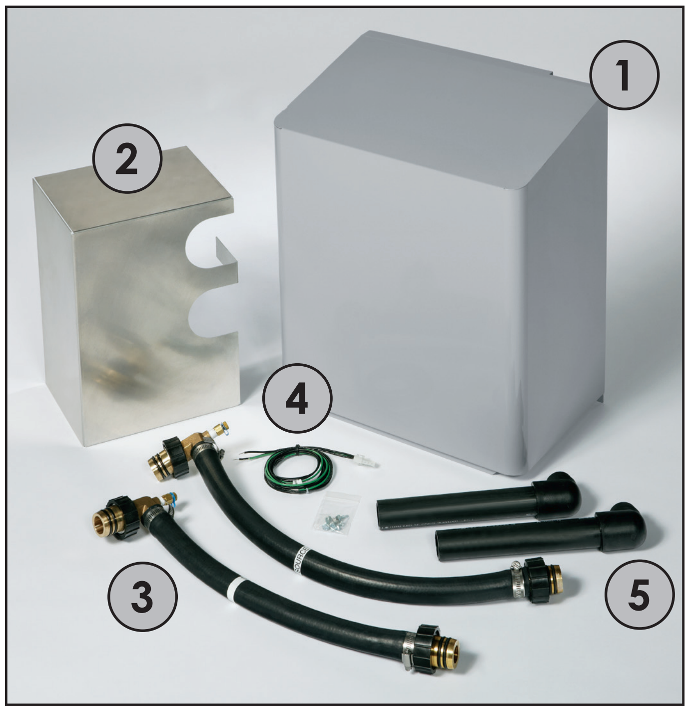
1. Compare the electrical data on the unit nameplate with packing slip and ordering information to verify that the correct unit has been shipped.
2. Inspect all electrical connections and wires. Connections must be clean and tight at the terminals, and wires should not touch any sharp edges or copper pipe.
3. Verify that all refrigerant tubing is free of dents and kinks. Refrigerant tubing should not be touching other unit components.
4. Before unit start-up, read all manuals and become familiar with unit components and operation. Thoroughly check the unit before operating.
5. Verify that all components of the system will have adequate service access.
6. Make sure that all applicable wiring, ductwork, piping, and accessories are correct and on the job site.
7. Verify that the air handler or "A" coil selected for the system is the correct AHRI match for the selected outdoor unit.

### ⚠ WARNING ⚠

**IF USING A DUAL FUEL APPLICATION, "A" COIL MUST BE INSTALLED ON THE OUTLET OF THE FURNACE. INSTALLATION ON THE RETURN COULD CAUSE FURNACE HEAT EXCHANGER FAILURE, AND MAY VOID FURNACE WARRANTY.**

8. For A-Coil installations, it is recommended that coil be sprayed with liquid detergent thoroughly and rinsed thoroughly before installation to assure proper drainage of condensate from the coil fins to eliminate water blowoff and to assure maximum coil performance. If not sprayed approximately 50 hours of break in time is required to achieve the same results.
9. Unpack all components of the outdoor installation kit, which is located in a separate box shipped with the unit. The kit should contain the following.

1 Flow Center Cover
2 Aluminum Pipe Shield
3 Pre-Assembled Hose Kit with P/T Ports
4 Pump Wiring Harness
5 PE 90° Street Elbows
(Shown with field provided piping)




### ⚠ CAUTION ⚠

**BEFORE DRILLING OR DRIVING ANY SCREWS INTO CABINET, CHECK TO BE SURE THE SCREW WILL NOT HIT ANY INTERNAL PARTS OR REFRIGERANT LINES.**

## Section 8a: Unit Placement

**Site Preparation**
First, survey the installation site to determine the best location for placing the outdoor unit. The outdoor unit must be installed no closer than 9 inches from the outdoor walls of the facility.

Ground level installations must be located according to local codes or ordinances. A suitable mounting pad must be used and it must be separate from the building foundation. The pad must be level and strong enough to support the weight of the unit. The pad height must be a minimum of 2 inches above grade and with adequate drainage.

An electrical disconnect must be located within sight of the unit and readily accessible. The electrical disconnect shall be capable of electrically de-energizing the outdoor unit. All electrical connections must be made in accordance with all applicable codes and ordinances. See electrical data tables for correct wire and fuse sizing.

**Unit Preparation**
Carefully remove all unit packaging and pallet fasteners that are located on two corners of the unit. Again inspect the unit for any damage to the cabinet or service valves.

**Unit Placement/Lifting Unit**
Once the site is ready for unit placement, the compressor section can be moved by lifting from the bottom of the unit. Do not lift the unit by placing your hand under the control box section, or by using the snow load bars, this could deform the unit and cause damage.

Once the unit is in-place, and oriented for both line set and loop connections, remove both the top cover and the control box cover.

**Unit Top Cover Removal**
To remove the unit top cover, remove the two screws on the front end of the top cover. Once the screws are removed, pull the lid slightly up, and then forward to disengage the rear retainer clips. Take care not to lift directly up as you may warp the retainer clips and cause the cover to not seat properly.

**Example 1: Outdoor Unit Placement**

**Example 2: Outdoor Unit Placement**

**Control Box Cover Removal**
To remove the control box cover, remove the four screws on both sides of the cover. The control box cover is designed to be removed wether the unit top cover is installed or not. However, if the unit top cover is installed, it might be slightly difficult to remove due to the gasketing that protects the control box from moisture. Take care with removal or replacement to not damage this gasketing.

## Section 8a: Unit Placement

**Flow Center Installation**
Once the unit is in-place, and the unit cover and control box cover is removed, the flow center can now be installed

The flow center is installed on the outside of the unit and is designed to hang over the unit pad. It is necessary to rotate the flow center to keep the flush valves between the loop and the pumps. Before installing the flow center, the pump(s) will need to be rotated on the flow center where the electrical box is in the upward direction (Figure 1). Failure to reorientate the pumps could lead to condensation entering the electrical box of the pump potentially causing unit damage. Once the pumps are rotated, the flow center can be attached to the cabinet with four provided screws.

After the flow center is mounted on the unit, the provided wire harness which connects the flow center to the control section can be attached (Figure 2).

Once the pumps are wired and connected, install the provided hose kit to connect the flow center to the unit. The hoses are clearly labeled  loop in and loop out. The hose kits are designed so that the 90° elbows with the PT ports are installed on the flow center side. All models utilize double o-ring fittings for hose kit connection. Make sure all connections are solid and retainer rings are secure and hand tight.

**Freeze Sensor**
A built-in freeze protection system energizes the flow center pumps to circulate the loop fluid when the cabinet temperature is below 22°F. The pumps are disengaged when the cabinet temperatures is above 32°F. (The switch has a tolerance of +/- 3°F)

**Figure 1: Flow Center Installation**

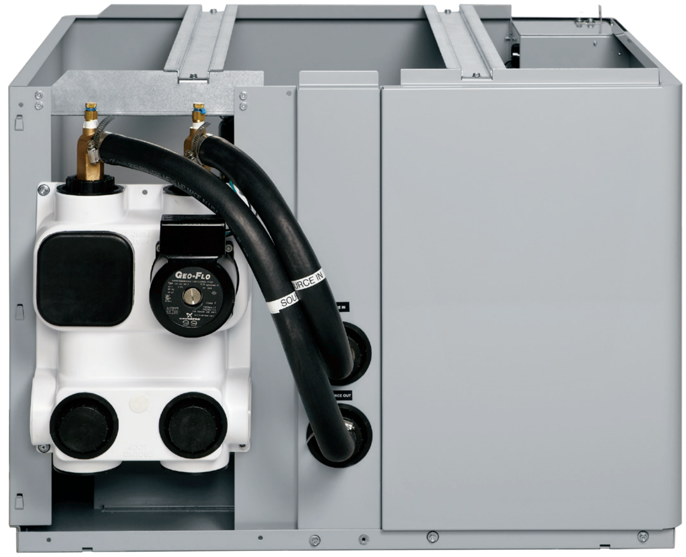
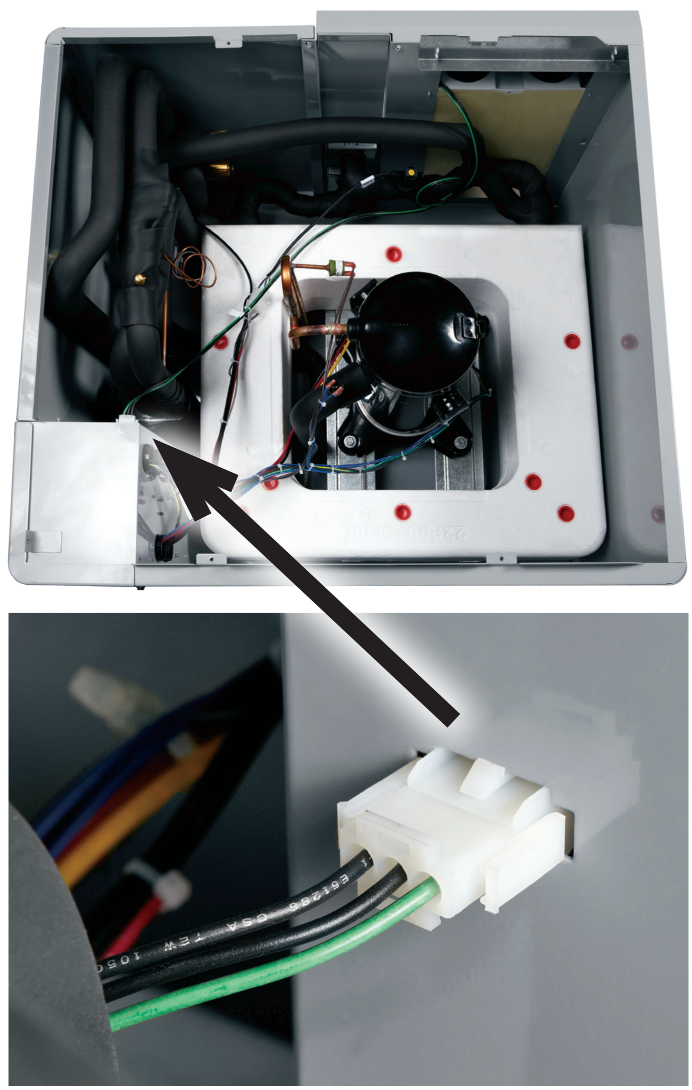


**Figure 2: Flow Center Wiring**



## Section 8a: Unit Placement

### Loop Connection

The RT is designed around making loop connection easy. Once the flow center is in-place, it's time to bring the loop to the unit.

After the loop has been installed and headered, the supply and return lines should be trenched to the side of the unit where the flow center is located. At this point, you have a couple of options on connecting the loop to the flow center.

### Option 1:

The loop can be brought directly into the bottom of the flow center using the double o-ring to PE fusion fitting included with the flow center (Figure 3). This might be slightly difficult depending on how much play you have with the piping and area to work in.

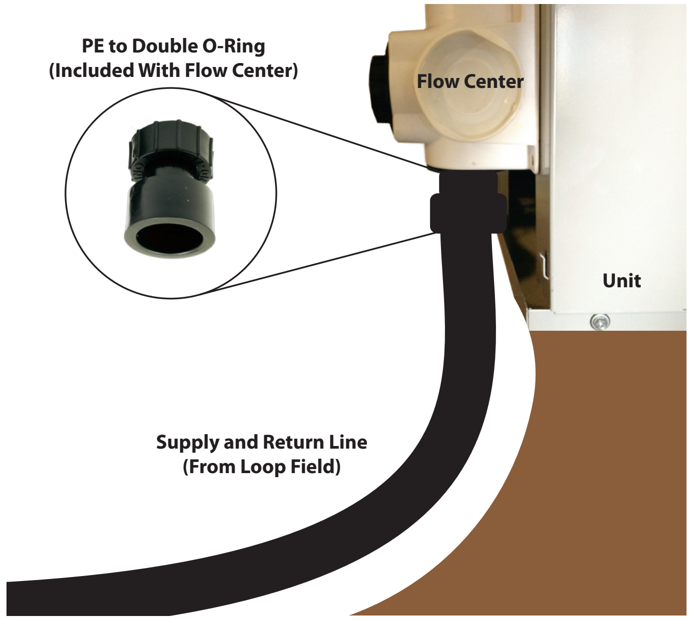
### Option 2:

The loop can be brought at an angle into the bottom of the flow center. Included with the installation kit are 2 90° PE street elbows. These should be fused to the double o-ring to PE fusion fitting included with the flow center. From there, you can use an extension of PE pipe and another 90° elbow to make the final connection. The aluminum pipe shield and outdoor cover have been designed with extra room to accommodate this option (Figure 4). If this option is installed above grade, the total assembly cannot exceed 9" to fit inside the pipe shield.

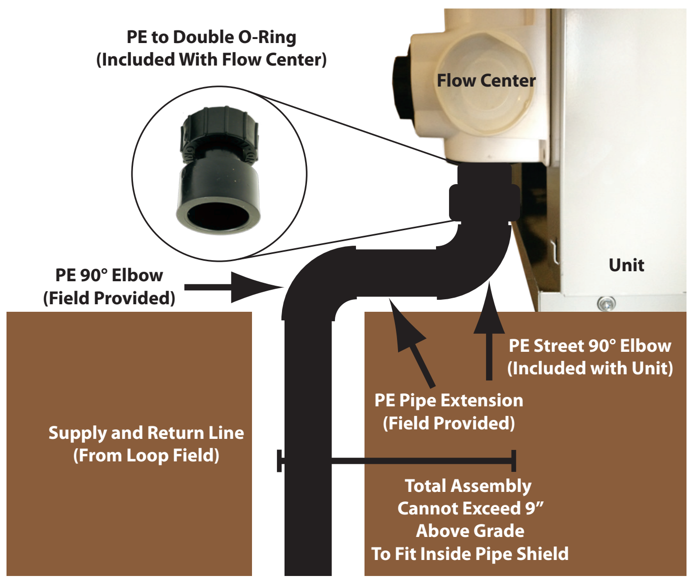
### Loop Flushing

Once all loop and unit piping is completed, flush and fill the loop using normal procedures outlined in the Loop & Flow Center AOM (PN# 2323-0027-001. See the water quality (Section 9) and antifreeze overview and charging (Section 10) sections in this document for additional information.

### Figure 3: Straight Loop Connection




### Figure 4: Angled Loop Connection




### Pipe Shield

Once the loop installation is completed, the pipe shield can be installed. This aluminum shield will protect the loop lines from damage.

To install the shield, you may have to clear out a small amount of dirt around the loop piping. The shield had notches and a guide for proper placement. The goal is to have the shield slightly buried to insure proper protection.

## Section 8a: Unit Placement

### Line Set Installation

The RT model features angled backseating service valves for line set installation. See Section 9b for proper procedures for installation of the line set and unit charging.

### Unit Wiring

Line voltage to the unit should be supplied from a dedicated branch circuit containing the correct fuse or circuit breaker for the unit. The outdoor unit requires both power and control circuit electrical connections. All electrical connections must be in accordance with all applicable codes and ordinances.

Line voltage to the unit must be protected and brought into the unit through the bottom of the control box. Wires should be attached to the L1 and L2 terminals of the contactor, and to ground. See electrical data tables for correct wire and fuse sizing for each unit.

### Unit Assembly

Once the following installation items are completed, use the Unit Startup form in this manual to begin final unit startup.

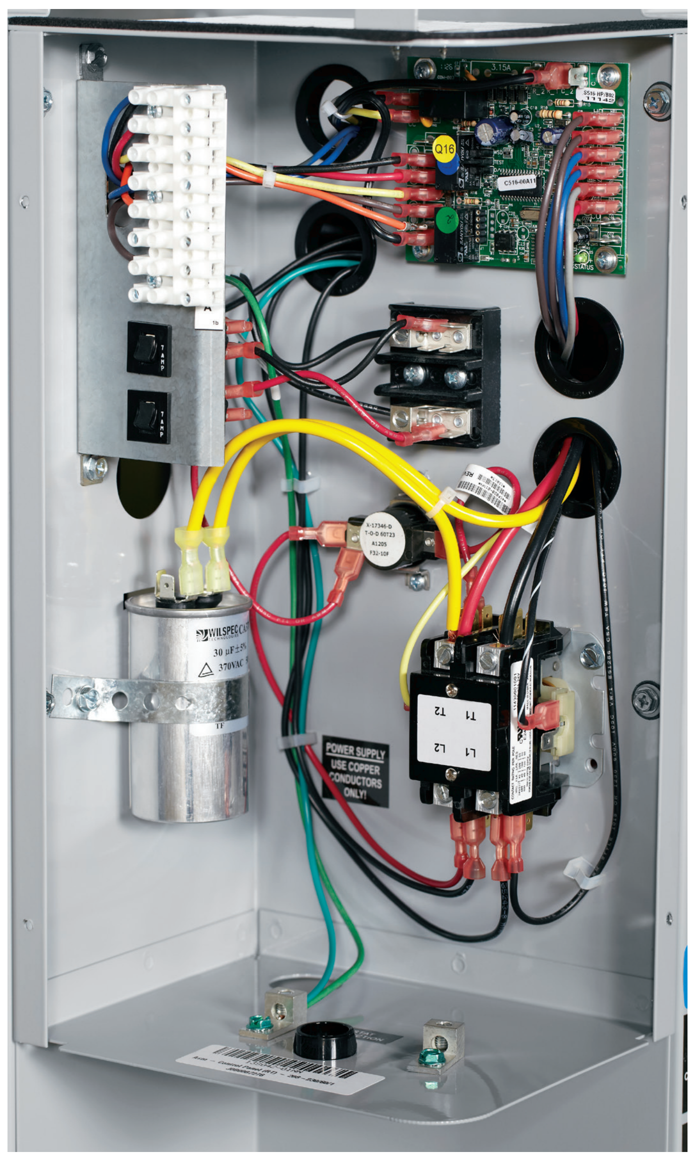
1. Flow center installed, loop field connected, hose kit connection, unit and loop field flushed and filled.
2. Line and low voltage wiring completed.
3. Line set installed at the unit and at the air handler or "A" coil.
4. Unit fully charged and ready for operation.

Once the final startup has been completed and the unit is operating properly, replace all panels and covers in the following order.

1. **Flow center cover.** The flow center cover locks into place with clips on the left side and screws along the top to secure the cover to the unit. The cover should fit over the aluminum pipe shield.
2. **Control Box Cover.** The control box cover secures to the cabinet with four screws.
3. **Top Unit Cover.** Place the unit cover clip first onto the back of the unit. Keeping the cover at about a 10° angle to the top of the unit, slide the cover back to engage the clips. Once the clips are engaged, lower the lid down and replace the two front screws to finish securing the lid.

**Figure 5: Service Valves**

**Figure 6: Control Box**



## Section 8b: Filter Drier Installation

**INSTALLATION**

A reversible heat pump filter drier must be installed on the liquid line near the cabinet of the compressor section. A filter drier is furnished with the unit. The filter drier kit includes a 3" piece of 1/2" or 5/8" copper tubing. This tubing will fit either inside or on the outside of the stub coming off the liquid line service valve. Braze it in place. Then braze the filter drier onto it. Make sure the arrow on the filter drier points in the appropriate direction. A second piece of copper is attached between the filter drier and the liquid line (not needed for all applications, depending upon line set size -- consult line set sizing chart).

Refer to the split system I.O.M. (installation, operating, and maintenance) manual for details on line set and unit installation. Always use dry nitrogen when brazing.

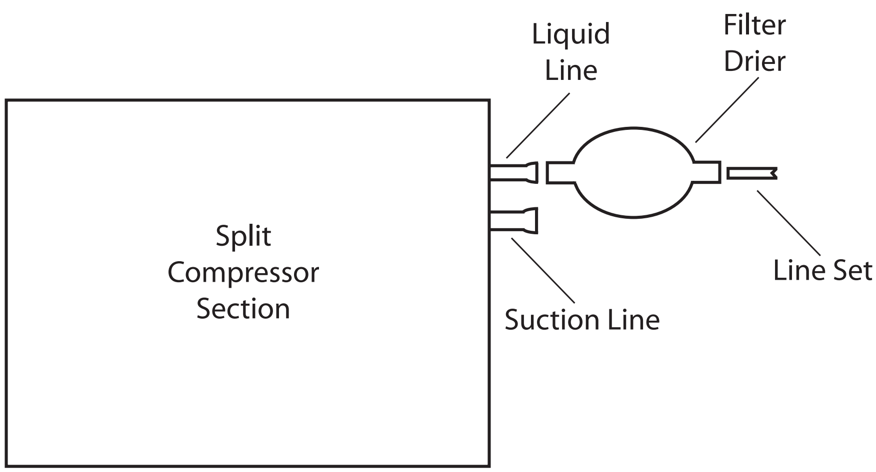
### Table 1: Recommended Line Set Sizes

| Model | Unit Refrigerant Connections | | Recommended Liquid & Suction Line Size | | | |
|---|---|---|---|---|---|---|
| | | | 20 Feet | | 50 Feet | |
| | Liquid Line (OD) | Suction Line (OD) | Liquid Line (OD) | Suction Line* (OD) | Liquid Line (OD) | Suction Line (OD) |
| 024 | 3/8 | 7/8 | 3/8 | 7/8 | Two-stage unit's line sizes should not be increased due to reduced pumping capacity in first stage. | |
| 036 | 3/8 | 7/8 | 3/8 | 7/8 | | |
| 048 | 3/8 | 7/8 | 3/8 | 7/8 | | |
| 060 | 1/2 | 1-1/8 | 1/2 | 1-1/8 | | |

40°F Evaporating Temperature
*Suction line is not sized large in two-stage units due to the lower velocity of first stage operation.

| Weight of refrigerant in copper lines per 10 feet | |
|---|---|
| Liquid Line Size (OD) | Oz. Per 10 Feet |
| 3/8" | 5.4 |
| 1/2" | 10.4 |
| 5/8" | 19.5 |

### Figure 7: Filter Drier Installation



## Section 8c: Line Set Installation

**INTRODUCTION**

The purpose of this section is to help in the design of refrigeration line sets on geothermal heat pump systems. The three considerations when designing a refrigerant piping system are as follows:

1. System Reliability: Poor Oil Management may shorten the life of the compressor. Proper liquid refrigerant control is essential.

2. System Performance: Pressure drop in refrigerant lines tends to decrease capacity and increase power consumption. High velocities can increase sound levels. Modulation often depends on proper piping.

3. Cost: Level of refrigerant, copper piping, accessories, and labor used will impact the applied cost.

**DEFINITIONS**

Long line set applications are defined as any line set that includes 50 feet or more of interconnecting tubing or a vertical distance between the evaporator and compressor sections exceeding 20 feet.

**LINE SET REQUIREMENTS/LIMITATIONS**

**Line Set Limitations**

Up to 50 equivalent feet: Use rated line sizes listed in unit installation instructions.

50 - 75 equivalent feet or 20 feet of vertical separation: Bi-flow liquid line solenoid and crankcase heater required (refer to figures 12-15 on pages 35-38).

**Maximum Piping Lengths:**

Maximum equivalent length = 75 feet
Maximum linear length = 50 feet
Maximum linear liquid lift = 50 feet
Maximum linear vapor rise =
50 feet (Single Speed)/25 feet (Two Stage)

**FITTINGS AND COMPONENTS**

All piping should be "ACR" or "L" type copper pipe. Long radius fittings should always be used unless there is not enough physical space. Pressure drop due to friction in pipe, fittings and field installed accessories such as a drier, solenoid valve or other devices should be considered (see Table 2). The pressure drop due to friction is usually smaller than pressure drop due to lift. The pressure drop ratings of field installed devices are usually supplied by the manufacturer of the device and should be used if available.

**Equivalent Length**

Valves, fittings, and bends create more friction pressure drop than straight copper piping. Find the equivalent feet of straight tubing for each fitting for calculations. This allows for a quick calculation of the total equivalent length (see Example 1). The equivalent length of copper tubing for commonly used fittings, valves, and filter-drier are shown in Table 2.

***Total Equivalent Length = Linear Feet of Straight Tubing + Fitting Losses in Equivalent Feet***

Example 1: A 3-ton unit with 7/8" vapor tubing has 50 linear feet of straight tubing. The total number of elbows includes three long radius 90° elbows and five standard 90° elbows.

50ft. of straight tubing
+ 4 standard 90° elbows X 2 equiv ft
+ 1 liquid line solenoid X 12 equiv ft
+ 1 filter-drier X 6 equiv ft
= 50ft. + 8ft. + 12ft. + 6ft.
= 76 ft. total equivalent length

### Table 2: Copper Fittings in Equivalent Length

| Tube Size O.D. (in.) | 90° Std A | 90° Long Radius - B | 45° Std C | 45° Long Radius |
|---|---|---|---|---|
| 3/8" | 1.2 | 0.8 | 0.5 | 0.3 |
| 1/2" | 1.3 | 0.9 | 0.6 | 0.4 |
| 5/8" | 1.6 | 1.0 | 0.8 | 0.5 |
| 3/4" | 1.8 | 1.2 | 0.9 | 0.6 |
| 7/8" | 2.0 | 1.4 | 1.0 | 0.7 |
| 1-1/8" | 2.6 | 1.7 | 1.3 | 0.9 |
| Liquid Line Solenoid | 12 | | | |
| Filter | 6 | | | |

## Section 8c: Line Set Installation

### LINE SETS

**Vapor Line**
A long line set application can critically increase the charge level needed for a system. As a result, the system is very prone to refrigerant migration during its off-cycle. A crankcase heater and bi-flow liquid line solenoid will help minimize this risk. A crankcase heater and bi-flow liquid line solenoid is recommended for any line set over 50 feet in equivalent length or 20 feet of vertical separation. Because oil separates from the refrigerant in the evaporator, the vapor line velocity must be adequate to carry the oil along with the refrigerant. Horizontal vapor lines require a minimum of 800 fpm velocity for oil entrainment. Vapor risers require 1200 fpm minimum, and preferably 1500 fpm regardless of the length of the riser.

***NOTE: When a two-stage compressor section is located above the indoor coil, the maximum vertical rise of a vapor line must not exceed 25 feet. This limit is due to velocity requirements for oil entrainment in the vapor riser.***

For example, a 4 ton unit producing 48,000 Btuh with a 7/8" vapor line has a velocity of 1500 fpm (See Figure 9). On first stage the compressor runs at 67% or 32,680 Btuh and has a velocity of less than 1200 fpm per the pressure drop chart. In order to achieve velocity up to 1500 fpm in first stage, the line would have to be 3/4". The pressure drop for 48,000 Btuh would be over 9 psi. A system will lose approximately 1% capacity for every pound of pressure drop due to friction in the suction line. This 1% factor is used to estimate the capacity loss of refrigerant lines. Due to the low velocities created in the vapor line in first stage, a two stage unit vapor line should not be increased from the pipe size at the compressor section.

For all vapor line trapping see Figure 8. Remember to add all the fittings into the total equivalent length of the vapor line.

**Liquid Line**
Pressure drop due to vertical liquid lift must be considered. The pressure drop for vertical lift is 0.43 pound per foot for R-410A. This is usually large and may be a limiting factor in the ultimate design of the system. Next, the pressure entering the expansion device must be sufficient to produce the required flow through the expansion device. A pressure drop of 175 psi for R-410A across the expansion valve and distributor is necessary to produce full refrigerant flow at rated capacity. Therefore, it is necessary for liquid refrigerant (free of flash gas) to be delivered to the expansion valve. Longer line sets may require a larger liquid line due to the higher pressure drops of smaller diameter tubing. Reference the Installation Manual for recommended liquid line sizes for each unit. Even liquid lines on two stage units can be increased because velocities required for oil return are not critical in the liquid line.

### Figure 8: Oil Trap Construction

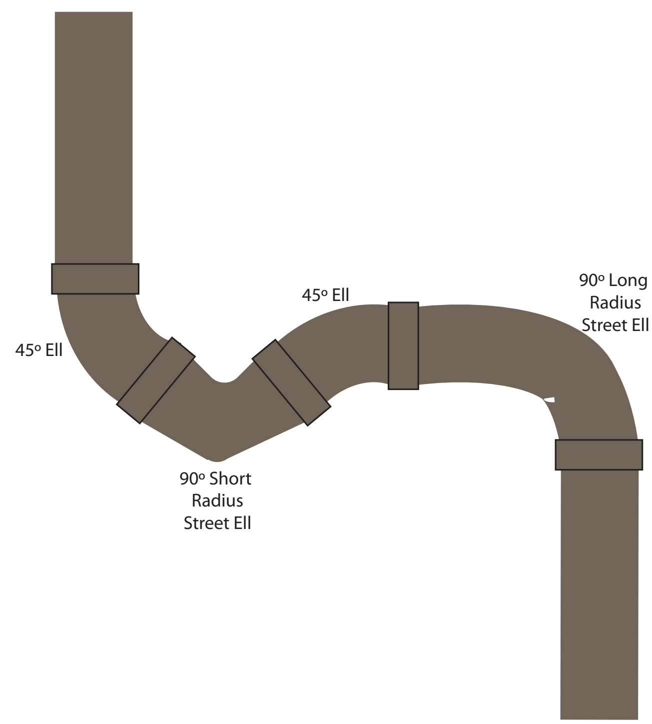
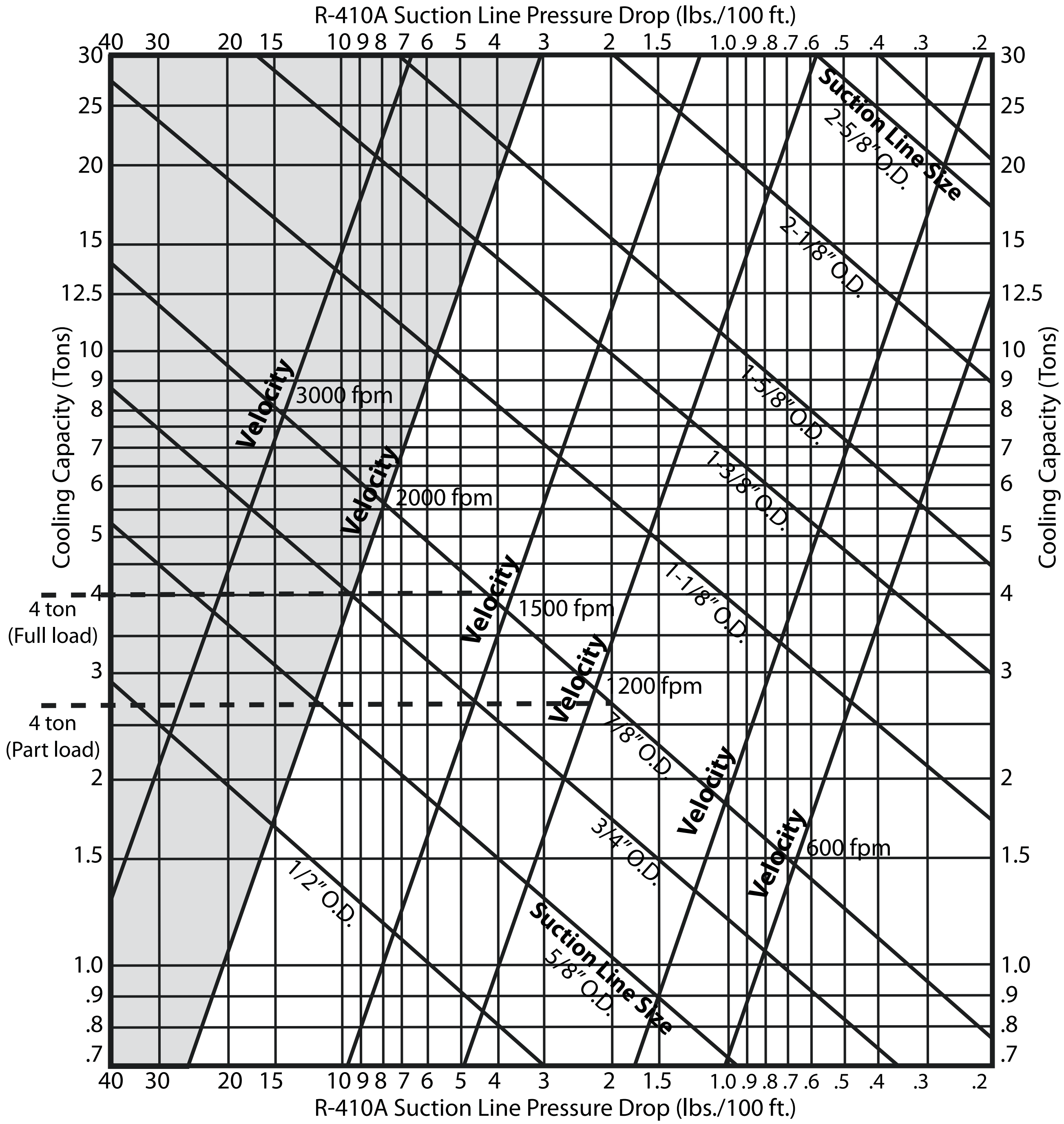


**Figure 9: Refrigerant R-410A Suction Line Pressure Drop/Velocity per 100 ft. of Line at 45°F Evaporating Temperature and 125°F Condensing Temperature**




To use this chart, first find capacity (tons) on the left side of the chart. To find pipe size, procede right to the smallest pipe size. Pressure drop (vertical line) and velocity (diagonal lines) can then be determined for the pipe size selected. For example, for a 4 ton unit, select 7/8" O.D. line.
NOTE: Shaded area denotes unacceptable velocity range.

## GEOTHERMAL REFRIGERATION CIRCUITS

### Bi-Flow Liquid Line Solenoid Valve

In order to minimize off-cycle refrigerant migration to the compressor, a bi-flow liquid line solenoid is required for all long line set heat pump applications. The Bi-flow solenoid valve controls the flow of refrigerant only in the direction of the arrow molded into the valve. The bi-flow liquid line solenoid valve is shipped as a single flow valve, the carton contains another valve stem which needs to be installed in the valve to convert it to a bi-flow valve. The bi-flow valve should be connected to the 24V side of the contactor. When installing the valve, **the arrow should be positioned toward the compressor section** to minimize the transfer of liquid directly into the coax in the heating mode. The solenoid should be installed right after the filter-drier or within two feet of the compressor section.

### Charging Information

Since the lengths of line sets vary, it is necessary to calculate additional refrigerant charge. Compressor sections do not have additional charge for the line set. Each foot of liquid line and vapor length requires the amount of refrigerant designated in Table 3. Also, long line applications require a minimum of 10 degrees subcooling to prevent any refrigerant flashing before the thermostatic expansion valve. The subcooling and superheat should be checked in both modes of operation. Refer to the operating pressure chart in the Specifications manual for the correct superheat.

## PIPING DIAGRAMS

The piping diagrams on the following pages illustrate considerations for applications of a solenoid valve, traps, and piping based upon the location of the compressor section and air handler.

### Table 3: Refrigerant Weight

| Weight of Refrigerant in Copper Tubing Per Foot (in Ounces) | | |
|---|---|---|
| O.D. (in.) | Liquid Line | Suction (Vapor) Line |
| 3/8” | 0.54 | |
| 1/2” | 1.04 | |
| 5/8” | 1.95 | 0.07 |
| 3/4” | | 0.10 |
| 7/8” | | 0.13 |
| 1-1/8” | | 0.21 |

## SPLIT SYSTEM CHARGING - APPROACH METHOD

Charging Enertech split systems can easily be accomplished by measuring approach temperatures when operating in the cooling mode. This method, outlined in the steps below, is based upon testing in Enertech's R & D labs with matched compressor/air handler or A-coil components. For best results, the indoor temperature should be between 70°F and 85°F in cooling. Charging the unit in cooling is the most accurate method. If unable to charge the unit in cooling mode, refer to the next section, "Split System Charging -- Subcooling/Superheat Method." Refer to figure 6 for temperature and pressure measurement locations when using the approach method.

**Please Note:** Before utilizing the approach method for checking the system charge, confirm the system reaches a minimum of 2°F subcooling, while maintaining a maximum of 22°F superheat. If you are not able to achieve these readings, further troubleshooting will be required (Reference Table 12 in Section 13, Refrigeration Troubleshooting). Consult the Refrigeration/Troubleshooting manual for a review of Superheat/Subcooling calculations.

1. If the entering water temperature is above 45°F and the entering air temperature is above 70°F, the unit should be charged in cooling for the most accurate results. If the return air temperature is below 70°F, it may be necessary to run the system in emergency heating mode to raise the indoor temperature above 70°F.
2. Evacuate the line set and A-coil. Open the service valves, and monitor the system pressures while charging. Model 024 is charged with 36oz; model 036 is charged with 56oz; and models 048 - 072 are charged with 80oz. This factory charge is a "starting" supply. Charge will need to be added for the line set and heat exchangers. However, do not add charge until the unit has run for at least five minutes, and the subcooling is above 2°F (see step #3).
3. The approach temperatures will not be usable if there is not a liquid lock at the liquid line (i.e. there is some subcooling at the liquid line). Record the liquid line pressure and the saturation temperature (most gauge sets show saturation temperature on the gauge). Measure the liquid line temperature. If the liquid line is not at least 2°F cooler than the liquid line saturation temperature, there may not be a liquid lock. Continue to add charge until subcooling reaches at least 2°F. Then, proceed to step #4.
4. Measure the water flow rate and entering water temperature (EWT). Measure the liquid line temperature (using the same digital thermometer if possible).
5. Subtract the EWT from the liquid line temperature (LLT) to determine approach temperature (Approach temperature = LLT - EWT).
6. Compare the result to Table 4. If the approach temperature is too high, add charge; if it's too low, recover charge. Approach temperature should be within 1°F of the table value.

## SPLIT SYSTEM CHARGING - SUBCOOLING/ SUPERHEAT METHOD

If checking charge in the heating mode (***preferred charging mode is cooling***), follow the steps below. For best results, the indoor temperature should be between 60°F and 70°F in heating. If the return air temperature is below 60°F, it may be necessary to run the system in emergency heating mode to raise the indoor temperature above 60°F. Refer to figure 7 for temperature and pressure measurement locations when using the Subcooling/Superheat method.

1. Evacuate the line set and A-coil. Open the service valves, and monitor the system pressures while charging. The compressor section is charged for the compressor section and air handler/A-coil only (except model 024, which includes about 65% of this charge for manufacturing process reasons). Charge will need to be added for the line set (and heat exchangers for model 024). However, do not add charge until the unit has run for at least five minutes, and the subcooling is above 2°F (see step #2).
2. The system will not be stable if there is not a liquid lock at the liquid line (i.e. there is some subcooling at the liquid line). Record the liquid line pressure and the saturation

## Section 8c: Line Set Installation

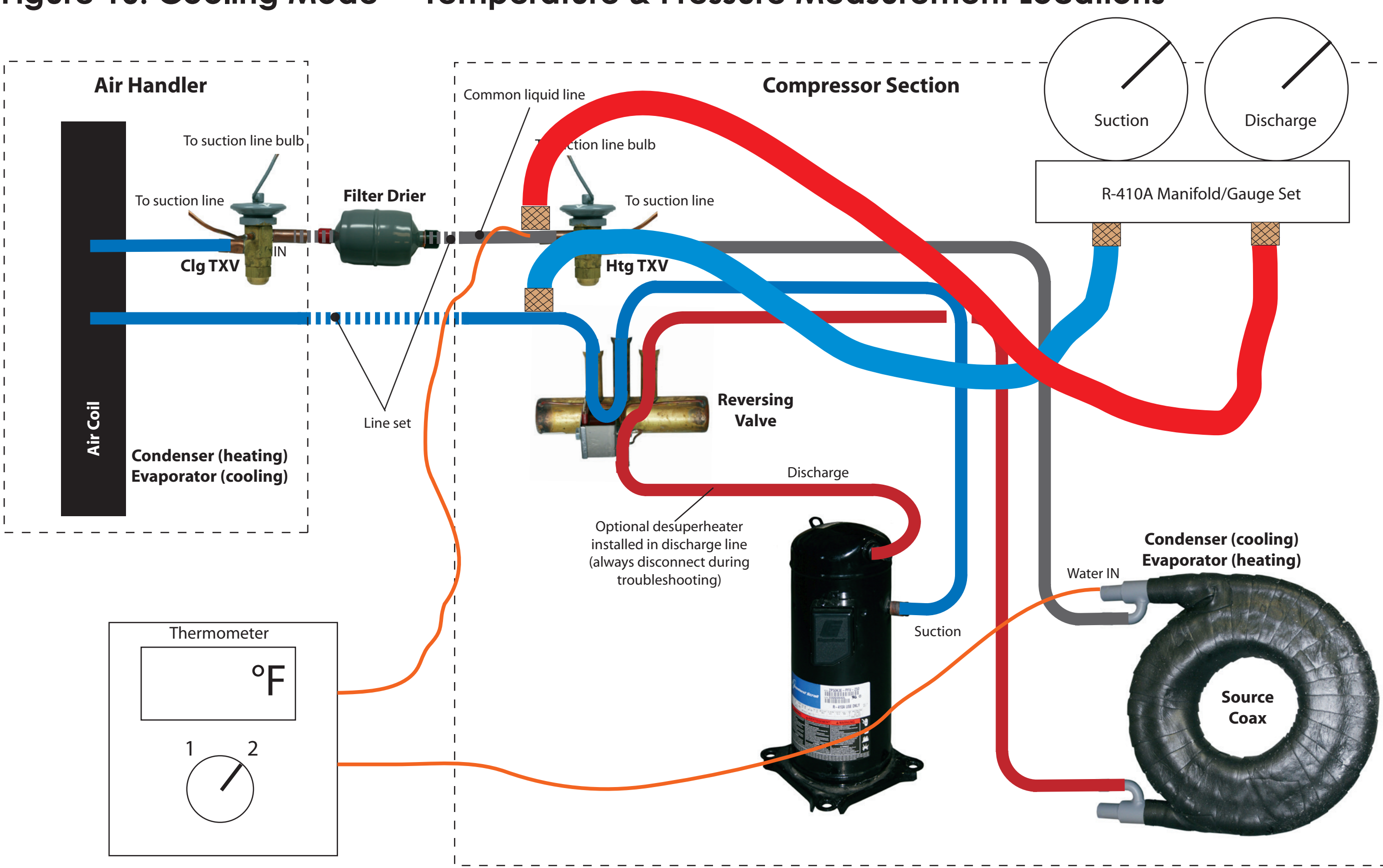
### Table 4: Approach Temperatures-Cooling Mode*

Full Load Operation

| Water Flow GPM/ton | Entering Water Temp., deg F | Entering Air DB Temp., deg F | Approach Temp. by Model, deg. F **Full Load** | | | |
|---|---|---|---|---|---|---|
| | | | 024 | 036 | 048 | 060 |
| 1.5 | 45 | 70 - 85 | 6 | 5 | 18 | 8 |
| | 55 | | 6 | 6 | 15 | 7 |
| | 65 | | 5 | 5 | 12 | 5 |
| | 75 | | 4 | 4 | 9 | 3 |
| | 85 | | 3 | 3 | 6 | 2 |
| 2.25 | 55 | 70 - 85 | 4 | 2 | 13 | 4 |
| | 65 | | 4 | 3 | 10 | 4 |
| | 75 | | 3 | 3 | 7 | 3 |
| | 85 | | 2 | 2 | 5 | 1 |
| | 95 | | 1 | 2 | 2 | 1 |
| 3.0 | 55 | 70 - 85 | 3 | 1 | 11 | 3 |
| | 65 | | 3 | 2 | 9 | 3 |
| | 75 | | 2 | 2 | 6 | 2 |
| | 85 | | 1 | 2 | 4 | 1 |
| | 95 | | 1 | 1 | 2 | 1 |

*Cooling approach temperature = Liquid Line temp - Entering Water temp
(should be within +/- 1 deg F)

### Figure 10: Cooling Mode -- Temperature & Pressure Measurement Locations




**NOTE: Check water flow via pressure drop method (pressurized systems) or flow meter tool (non-pressurized systems). Compare water flow to chart in Table 2.**

temperature (most gauge sets show saturation temperature on the gauge). Measure the liquid line temperature at the air handler. If the liquid line is not at least 2°F cooler than the liquid line saturation temperature (i.e. 2°F Subcooling), there may not be a liquid lock. Continue to add charge until subcooling reaches at least 2°F. Then, proceed to step #3.

3. Record the suction pressure and the saturation temperature (most gauge sets show saturation temperature on the gauge). Measure the suction line temperature. If the suction line temperature is more than 15°F higher than the saturation temperature (i.e. 15°F Superheat), the unit is undercharged.
4. Continue to add charge to the unit, comparing the Superheat/Subcooling results to Table 5. Stop adding charge when the Superheat/Subcooling values are within range. Each time the refrigerant charge is adjusted, allow at least five minutes run time for the system to stabilize.

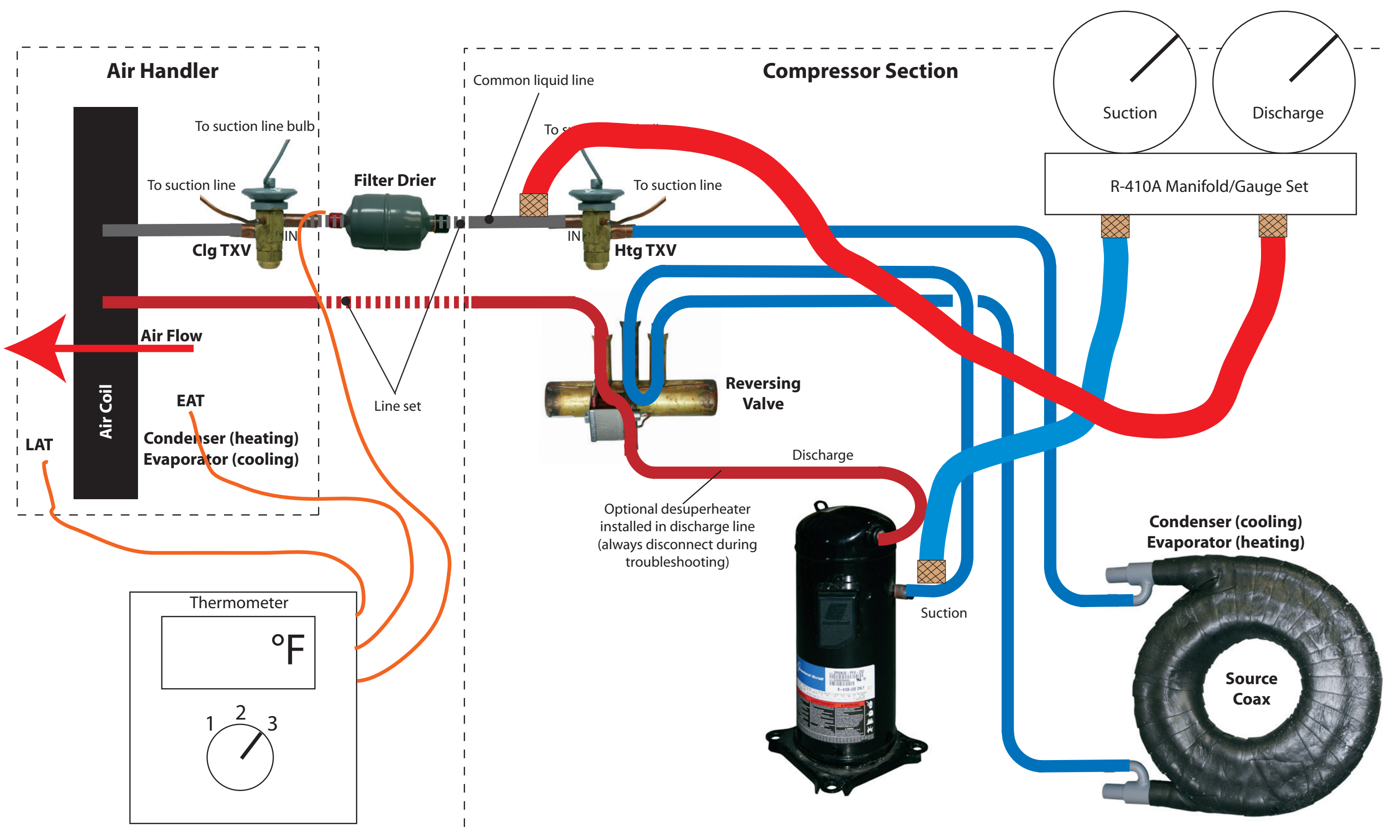
### Table 5: Subcooling/Superheat-Heating Mode*

Full Load Operation

| Model | Entering Water Temp., deg. F | Entering Air Temp., deg. F | Subcooling | Superheat |
|---|---|---|---|---|
| 024 | 32 | 60 - 70 | 3 - 5 | 8 - 10 |
| | 40 | | 2 - 4 | 9 - 11 |
| | 50 | | 2 - 4 | 9 - 11 |
| 036 | 32 | 60 - 70 | 7 - 9 | 5 - 7 |
| | 40 | | 7 - 9 | 5 - 7 |
| | 50 | | 7 - 9 | 5 - 7 |
| 048 | 32 | 60 - 70 | 4 - 6 | 6 - 8 |
| | 40 | | 4 - 6 | 7 - 9 |
| | 50 | | 4 - 6 | 9 - 11 |
| 060 | 32 | 60 - 70 | 2 - 4 | 4 - 6 |
| | 40 | | 3 - 5 | 5 - 7 |
| | 50 | | 6 - 8 | 5 - 7 |

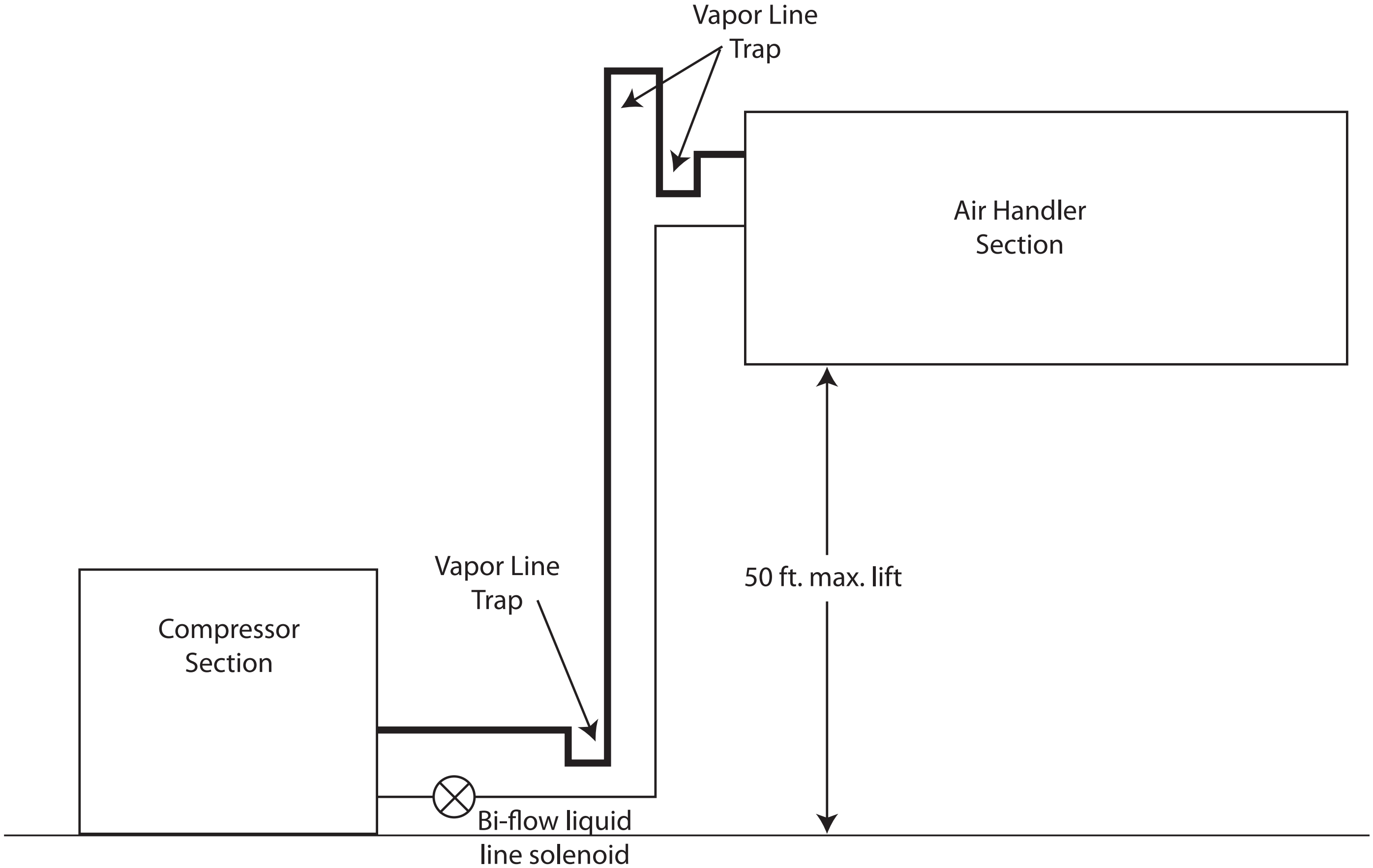
*Valid for flow rates between 1.5 and 3 GPM/ton.

### Figure 11: Heating Mode -- Temperature & Pressure Measurement Locations



## Section 8c: Line Set Installation

### Figure 12: Air handler section above compressor section



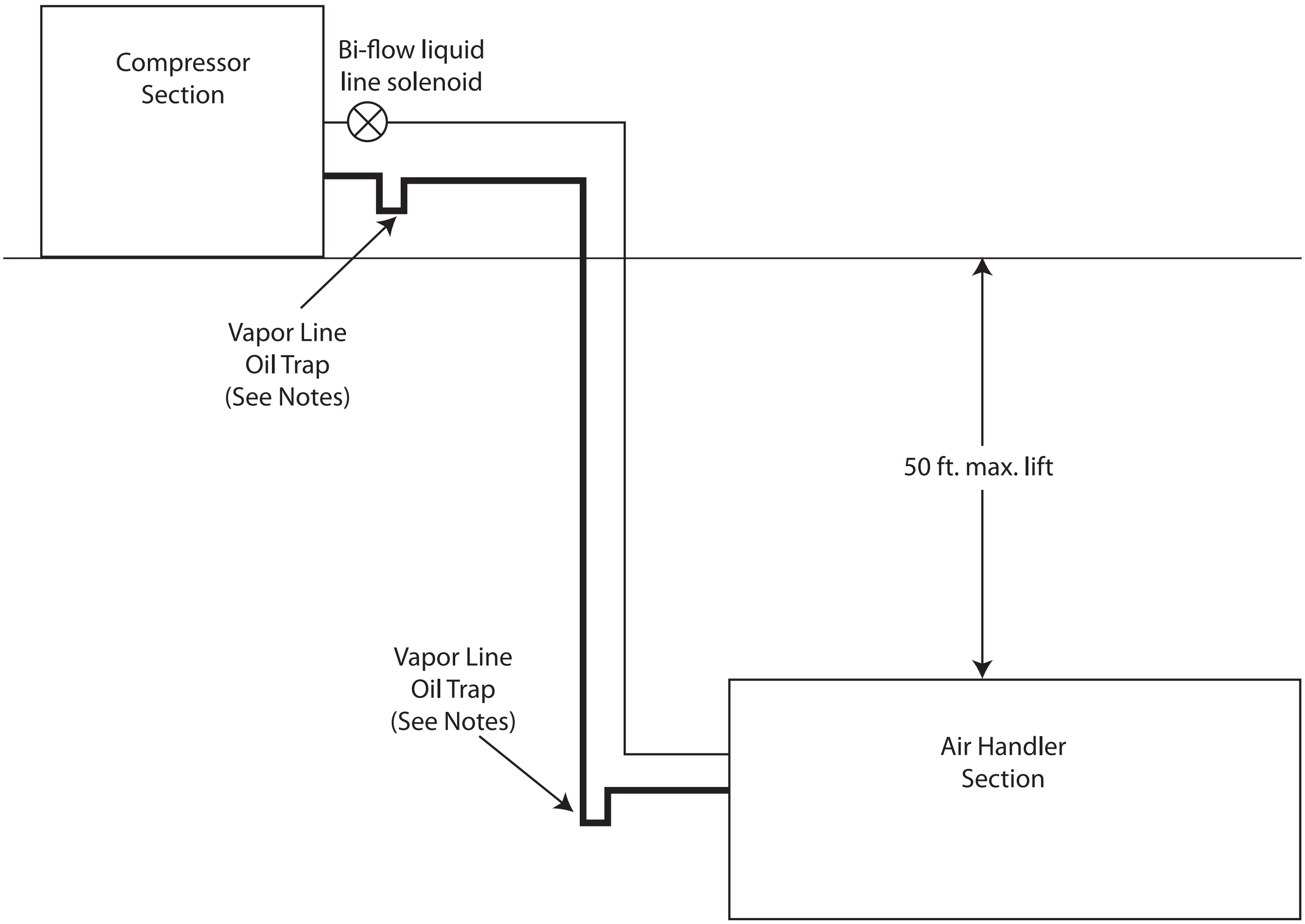

**Notes:**

- A Bi-flow liquid line solenoid required if total equivalent length is greater than or equal to 50 feet or the vertical separation is greater than or equal to 20 feet. See tables below for descriptions and part numbers.
- An inverted vapor line trap must be installed with the top of the trap above the evaporator section.
- P-traps should be installed at the outlet of the evaporator section and at the bottom of vapor line drop.
- 75 feet maximum equivalent line length
- 50 feet maximum vertical separation
- Vapor Line sizes on Two-stage units should not be increased due to the velocity requirements for returning oil to the compressor.

| Bi-flow Solenoid Data | | |
|---|---|---|
| Compatible Models | Description | Part Number |
| All Split Models (24-60) | 1/2" Valve Body | ARS-4A |
| | 24V Coil | ARSCB |
| | Bi-flow kit | ARSBK |
| Only required in long line set applications. All three parts must be ordered. | | |

## Section 8c: Line Set Installation

### Figure 13: Compressor section above air handler section



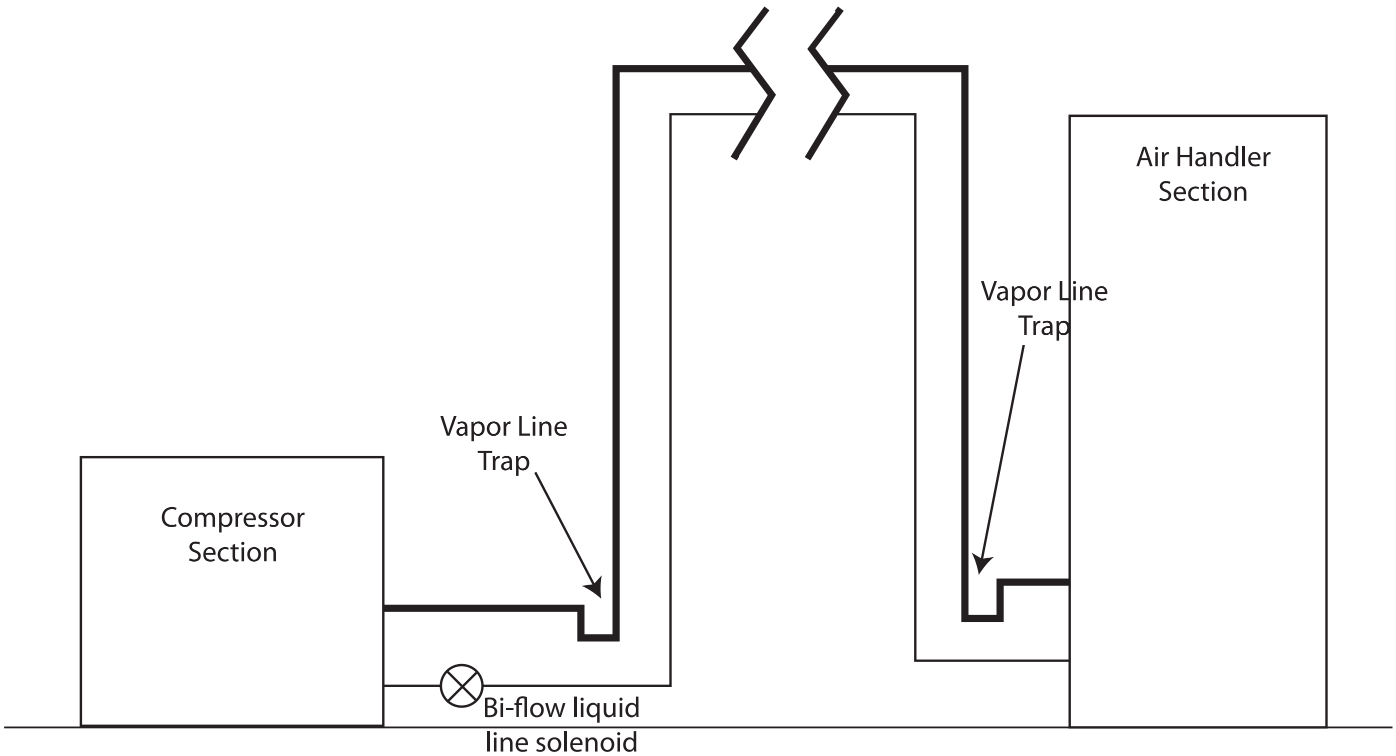

**Notes:**

- A Bi-flow liquid line solenoid required if total equivalent length is greater than or equal to 50 feet or the vertical separation is greater than or equal to 20 feet. See tables below for descriptions and part numbers.
- A P-trap should be installed at the outlet of the evaporator section.
- If vertical separation is greater than or equal to 50 feet a second trap should be installed at the 50 feet mark.
- 75 feet maximum equivalent line length
- 50 feet maximum vertical separation
- Vapor Line sizes on Two-stage units should not be increased due to the velocity requirements for returning oil to the compressor.
- Two-stage units should have a maximum of 25 feet of vertical lift on the vapor line.

| Bi-flow Solenoid Data | | |
|---|---|---|
| Compatible Models | Description | Part Number |
| All Split Models (24-60) | 1/2" Valve Body | ARS-4A |
| | 24V Coil | ARSCB |
| | Bi-flow kit | ARSBK |
| Only required in long line set applications. All three parts must be ordered. | | |

## Section 8c: Line Set Installation

### Figure 14: Horizontal piping above air handler section



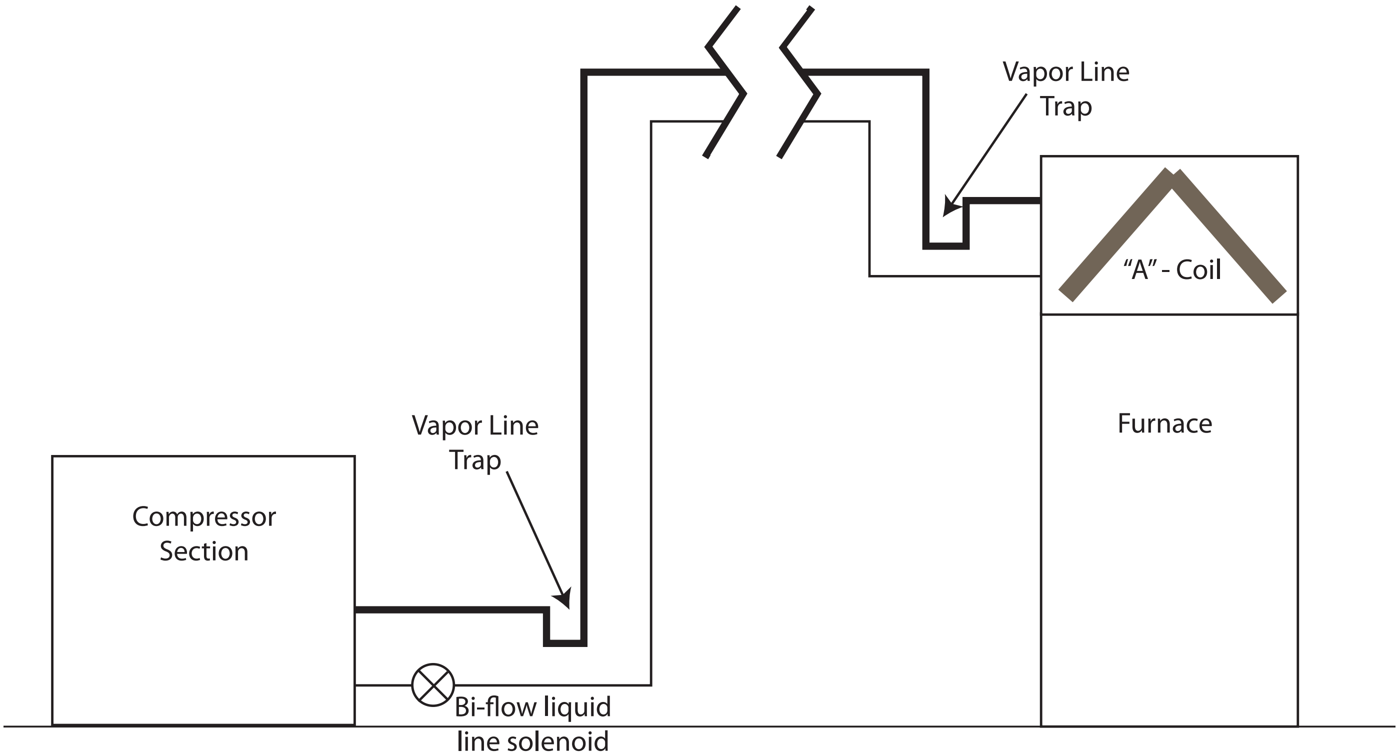

**Notes:**

- A Bi-flow liquid line solenoid required if total equivalent length is greater than or equal to 50 feet or the vertical separation is greater than or equal to 20 feet. See tables below for descriptions and part numbers.
- The vapor line must be installed with the horizontal run higher than the top of the evaporator section.
- P-traps should be installed at the outlet of the evaporator section and at the bottom of vapor line drop.
- 75 feet maximum equivalent line length
- 50 feet maximum vertical separation
- Vapor Line sizes on Two-stage units should not be increased due to the velocity requirements for returning oil to the compressor.

| Bi-flow Solenoid Data | | |
|---|---|---|
| Compatible Models | Description | Part Number |
| All Split Models (24-60) | 1/2" Valve Body | ARS-4A |
| | 24V Coil | ARSCB |
| | Bi-flow kit | ARSBK |
| Only required in long line set applications. All three parts must be ordered. | | |

## Section 8c: Line Set Installation

### Figure 15: Horizontal piping above "A" coil




**Notes:**

- A Bi-flow liquid line solenoid required if total equivalent length is greater than or equal to 50 feet or the vertical separation is greater than or equal to 20 feet. See tables below for descriptions and part numbers.
- The vapor line must be installed with the horizontal run higher than the top of the evaporator section.
- P-traps should be installed at the outlet of the evaporator section and at the bottom of vapor line drop.
- 75 feet maximum equivalent line length
- 50 feet maximum vertical separation
- Vapor Line sizes on Two-stage units should not be increased due to the velocity requirements for returning oil to the compressor.

| Bi-flow Solenoid Data | | |
|---|---|---|
| Compatible Models | Description | Part Number |
| All Split Models (24-60) | 1/2" Valve Body | ARS-4A |
| | 24V Coil | ARSCB |
| | Bi-flow kit | ARSBK |
| Only required in long line set applications. All three parts must be ordered. | | |

**⚠ WARNING ⚠**

**IF USING A DUAL FUEL APPLICATION, "A" COIL MUST BE INSTALLED ON THE OUTLET OF THE FURNACE. INSTALLATION ON THE RETURN COULD CAUSE FURNACE HEAT EXCHANGER FAILURE, AND MAY VOID FURNACE WARRANTY.**

## Section 8d: Ductwork Installation

**DUCT WORK**

All new ductwork shall be designed as outlined in Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or Air Conditioning Contractors of America (ACCA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) handbooks.

All supply/return plenums should be isolated from the unit by a flexible connector (canvas) or equivalent to prevent transfer of vibration noise to the ductwork. The flex connector should be designed so as not to restrict airflow. Turning vanes should be used on any run over 500 CFM. If the unit is installed in a noninsulated space the metal ductwork should be insulated on the inside with fiberglass insulation or similar insulation to prevent heat loss/gain and to absorb air noise. If the unit is being installed with existing ductwork, the ductwork must be designed to handle the air volume required by the unit being installed. When running a cooling or heating load on a building, size ductwork accordingly to the building design load and heat pump CFM.

***Rule of Thumb:*** When sizing ductwork use 400 CFM per Ton.

As a general rule, maximum recommended face velocity for a supply outlet used in a residential application is 800 FPM. Maximum recommended return grille velocity is 400 FPM. Systems with higher velocity, are likely to have noise problems.

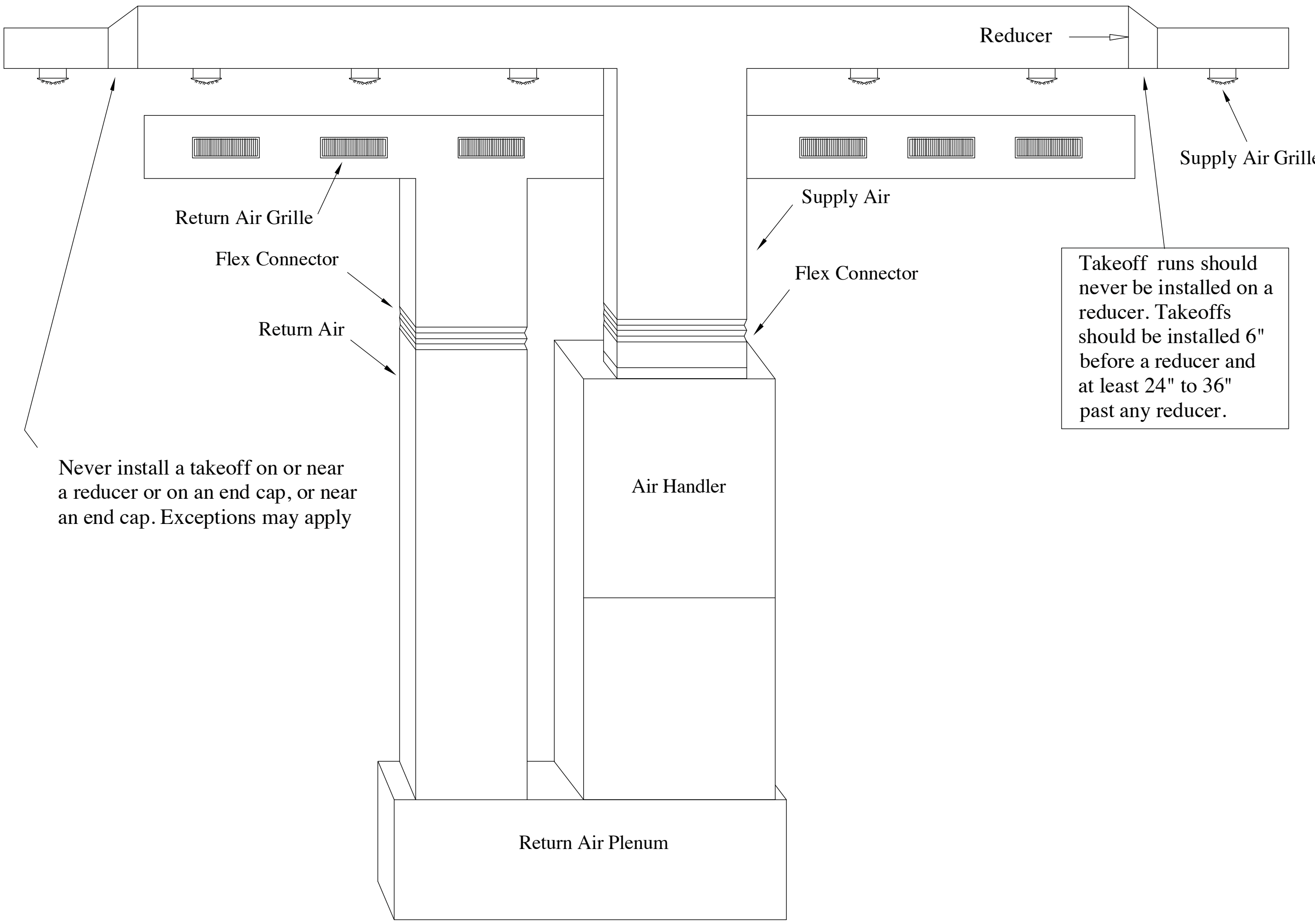
In buildings where ceilings are 8 feet or more, at least 50 percent of the return air should be taken back to the heat pump from the ceiling or high sidewall location and not more than 50 percent from the floor or low sidewall location.

**⚠ NOTICE ⚠**

**WHEN MATCHING AN RT048 OR RT060 WITH AN MPD060B, REFER TO THE CFM CHART ON PAGE 50 FOR THE PROPER AIRFLOW JUMPER SETTINGS.**

## Section 8d: Ductwork Installation

### Figure 16: Standard Ductwork Connection Setup



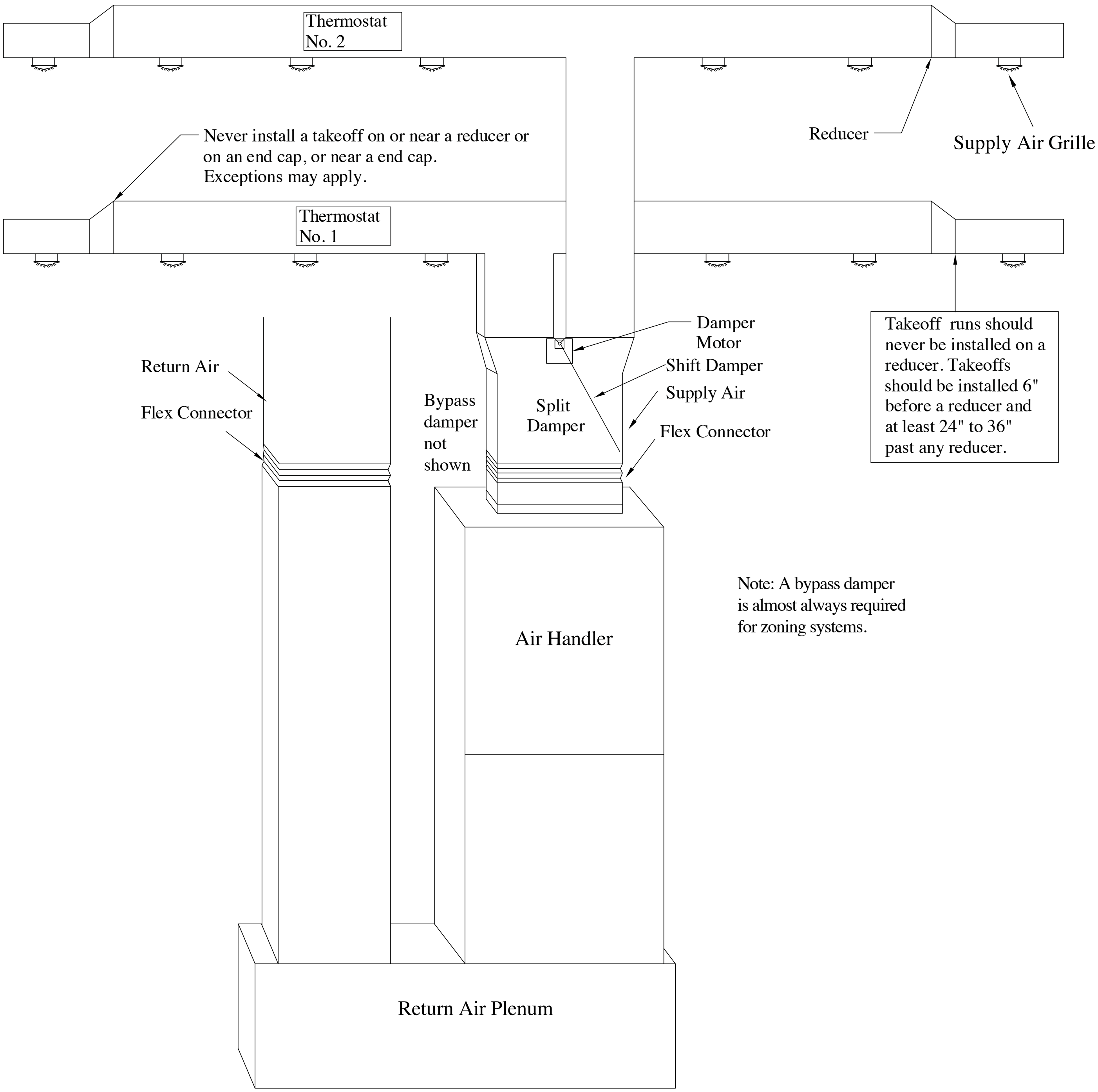

The air handling unit comes with an ECM blower motor. For maximum performance, the blower speed should be set to maintain between 350 and 450 CFM/ton. Changing the wires (for PSC) at the blower will change the blower speed.

### Table 6: Maximum Air Velocities

| Location | Supply | Return |
|---|---|---|
| Main Ducts | 900 FPM | 600 FPM |
| Branch Ducts | 700 FPM | 600 FPM |
| Grills, Registers, Diffusers | 750 FPM | 600 FPM |

## Section 8d: Ductwork Installation

### Figure 17: Ductwork with Split Damper Connection Setup



### Water Quality

The quality of the water used in geothermal systems is very important. In closed loop systems the dilution water (water mixed with antifreeze) must be of high quality to ensure adequate corrosion protection. Water of poor quality contains ions that make the fluid "hard" and corrosive. Calcium and magnesium hardness ions build up as scale on the walls of the system and reduce heat transfer. These ions may also react with the corrosion inhibitors in glycol based heat transfer fluids, causing them to precipitate out of solution and rendering the inhibitors ineffective in protecting against corrosion. In addition, high concentrations of corrosive ions, such as chloride and sulfate, will eat through any protective layer that the corrosion inhibitors form on the walls of the system.

Ideally, de-ionized water should be used for dilution with antifreeze solutions since de-ionizing removes both corrosive and hardness ions. Distilled water and zeolite softened water are also acceptable. Softened water, although free of hardness ions, may actually have increased concentrations of corrosive ions and, therefore, its quality must be monitored. It is recommended that dilution water contain less than 100 PPM calcium carbonate or less than 25 PPM calcium plus magnesium ions; and less than 25 PPM chloride or sulfate ions.

In an open loop system the water quality is of no less importance. Due to the inherent variation of the supply water, it should be tested prior to making the decision to use an open loop system. Scaling of the heat exchanger and corrosion of the internal parts are two of the potential problems. The Department of Natural Resources or your local municipality can direct you to the proper testing agency. Please see Table 7 for guidelines.

### Table 7: Water Quality

| Potential Problem | Chemical(s) or Condition | Range for Copper Heat Exchangers | Range for Cupro-Nickel Heat Exchangers |
|---|---|---|---|
| Scaling | Calcium & Magnesium Cabonate | Less than 350 ppm | Less than 350 ppm |
| Corrosion | pH Range | 7 - 9 | 5 - 9 |
| | Total Disolved Solids | Less than 1000 ppm | Less than 1500 ppm |
| | Ammonia, Ammonium Hydroxide | Less than 0.5 ppm | Less than 0.5 ppm |
| | Ammonium Chloride, Ammonium Nitrate | Less than 0.5 ppm | Less than 0.5 ppm |
| | Calcium Chloride / Sodium Chloride | Less than 125 ppm | Less than 125 ppm - Note 4 |
| | Chlorine | Less than 0.5 ppm | Less than 0.5 ppm |
| | Hydrogen Sulfide | None Allowed | None Allowed |
| Biological Growth | Iron Bacteria | None Allowed | None Allowed |
| | Iron Oxide | Less than 1 ppm | Less than 1 ppm |
| Erosion | Suspended Solids | Less than 10 ppm | Less than 10 ppm |
| | Water Velocity | Less than 8 ft/s | Less than 12 ft/s |

Notes:
1. Harness in ppm is equivalent to hardness in mg/l
2. Grains/gallon = ppm divided by 17.1
3. Copper and cupro-nickel heat exchangers are not recommended for pool applications for water outside the range of the table. Secondary heat exchangers are required for applications not meeting the requirements shown above.
4. Saltwater applications (approx. 25,000 ppm) require secondary heat exchangers due to copper piping between the heat exchanger and the unit fittings.

## Section 10: Antifreeze

### Antifreeze Overview

In areas where minimum entering loop temperatures drop below 40°F, or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze. However, local and state/provincial codes supersede any instructions in this document. The system needs antifreeze to protect the coaxial heat exchanger from freezing and rupturing. Freeze protection should be maintained to 15°F below the lowest expected entering source loop temperature. For example, if 30°F is the minimum expected entering source loop temperature, the leaving source loop temperature could be 22 to 25°F. Freeze protection should be set at 15°F (30-15 = 15°F). To determine antifreeze requirements, calculate how much volume the system holds. Then, calculate how much antifreeze will be needed by determining the percentage of antifreeze required for proper freeze protection. See Tables 9 and 10 for volumes and percentages. The freeze protection should be checked during installation using the proper hydrometer to measure the specific gravity and freeze protection level of the solution.

### Antifreeze Characteristics

Selection of the antifreeze solution for closed loop systems require the consideration of many important factors, which have long-term implications on the performance and life of the equipment. Each area of concern leads to a different "best choice" of antifreeze. *There is no "perfect" antifreeze.* Some of the factors to consider are as follows (Brine = antifreeze solution including water):

***Safety:*** The toxicity and flammability of the brine (especially in a pure form).

***Cost:*** Prices vary widely.

***Thermal Performance:*** The heat transfer and viscosity effect of the brine.

***Corrosiveness:*** The brine must be compatible with the system materials.

***Stability:*** Will the brine require periodic change out or maintenance?

***Convenience:*** Is the antifreeze available and easy to transport and install?

***Codes:*** Will the brine meet local and state/provincial codes?

The following are some general observations about the types of brines presently being used:

***Methanol:*** Wood grain alcohol that is considered toxic in pure form. It has good heat transfer, low viscosity, is non-corrosive, and is mid to low price. The biggest down side is that it is flammable in concentrations greater than 25%.

***Ethanol:*** Grain alcohol, which by the ATF (Alcohol, Tobacco, Firearms) department of the U.S. government, is required to be denatured and rendered unfit to drink. It has good heat transfer, mid to high price, is non-corrosive, non-toxic even in its pure form, and has medium viscosity. It also is flammable with concentrations greater than 25%. Note that the brand of ethanol is very important. Make sure it has been formulated for the geothermal industry. Some of the denaturants are not compatible with HDPE pipe (for example, solutions denatured with gasoline).

***Propylene Glycol:*** Non-toxic, non-corrosive, mid to high price, poor heat transfer, high viscosity when cold, and can introduce micro air bubbles when adding to the system. It has also been known to form a "slime-type" coating inside the pipe. Food grade glycol is recommended because some of the other types have certain inhibitors that react poorly with geothermal systems. A 25% brine solution is a minimum required by glycol manufacturers, so that bacteria does not start to form.

***Ethylene Glycol:*** Considered toxic and is not recommended for use in earth loop applications.

***GS4 (POTASSIUM ACETATE):*** Considered highly corrosive (especially if air is present in the system) and has a very low surface tension, which causes leaks through most mechanical fittings. This brine is not recommended for use in earth loop applications.

*Notes:*
1. Consult with your representative or distributor if you have any questions regarding antifreeze selection or use.
2. All antifreeze suppliers and manufacturers recommend the use of either de-ionized or distilled water with their products.

**Antifreeze Charging**

Calculate the total amount of pipe in the system and use Table 9 to calculate the amount of volume for each specific section of the system. Add the entire volume together, and multiply that volume by the proper antifreeze percentage needed (Table 9) for the freeze protection required in your area. Then, double check calculations during installation with the proper hydrometer and specific gravity chart (Figure 18) to determine if the correct amount of antifreeze was added.

## ⚠ CAUTION ⚠

**USE EXTREME CARE WHEN OPENING, POURING, AND MIXING FLAMMABLE ANTIFREEZE SOLUTIONS. REMOTE FLAMES OR ELECTRICAL SPARKS CAN IGNITE UNDILUTED ANTIFREEZES AND VAPORS. USE ONLY IN A WELL VENTILATED AREA. DO NOT SMOKE WHEN HANDLING FLAMMABLE SOLUTIONS. FAILURE TO OBSERVE SAFETY PRECAUTIONS MAY RESULT IN FIRE, INJURY, OR DEATH. NEVER WORK WITH 100% ALCOHOL SOLUTIONS.**

### Table 8: Pipe Fluid Volume

| Type | Size | Volume Per 100ft US Gallons |
|---|---|---|
| Copper | 1” CTS | 4.1 |
| Copper | 1.25” CTS | 6.4 |
| Copper | 1.5” CTS | 9.2 |
| HDPE | .75” SDR11 | 3.0 |
| HDPE | 1” SDR11 | 4.7 |
| HDPE | 1.25” SDR11 | 7.5 |
| HDPE | 1.5” SDR11 | 9.8 |
| HDPE | 2” SDR11 | 15.4 |

Additional component volumes:
Unit coaxial heat exchanger = 1 Gallon
Flush Cart = 8-10 Gallons
10’ of 1” Rubber Hose = 0.4 Gallons

## Section 10: Antifreeze

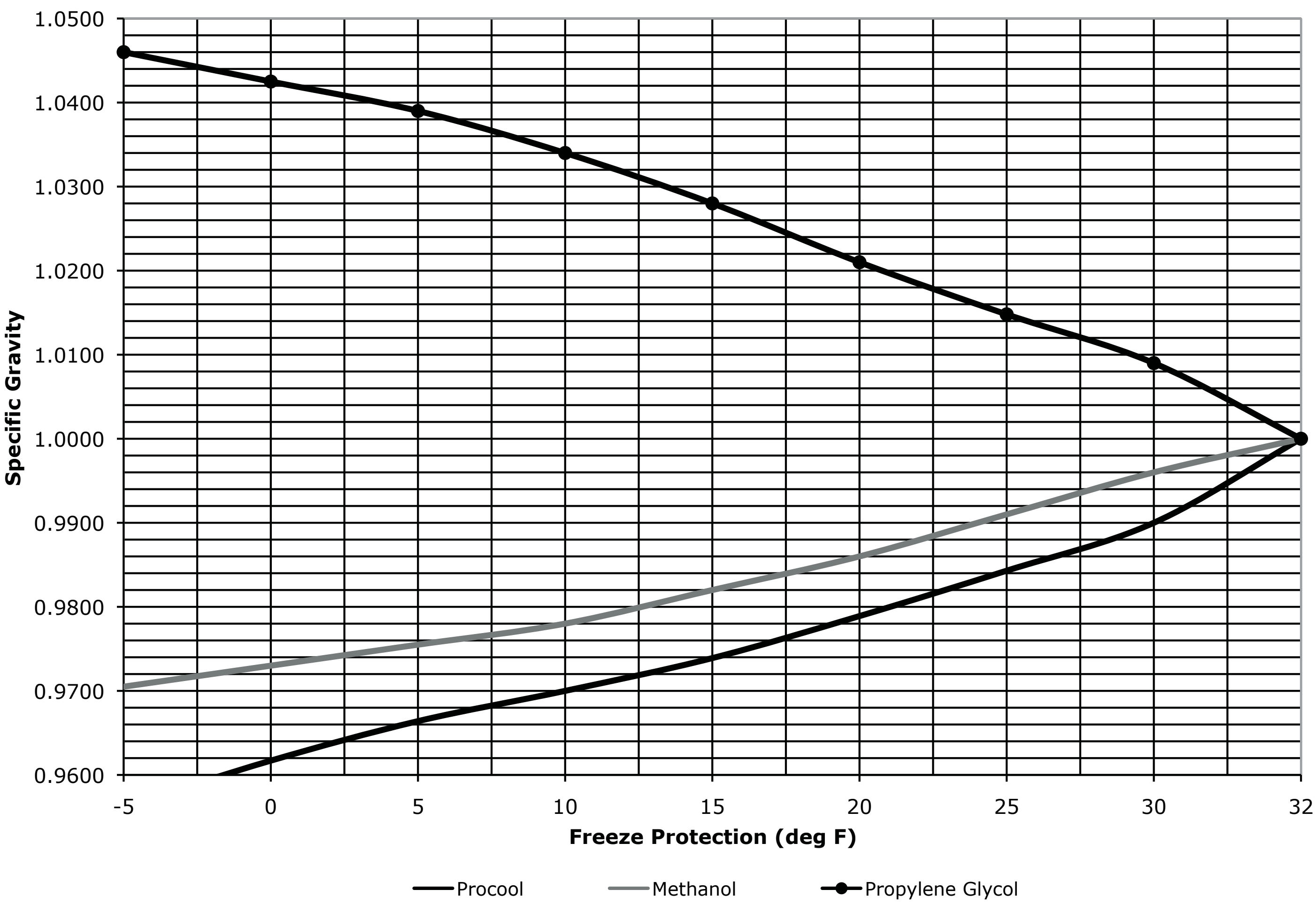
### Table 9  Antifreeze Percentages by Volume

| Type of Antifreeze | Minimum Temperature for Freeze Protection | | | |
|---|---|---|---|---|
| | 10°F (-12.2°C) | 15°F (-9.4°C) | 20°F (-6.7°C) | 25°F (-3.9°C) |
| ProCool (Ethanol) | 25% | 22% | 17% | 12% |
| Methanol | 25% | 21% | 16% | 10% |
| Propylene Glycol | 38% | 30% | 22% | 15% |

All antifreeze solutions are shown in pure form - not premixed

***NOTE:*** Most manufacturers of antifreeze solutions recommend the use of de-ionized water. Tap water may include chemicals that could react with the antifreeze solution.

### Figure 18:  Antifreeze Specific Gravity



## MICROPROCESSOR FEATURES AND OPERATION

Enertech Global geothermal heat pump controls provide a unique modular approach for controlling heat pump operation. The control system uses one, two, or three printed circuit boards, depending upon the features of a particular unit. This approach simplifies installation and troubleshooting, and eliminates features that are not applicable for some units. Split units include only the lockout board in the compressor section.

A microprocessor-based printed circuit board controls the inputs to the unit as well as outputs for status mode, faults, and diagnostics. A status LED and an LED for each fault is provided for diagnostics. Removable low voltage terminal strips provide all necessary terminals for field connections.

### Startup/Random Start

The unit will not operate until all the inputs and safety controls are checked for normal conditions. At first power-up, the compressor is energized after a five minute delay. In addition, a zero to sixty second random start delay is added at first power-up to avoid multiple units from being energized at the same time.

### Short Cycle Protection

A built-in five minute anti-short cycle timer provides short cycle protection of the compressor.

### Component Sequencing Delays

Components are sequenced and delayed for optimum space conditioning performance and to make any startup noise less noticeable.

### Test Mode

The microprocessor control allows the technician to shorten most timing delays for faster diagnostics by changing the position of a jumper located on the lockout board.

### Water Solenoid Valve Connections

Two accessory relay outputs at the terminal strip provide a field connection for two types of water solenoid valves, a standard 24VAC solenoid valve, or a 24VAC solenoid valve with an end switch. Additional field wiring is no longer required for operation of the end switch.

### Loop Pump Circuit Breakers (Single Compressor Units)

The loop pump(s) are protected by control box mounted circuit breakers for easy wiring of pumps during installation. Circuit breakers eliminate the need to replace fuses.

### Safety Controls

The control receives separate signals for high pressure, low pressure, low water flow, and condensate overflow faults. Upon a continuous 30-second measurement of the fault (immediate for high pressure), compressor operation is suspended (see Fault Retry below), and the appropriate LED flashes. Once the unit is locked out (see Fault Retry below), an output (terminal "L") is made available to a fault LED at the thermostat (water-to-water unit has fault LED on the corner post).

***Low Pressure:*** If the low pressure switch is open for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. At startup, the low pressure switch is not monitored for 90 seconds to avoid nuisance faults.

***High Pressure:*** If the high pressure switch opens, the compressor operation will be interrupted, and the control will go into fault retry mode. There is no delay from the time the switch opens and the board goes into fault retry mode. There is also no delay of switch monitoring at startup.

***Flow Switch:*** If the flow switch is open for 30 continuous seconds, the compressor operation will be interrupted, and the control will go into fault retry mode. At startup, the flow switch is not monitored for 30 seconds to avoid nuisance faults.

## FAULT RETRY

All faults are retried twice before finally locking the unit out. The fault retry feature is designed to prevent nuisance service calls. There is an anti-short cycle period between fault retries. On the third fault, the board will go into lockout mode.

### Over/Under Voltage Shutdown

The lockout board protects the compressor from operating when an over/under voltage condition exists. The control monitors secondary voltage (24VAC) to determine if an over/under voltage condition is occurring on the primary side of the transformer. For example, if the secondary voltage is 19 VAC, the primary voltage for a 240V unit would be approximately 190V, which is below the minimum voltage (197V) recommended by the compressor manufacturer. This feature is self-resetting. If the voltage comes back within range, normal operation is restored. Therefore, over/under voltage is not a lockout.

Under voltage (18 VAC) causes the compressor to disengage and restart when the voltage returns to 20 VAC. Over voltage (31 VAC) causes the compressor to disengage and restart when the voltage returns to 29 VAC. During an over or under voltage condition, all five fault LEDs will blink (HP + LP + FS + CO + Status). When voltage returns to normal operation, the four fault LED's will stop blinking, but the status LED will continue to flash. While the board LEDs are flashing, the thermostat fault light will be illuminated.

### Intelligent Reset

If the thermostat is powered off and back on (soft reset), the board will reset, but the last fault will be stored in memory for ease of troubleshooting. If power is interrupted to the board, the fault memory will be cleared.

### Diagnostics

The lockout board includes five LEDs (status, high pressure, low pressure, low water flow, condensate overflow) for fast and simple control board diagnosis. On the following page is a table showing LED function.

NOTE: Condensate overflow is not used for split systems. Any condensate overflow protection must be added to the air handler.

### Lockout Board Jumper Selection

The lockout board includes three jumpers for field selection of various board features.

***Water Solenoid Valve Delay (WSD):*** When the WSD jumper is installed, the "A" terminal is energized when the compressor is energized. When the jumper is removed, the "A" terminal is energized 10 seconds after the compressor. If using the Taco water solenoid valve (or a valve with an end switch), the unit terminal strip includes a means for connecting a valve of this type. The WSD jumper should be installed. If using a fast opening valve that does not have an end switch, the jumper should be removed.

***Test Mode (TEST):*** When the TEST jumper is installed, the board operates in the normal mode. When the jumper is removed, the board operates in test mode, which speeds up all delays for easier troubleshooting. When service is complete, the jumper must be re-installed in order to make sure that the unit operates with normal sequencing delays.

***Over/Under Voltage Disable (O/V):*** When the O/V jumper is installed, the over/under voltage feature is active. When the jumper is removed, the over/under voltage feature is disabled. On rare occasions, variations in voltage will be outside the range of the over/under voltage feature, which may require removal of the jumper. However, removal of the jumper could cause the unit to run under adverse conditions, and therefore should not be removed without contacting technical services. An over/under voltage condition could cause premature component failure or damage to the unit controls. Any condition that would cause this fault must be thoroughly investigated before taking any action regarding the jumper removal. Likely causes of an over/under voltage condition include power company transformer selection, insufficient entrance wire sizing, defective breaker panel, incorrect transformer tap (unit control box), or other power-related issues.

## Table 10: LED Identification

| LED Color | Location[1] | Function | Normal Operation | Fault Retry[2] | Lockout[2] |
|---|---|---|---|---|---|
| Green | Top | High Pressure | OFF | Flashing[3] | ON[3] |
| Orange | 2nd | Low Pressure | OFF | Flashing[3] | ON[3] |
| Red | 3rd | Water Flow | OFF | Flashing[3] | ON[3] |
| Yellow | 4th | Condensate* Overflow | OFF | Flashing[3] | ON[3] |
| Green | Bottom | Status | Flashing[4] | Flashing[5] | Flashing[4] |

Notes:
1. Looking at the board when the LEDs are on the right hand side
2. If all five lights are flashing, the fault is over/under voltage
3. Only the light associated with the particular fault/lockout will be on or flashing.
   For example, if a high pressure lockout has occurred, the top green light will be on.
   The orange, red, and yellow lights will be off
4. Status lights will be off when tin test mode
5. Flashes alternately with the fault LED

* Not applicable in split units

**SEQUENCE OF OPERATION**
Water-to-Air Units, Single Compressor, ECM Fan

***Heating, 1st Stage (Y1,G)***
The ECM fan is started immediately at 75% (of 1st stage operation) CFM level, first stage compressor and the loop pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% (of 1st stage operation) CFM level 30 seconds after the "Y1" input.

***Heating, 2nd Stage (Y1,Y2,G)***
The ECM fan adjusts to 2nd stage CFM level, and the compressor full load solenoid valve is energized.

***Heat, 3rd Stage (Y1,Y2,W,G)***
The ECM fan remains at 100% of 2nd stage CFM level, and the electric backup heat is energized.

***Emergency Heat (W,G)***
The fan is started immediately at 100% of 2nd stage CFM level, and the electric backup heat is energized.

***Cooling Operation***
The reversing valve is energized for cooling operation. Terminal "O" from the thermostat is connected to the reversing valve solenoid.

***Cooling, 1st stage (Y1,0,G) Two-Stage Units***
The ECM fan is started immediately at 75% (of 1st stage operation) CFM level, first stage compressor and the loop pump(s) are energized 10 seconds after the "Y1" input is received, and the ECM fan adjusts to 100% (of 1st stage operation) CFM level 30 seconds after the "Y1" input.

***Cooling, 2nd Stage (Y1,Y2,O,G)***
The ECM fan adjusts to 2nd stage CFM level, and the compressor full load solenoid valve is energized.

***Fan Only***
When the ECM control module receives a "G" call without a call for heating or cooling, the fan operates at 50% of the full load CFM level.

***Thermostat Wiring / Fan Speed Notes***
For two-stage compressor section units, wire as shown in the wiring diagram on the following page. For single stage units, jumper Y1 and Y2, and use the "CFM Y2" column in table 9b for determining jumper location. The ECM control board in the air handler is the thermostat connection point. Wire nut the thermostat wiring to the "pigtails" connected to the 1/4" spades on the ECM board.

## Section 11: Controls

For dehumidification in cooling, cut the resistor at the "DEHUMIDIFY" LED. Use either the HUM terminal (reverse logic -- designed to be used with a humidistat) to lower the fan speed when dehumidification is needed, or if the HUM terminal is not connected (and the resistor is cut), the air handler will operate at a lower fan speed in cooling and normal fan speed in heating.

**Figure 19: Lockout Board (Compr Section)**

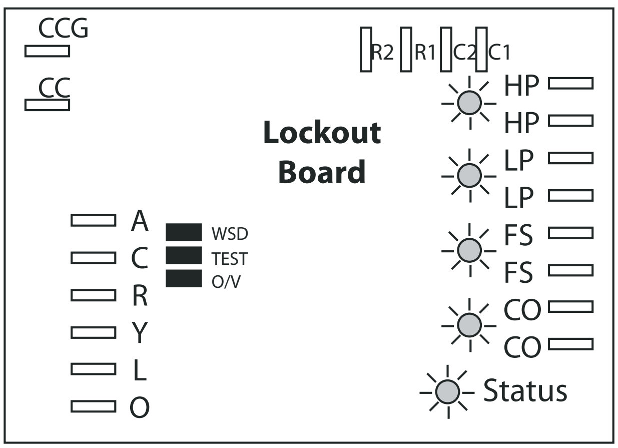
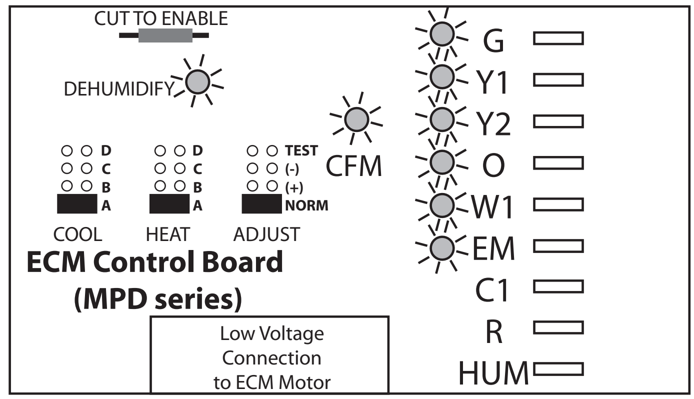



**Figure 20: ECM Board (Air Handler Section)**

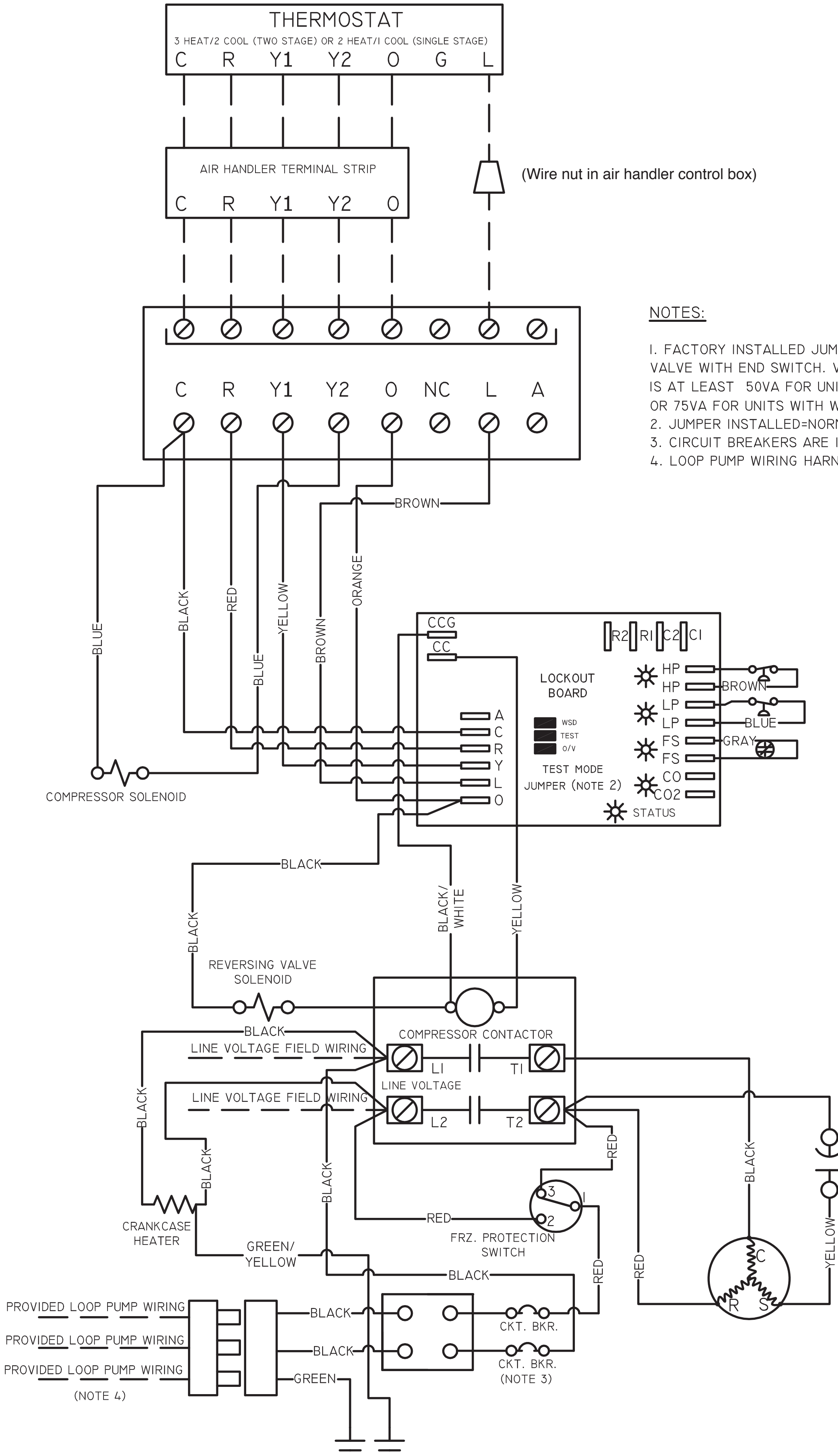


## Table 11: MPD Air Handler Fan Speeds

| Model Number | COOL Jumper | HEAT Jumper | ADJUST Jumper | High SPD CFM Y2 | | | Low SPD CFM Y1 | | | FAN G | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | .40" | .60" | .80" | .40" | .60" | .80" | .40" | .60" | .80" |
| **RT024 with MPD024A**<br>Ships Set On:<br>COOL Jumper A<br>HEAT Jumper A<br>ADJUST Jumper Norm | A | A | Norm | 970 | 957 | 941 | 739 | 731 | 726 | 370 | 366 | 363 |
| | B | B | Norm | 895 | 884 | 874 | 688 | 674 | 652 | 344 | 337 | 326 |
| | C | C | Norm | 835 | 828 | 817 | 647 | 637 | 609 | 324 | 319 | 305 |
| | D | D | Norm | 807 | 803 | 788 | 623 | 604 | 579 | 312 | 302 | 290 |
| | A | A | + | 1009 | 997 | 985 | 860 | 849 | 806 | 430 | 425 | 403 |
| | B | B | + | 1012 | 991 | 982 | 783 | 775 | 763 | 392 | 388 | 382 |
| | C | C | + | 963 | 957 | 944 | 739 | 726 | 722 | 370 | 363 | 361 |
| | D | D | + | 924 | 914 | 901 | 708 | 704 | 687 | 354 | 352 | 344 |
| **RT036 with MPD036A**<br>Ships Set On:<br>COOL Jumper C<br>HEAT Jumper C<br>ADJUST Jumper Norm | A | A | Norm | 1556 | 1556 | 1508 | 1448 | 1448 | 1428 | 567 | 539 | 502 |
| | B | B | Norm | 1547 | 1547 | 1518 | 1239 | 1239 | 1227 | 476 | 433 | 407 |
| | C | C | Norm | 1312 | 1308 | 1308 | 1012 | 1006 | 1006 | 396 | 349 | 302 |
| | D | D | Norm | 1150 | 1145 | 1139 | 880 | 873 | 865 | 322 | 288 | N/A |
| | A | A | + | 1556 | 1556 | 1508 | 1566 | 1566 | 1518 | 674 | 633 | 619 |
| | B | B | + | 1547 | 1547 | 1518 | 1428 | 1428 | 1428 | 558 | 529 | 493 |
| | C | C | + | 1528 | 1520 | 1486 | 1156 | 1156 | 1156 | 450 | 404 | 377 |
| | D | D | + | 1317 | 1317 | 1317 | 1024 | 1020 | 1006 | 395 | 345 | 302 |
| **RT048 with MPD060B**<br>Change to:<br>COOL Jumper C<br>HEAT Jumper C<br>ADJUST Jumper Norm | A | A | Norm | 2180 | 2170 | 2116 | 1810 | 1810 | 1784 | 1157 | 1137 | 1137 |
| | B | B | Norm | 2015 | 2015 | 2004 | 1678 | 1678 | 1664 | 1087 | 1087 | 1045 |
| | C | C | Norm | 1710 | 1701 | 1693 | 1407 | 1407 | 1396 | 953 | 934 | 905 |
| | D | D | Norm | 1567 | 1567 | 1546 | 1318 | 1304 | 1274 | 911 | 989 | 962 |
| **RT060 with MPD060B**<br>Ships Set On:<br>COOL Jumper B<br>HEAT Jumper B<br>ADJUST Jumper Norm | A | A | + | 2243 | 2170 | 2116 | 1885 | 1860 | 1823 | 1289 | 1271 | 1253 |
| | B | B | + | 2232 | 2170 | 2105 | 1897 | 1873 | 1848 | 1215 | 1203 | 1191 |
| | C | C | + | 1937 | 1921 | 1914 | 1612 | 1612 | 1603 | 1032 | 1017 | 981 |
| | D | D | + | 1809 | 1795 | 1752 | 1493 | 1488 | 1467 | 1003 | 978 | 945 |

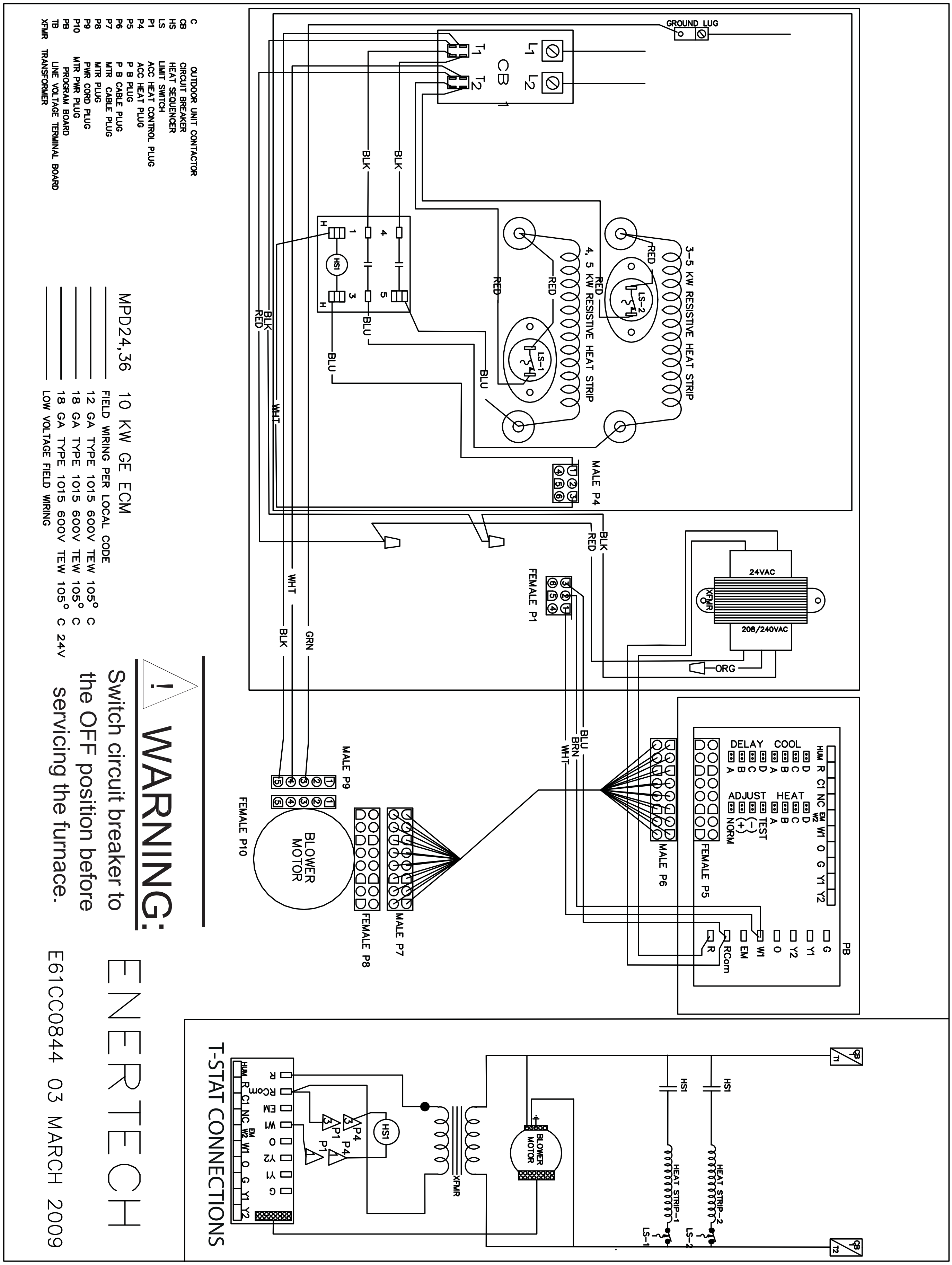
**NOTES:**

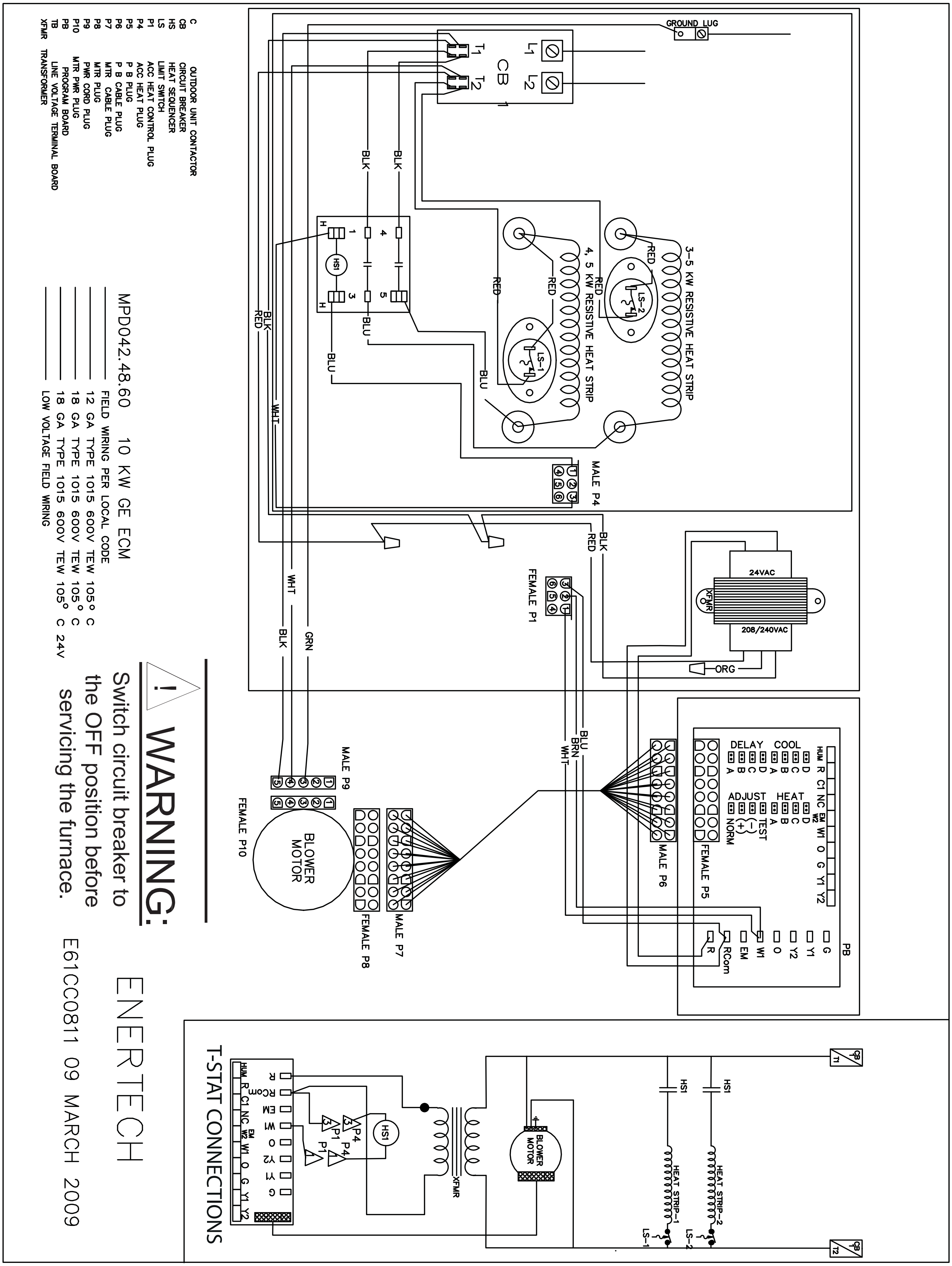
1. Dehumidification mode can be enabled by cutting the jumper on the ECM board. When cut, cooling CFM is reduced by 15%, and heating/auxiliary heat CFM remains unchanged. **Example:** Model 036 with HEAT and COOL jumpers on C setting and ADJUST jumper on Norm setting would run at 1115 CFM with jumper cut, instead of 1308 CFM with jumper intact.
1. Gray shaded areas are recommended settings. Other settings may be used, depending upon application. DO NOT cut dehumidification jumper if CFM setting will cause airflow to be below 250 CFM per ton on first stage, and below 325 CFM per ton on second stage. **Example:** Model 036 should not run below 750 CFM in first stage, or below 975 CFM in second stage.
2. The COOL and HEAT jumpers should both be set at the same position. COOL controls heating and cooling airflow; HEAT controls electric heat airflow.
3. Above CFM will be maintained up to 0.50" ESP for models MPD024 and 036, and up to 0.75" ESP for models MPD048 and 60.

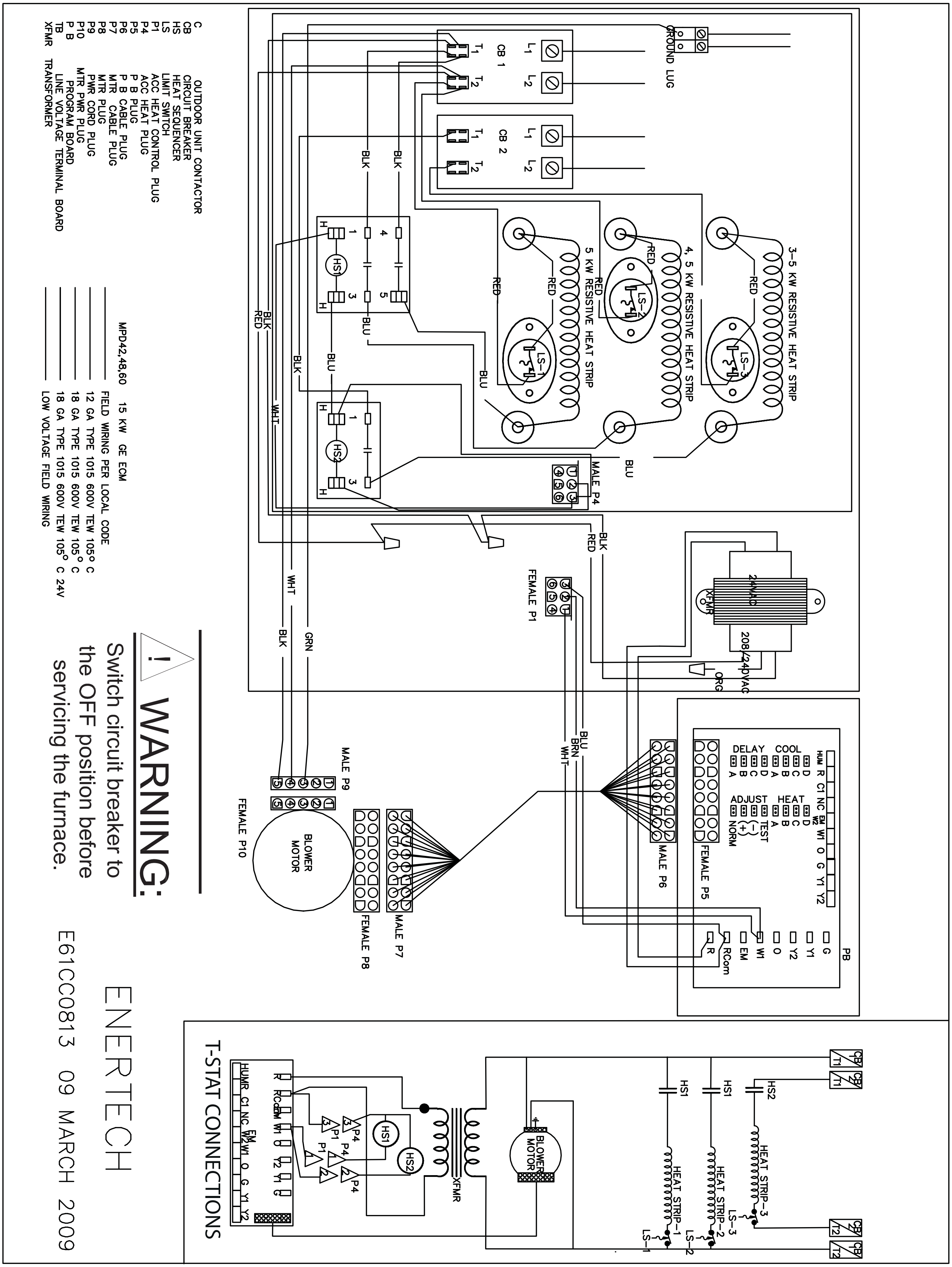


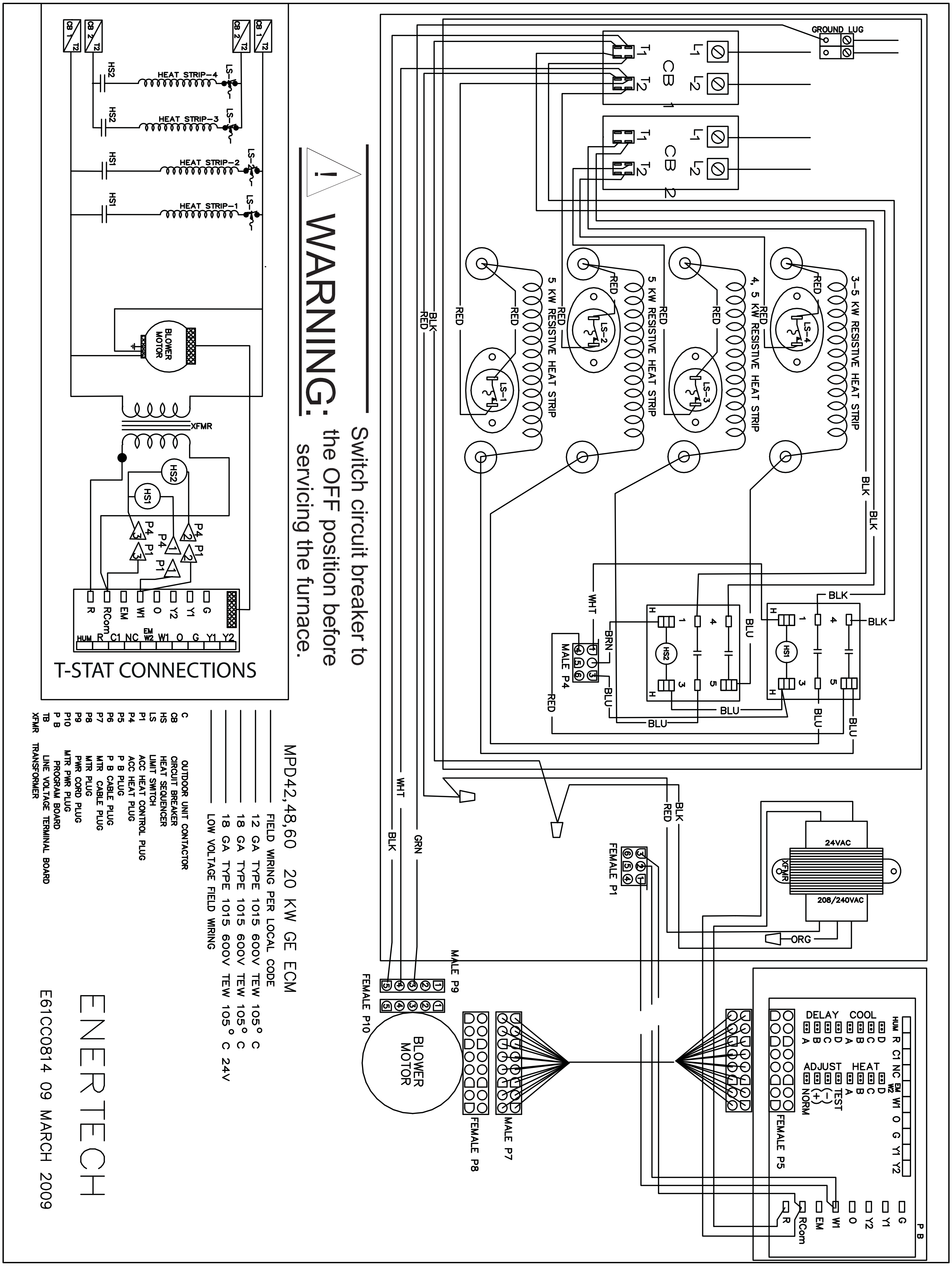

NOTES:

1. FACTORY INSTALLED JUMPER. REMOVE FOR USE WITH SOLENOID VALVE WITH END SWITCH. VERIFY THAT AIR HANDLER TRANSFORMER IS AT LEAST 50VA FOR UNITS WITHOUT WATER SOLENOID VALVE(S), OR 75VA FOR UNITS WITH WATER SOLENOID VALVE(S).
2. JUMPER INSTALLED=NORMAL; JUMPER REMOVED=TEST.
3. CIRCUIT BREAKERS ARE INSTALLED ON RESIDENTIAL MODELS ONLY.
4. LOOP PUMP WIRING HARNESS IS PROVIDED IN LOOP PUMP KIT.


C OUTDOOR UNIT CONTACTOR
CB CIRCUIT BREAKER
HS HEAT SEQUENCER
LS LIMIT SWITCH
P1 ACC HEAT CONTROL PLUG
P4 ACC HEAT PLUG
P5 P B PLUG
P6 P B CABLE PLUG
P7 MTR CABLE PLUG
P8 MTR PLUG
P9 PWR CORD PLUG
P10 MTR PWR PLUG
PB PROGRAM BOARD
TB LINE VOLTAGE TERMINAL BOARD
XFMR TRANSFORMER
MPD24,36 10 KW GE ECM
FIELD WIRING PER LOCAL CODE
12 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C 24V
LOW VOLTAGE FIELD WIRING
WARNING:
Switch circuit breaker to the OFF position before servicing the furnace.
ENERTECH
E61CC0844 03 MARCH 2009
GROUND LUG
CB
3-5 KW RESISTIVE HEAT STRIP
4, 5 KW RESISTIVE HEAT STRIP
MALE P4
FEMALE P1
24VAC
208/240VAC
XFMR
MALE P9
FEMALE P10
BLOWER MOTOR
MALE P7
FEMALE P8
MALE P6
FEMALE P5
DELAY
COOL
ADJUST
HEAT
NORM
TEST
PB
T-STAT CONNECTIONS
HEAT STRIP-1
HEAT STRIP-2
LS-1
LS-2
HS1


C OUTDOOR UNIT CONTACTOR
CB CIRCUIT BREAKER
HS HEAT SEQUENCER
LS LIMIT SWITCH
P1 ACC HEAT CONTROL PLUG
P4 ACC HEAT PLUG
P5 P B PLUG
P6 P B CABLE PLUG
P7 MTR CABLE PLUG
P8 MTR PLUG
P9 PWR CORD PLUG
P10 MTR PWR PLUG
PB PROGRAM BOARD
TB LINE VOLTAGE TERMINAL BOARD
XFMR TRANSFORMER
MPD042.48.60 10 KW GE ECM
FIELD WIRING PER LOCAL CODE
12 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C 24V
LOW VOLTAGE FIELD WIRING
WARNING:
Switch circuit breaker to the OFF position before servicing the furnace.
ENERTECH
E61CC0811 09 MARCH 2009
T-STAT CONNECTIONS
GROUND LUG
CB
3-5 KW RESISTIVE HEAT STRIP
4, 5 KW RESISTIVE HEAT STRIP
MALE P4
FEMALE P1
24VAC
208/240VAC
XFMR
MALE P9
FEMALE P10
BLOWER MOTOR
MALE P7
FEMALE P8
MALE P6
FEMALE P5
DELAY COOL
ADJUST HEAT
PB
HEAT STRIP-1
HEAT STRIP-2


C OUTDOOR UNIT CONTACTOR
CB CIRCUIT BREAKER
HS HEAT SEQUENCER
LS LIMIT SWITCH
P1 ACC HEAT CONTROL PLUG
P4 ACC HEAT PLUG
P5 P B PLUG
P6 P B CABLE PLUG
P7 MTR CABLE PLUG
P8 MTR PLUG
P9 PWR CORD PLUG
P10 MTR PWR PLUG
P B PROGRAM BOARD
TB LINE VOLTAGE TERMINAL BOARD
XFMR TRANSFORMER
MPD42,48,60 15 KW GE ECM
FIELD WIRING PER LOCAL CODE
12 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C 24V
LOW VOLTAGE FIELD WIRING
WARNING:
Switch circuit breaker to the OFF position before servicing the furnace.
ENERTECH
E61CC0813 09 MARCH 2009
T-STAT CONNECTIONS
GROUND LUG
CB 1
CB 2
3–5 KW RESISTIVE HEAT STRIP
4, 5 KW RESISTIVE HEAT STRIP
5 KW RESISTIVE HEAT STRIP
BLOWER MOTOR
MALE P4
FEMALE P1
MALE P9
FEMALE P10
MALE P7
FEMALE P8
MALE P6
FEMALE P5
24VAC
208/240VAC
XFMR

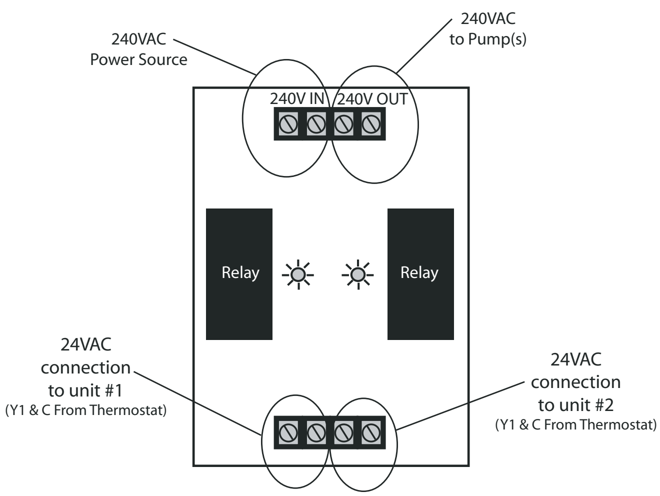

WARNING:
Switch circuit breaker to the OFF position before servicing the furnace.
T-STAT CONNECTIONS
MPD42,48,60 20 KW GE ECM
FIELD WIRING PER LOCAL CODE
12 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C
18 GA TYPE 1015 600V TEW 105° C 24V
LOW VOLTAGE FIELD WIRING
C OUTDOOR UNIT CONTACTOR
CB CIRCUIT BREAKER
HS HEAT SEQUENCER
LS LIMIT SWITCH
P1 ACC HEAT CONTROL PLUG
P4 ACC HEAT PLUG
P5 P B PLUG
P6 P B CABLE PLUG
P7 MTR CABLE PLUG
P8 MTR PLUG
P9 PWR CORD PLUG
P10 MTR PWR PLUG
P B PROGRAM BOARD
TB LINE VOLTAGE TERMINAL BOARD
XFMR TRANSFORMER
ENERTECH
E61CC0814 09 MARCH 2009
GROUND LUG
3-5 KW RESISTIVE HEAT STRIP
4, 5 KW RESISTIVE HEAT STRIP
5 KW RESISTIVE HEAT STRIP
5 KW RESISTIVE HEAT STRIP
HEAT STRIP-1
HEAT STRIP-2
HEAT STRIP-3
HEAT STRIP-4
BLOWER MOTOR
24VAC
208/240VAC
MALE P4
FEMALE P1
MALE P9
FEMALE P10
FEMALE P8
MALE P7
FEMALE P5
DELAY
COOL
ADJUST
HEAT

## Section 12: Accessories

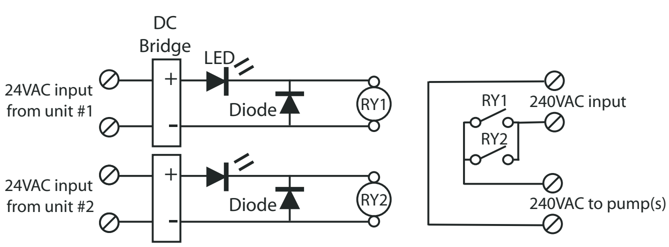
### APSMA PUMP SHARING MODULE

The pump sharing module, part number APSMA, is designed to allow two units to share one flow center. With the APSMA module, either unit can energize the pump(s). Connect the units and flow center as shown in Figure 21, below. Figure 22 includes a schematic of the board. The module must be mounted in a NEMA enclosure or inside the unit control box. Local code supersedes any recommendations in this document.

### Figure 21: APSMA Module Layout




### Figure 22: APSMA Module Wiring Schematic



**PERFORMANCE CHECK**

Heat of Extraction(HE)/Rejection(HR)
Record information on the Unit Start-up Form

Equipment should be in full load operation for a minimum of 10 minutes in either mode – ***WITH THE HOT WATER GENERATOR TURNED OFF.***

**1.** Determine flow rate in gallons per minute
   a. Check entering water temperature
   b. Check entering water pressure
   c. Check leaving water pressure

Once this information is recorded, find corresponding entering water temperature column in Specification Manual for unit.
Find pressure differential in PSI column in Spec Manual. Then read the GPM column in Spec Manual to determine flow in GPM.

**2.** Check leaving water temperature of unit.
FORMULA: GPM x water temp diff, x 485 (antifreeze) or 500 (fresh water) = HE or HR in BTU/HR

A 10% variance from Spec Manual is allowed.
Always use the same pressure gauge & temperature measuring device.
Water flow must be in range of Specification Manual. If system has too much water flow, performance problems should be expected

## Section 13: Troubleshooting

### A: UNIT WILL NOT START IN EITHER CYCLE

| | |
|---|---|
| Thermostat | Set thermostat on heating and highest temperature setting. Unit should run. Set thermostat on cooling and lowest temperature setting. Unit should run. Set fan to On position. Fan should run. If unit does not run in any position, disconnect wires at heat pump terminal block and jump R, G, Y. Unit should run in heating. If unit runs, replace thermostat with correct thermostat only. |
| Loose or broken wires | Tighten or replace wires. |
| Blown Fuse/<br>Tripped Circuit Breakers | Check fuse size, replace fuse or reset circuit breaker.<br>Check low voltage circuit breaker. |
| Low Voltage Circuit | Check 24 volt transformer. If burned out or less than 24 volt, replace. Before replacing, verify tap setting and correct if necessary. |
| Water Flow | If water flow is low (less than 3.5 GPM), unit will not start. Make sure Pump Module or solenoid valve is connected (see wiring diagram). Water has to flow through the heat exchanger in the right direction (see labels at water fitting connections) before the compressor can start. If water flow is at normal flow, use an ohmmeter to check if you get continuity at the flow switch. If no switch is open and flow is a normal flow, remove switch and check for stuck particles or bad switch. |

### B: UNIT RUNNING NORMAL, BUT SPACE TEMPERATURE IS UNSTABLE

| | |
|---|---|
| Thermostat | Thermostat is getting a draft of cold or warm air. Make sure that the wall or hole used to run thermostat wire from the ceiling or basement is sealed, so no draft can come to the thermostat.<br>Faulty Thermostat (Replace). |

### C: NO WATER FLOW

| | |
|---|---|
| Pump Module | Make sure Pump Module is connected to the control box relay (check all electrical connections). For non-pressurized systems, check water level in Pump Module. If full of water, check pump. Close valve on the pump flanges and loosen pump. Take off pump and see if there is an obstruction in the pump. If pump is defective, replace. For pressurized systems, check loop pressure. Repressurize if necessary. May require re-flushing if there is air in the loop. |
| Solenoid valve | Make sure solenoid valve is connected. Check solenoid. If defective, replace. |

### D: IN HEATING OR COOLING MODE, UNIT OUTPUT IS LOW

| | |
|---|---|
| Water | Water flow & temperature insufficient. |
| Airflow | Check speed setting, check nameplate or data manual for proper speed, and correct speed setting.<br>Check for dirty air filter—Clean or replace.<br>Restricted or leaky ductwork. Repair. |
| Refrigerant charge | Refrigerant charge low, causing inefficient operation. Make adjustments only after airflow and water flow are checked. |
| Reversing valve | Defective reversing valve can create bypass of refrigerant to suction side of compressor. Switch reversing valve to heating and cooling mode rapidly. If problem is not resolved, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened. |

### E: IN HEATING OR COOLING MODE, UNIT OUTPUT IS LOW

| | |
|---|---|
| Heat pump will not cool but will heat. Heat pump will not heat but will cool. | Reversing valve does not shift. Check reversing valve wiring. If wired wrong, correct wiring. If reversing valve is stuck, replace valve. Wrap the valve with a wet cloth and direct the heat away from the valve. Excessive heat can damage the valve. Always use dry nitrogen when brazing. Replace filter/drier any time the circuit is opened. |
| Water heat exchanger | Check for high-pressure drop, or low temperature drop across the coil. It could be scaled. If scaled, clean with condenser coil cleaner. |
| System undersized | Recalculate conditioning load. |

### F: WATER HEAT EXCHANGER FREEZES IN HEATING MODE

| | |
|---|---|
| Water flow | Low water flow. Increase flow. See F. No water flow. |
| Flow Switch | Check switch. If defective, replace. |

### G: EXCESSIVE HEAD PRESSURE IN COOLING MODE

| | |
|---|---|
| Inadequate water flow | Low water flow, increase flow. |

## H: EXCESSIVE HEAD PRESSURE IN HEATING MODE

| | |
|---|---|
| Low air flow | See E: Noisy blower and low air flow. |

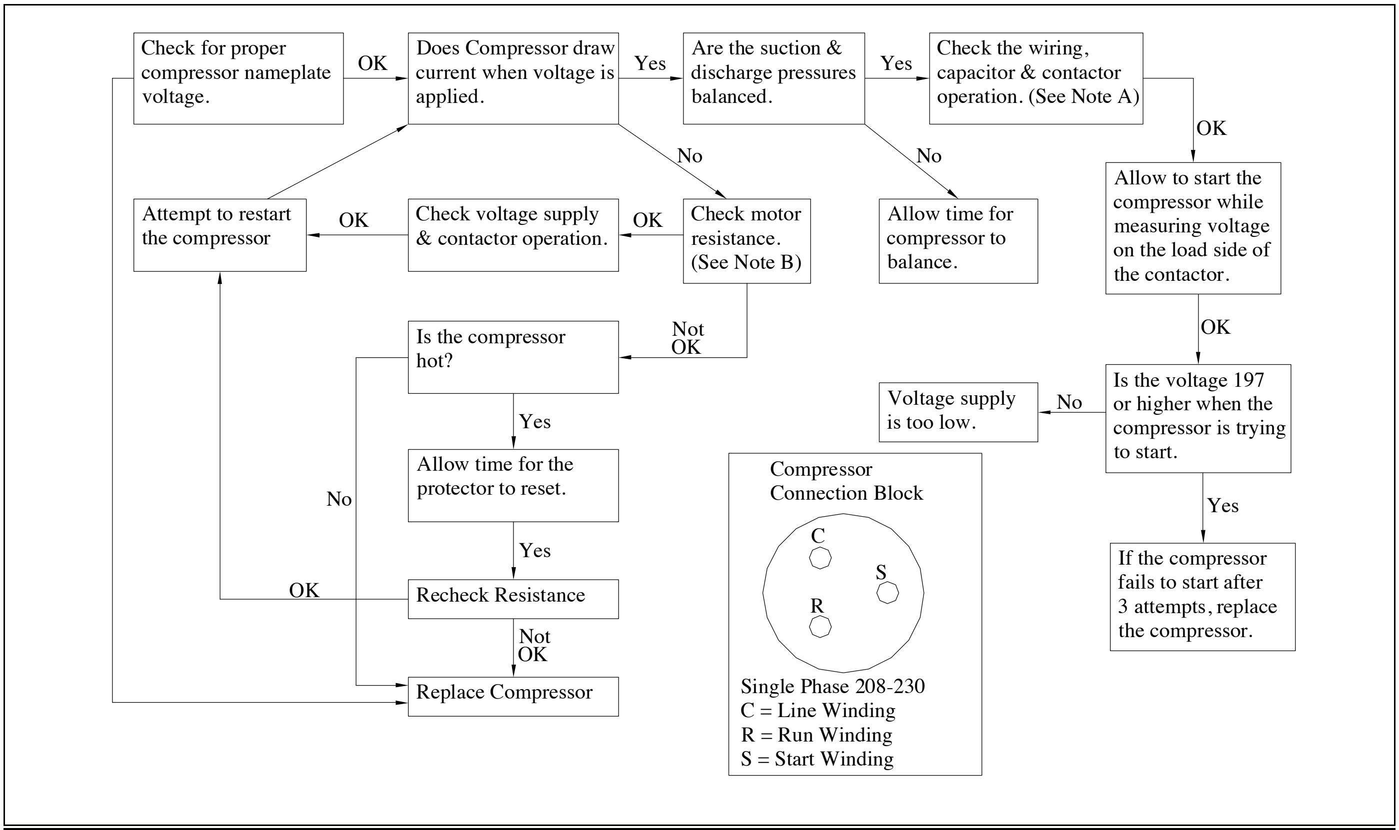
## I: AIR COIL FREEZES OVER IN COOLING MODE

| | |
|---|---|
| Air flow | See E: Noisy blower and low air flow. |
| Blower motor | Motor not running or running too slow. Motor tripping off on overload. Check for overheated blower motor and tripped overload. Replace motor if defective. |
| Panels | Panels not in place. |
| Low air flow | See E: Noisy blower and low air flow. |

## J: WATER DRIPPING FROM UNIT

| | |
|---|---|
| Unit not level | Level unit. |
| Condensation drain line plugged | Unplug condensation line. |
| Water sucking off the air coil in cooling mode | Too much airflow. Duct work not completely installed. If duct work is not completely installed, finish duct work. Check static pressure and compare with air flow chart in spec manual under specific models section. If ductwork is completely installed it may be necessary to reduce CFM. |
| Water sucking out of the drain pan | Install an EZ-Trap or P-Trap on the drain outlet so blower cannot suck air back through the drain outlet. |

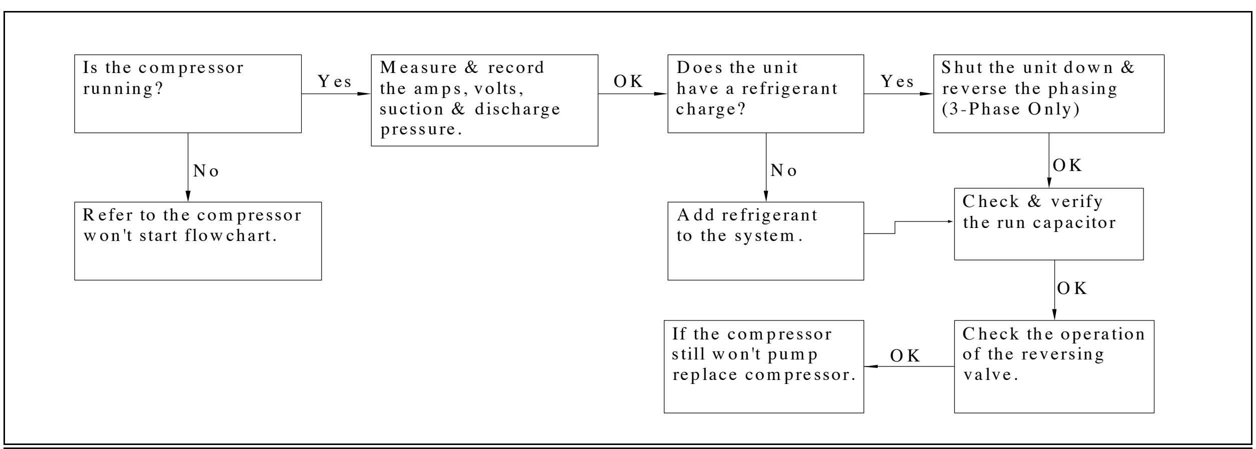
## O: COMPRESSOR WON'T START




A: Check all terminals, wires & connections for loose or burned wires and connections. Check contactor and 24 Volt coil. Check capacitor connections & check capacitor with capacitor tester.

B: If ohm meter reads 0 (short) resistance from C to S, S to R, R to C or from anyone of one of these terminals to ground (shorted to ground), compressor is bad.

## P: COMPRESSOR WON'T PUMP CHART



## Table 12a: Model 024 Operational Data - Cooling Mode

Troubleshooting Data - Cooling Mode, Full Load Operation*

| Model | Entering Water Temp., DB deg. F | Entering Air Temp., DB deg. F | GPM/ ton | Liquid Line Press., psi | Suction Line Press., psi | Subcooling | Superheat | Water Temp. Rise, deg. F | Air Temp. Drop, deg F: 375 CFM/ ton | Air Temp. Drop, deg F: 400 CFM/ ton | Air Temp. Drop, deg F: 425 CFM/ ton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 024 | 50 | 70 - 85 | 1.5 | 212 - 232 | 127 - 147 | 20 - 24 | 12 - 16 | 20 - 24 | 24 - 28 | 22 - 26 | 21 - 25 |
| | | | 2.25 | 188 - 208 | 127 - 147 | 16 - 20 | 13 - 17 | 13 - 17 | | | |
| | | | 3 | 176 - 196 | 126 - 146 | 13 - 17 | 13 - 17 | 9 - 13 | | | |
| | 60 | | 1.5 | 254 - 274 | 129 - 149 | 20 - 24 | 12 - 16 | 20 - 24 | 24 - 28 | 22 - 26 | 21 - 25 |
| | | | 2.25 | 230 - 250 | 129 - 149 | 15 - 19 | 12 - 16 | 13 - 17 | | | |
| | | | 3 | 218 - 238 | 128 - 148 | 13 - 17 | 12 - 16 | 9 - 13 | | | |
| | 70 | | 1.5 | 296 - 316 | 131 - 151 | 20 - 24 | 11 - 15 | 20 - 24 | 23 - 27 | 22 - 26 | 20 - 24 |
| | | | 2.25 | 272 - 292 | 130 - 150 | 16 - 20 | 12 - 16 | 12 - 16 | | | |
| | | | 3 | 260 - 280 | 130 - 150 | 13 - 17 | 12 - 16 | 9 - 13 | | | |
| | 80 | | 1.5 | 338 - 358 | 133 - 153 | 20 - 24 | 11 - 15 | 19 - 23 | 23 - 27 | 21 - 25 | 20 - 24 |
| | | | 2.25 | 314 - 334 | 132 - 152 | 16 - 20 | 11 - 15 | 12 - 16 | | | |
| | | | 3 | 302 - 322 | 132 - 152 | 14 - 18 | 11 - 15 | 8 - 12 | | | |
| | 90 | | 1.5 | 380 - 400 | 135 - 155 | 22 - 26 | 11 - 15 | 19 - 23 | 22 - 26 | 21 - 25 | 19 - 23 |
| | | | 2.25 | 356 - 376 | 134 - 154 | 17 - 21 | 11 - 15 | 12 - 16 | | | |
| | | | 3 | 344 - 364 | 134 - 154 | 15 - 19 | 11 - 15 | 8 - 12 | | | |

## Table 12b: Model 036 Operational Data - Cooling Mode

Troubleshooting Data - Cooling Mode, Full Load Operation*

| Model | Entering Water Temp., DB deg. F | Entering Air Temp., DB deg. F | GPM/ ton | Liquid Line Press., psi | Suction Line Press., psi | Subcooling | Superheat | Water Temp. Rise, deg. F | Air Temp. Drop, deg F: 375 CFM/ ton | Air Temp. Drop, deg F: 400 CFM/ ton | Air Temp. Drop, deg F: 425 CFM/ ton |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 036 | 50 | 70 - 85 | 1.5 | 220 - 240 | 117 - 137 | 23 - 27 | 19 - 23 | 19 - 23 | 20 - 24 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 198 - 218 | 114 - 134 | 20 - 24 | 24 - 28 | 12 - 16 | 20 - 24 | 18 - 22 | 17 - 21 |
| | | | 3 | 187 - 207 | 112 - 132 | 18 - 22 | 25 - 29 | 9 - 13 | 20 - 24 | 18 - 22 | 17 - 21 |
| | 60 | | 1.5 | 260 - 280 | 121 - 141 | 22 - 26 | 16 - 20 | 18 - 22 | 20 - 24 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 238 - 258 | 118 - 138 | 19 - 23 | 20 - 24 | 11 - 15 | 20 - 24 | 18 - 22 | 17 - 21 |
| | | | 3 | 227 - 247 | 116 - 136 | 17 - 21 | 22 - 26 | 8 - 12 | 19 - 23 | 18 - 22 | 17 - 21 |
| | 70 | | 1.5 | 301 - 321 | 125 - 145 | 21 - 25 | 13 - 17 | 18 - 22 | 20 - 24 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 279 - 299 | 122 - 142 | 18 - 22 | 17 - 21 | 11 - 15 | 20 - 24 | 18 - 22 | 17 - 21 |
| | | | 3 | 268 - 288 | 120 - 140 | 17 - 21 | 19 - 23 | 8 - 12 | 19 - 23 | 18 - 22 | 17 - 21 |
| | 80 | | 1.5 | 341 - 361 | 129 - 149 | 21 - 25 | 10 - 14 | 18 - 22 | 20 - 24 | 19 - 23 | 17 - 21 |
| | | | 2.25 | 320 - 340 | 126 - 146 | 18 - 22 | 14 - 18 | 11 - 15 | 20 - 24 | 18 - 22 | 17 - 21 |
| | | | 3 | 308 - 328 | 124 - 144 | 16 - 20 | 16 - 20 | 8 - 12 | 19 - 23 | 18 - 22 | 17 - 21 |
| | 90 | | 1.5 | 382 - 402 | 133 - 153 | 20 - 24 | 7 - 11 | 17 - 21 | 20 - 24 | 19 - 23 | 17 - 21 |
| | | | 2.25 | 360 - 380 | 130 - 150 | 17 - 21 | 11 - 15 | 11 - 15 | 19 - 23 | 18 - 22 | 17 - 21 |
| | | | 3 | 349 - 369 | 128 - 148 | 16 - 20 | 13 - 17 | 7 - 11 | 19 - 23 | 18 - 22 | 17 - 21 |

* Pressures are for reference only--Do not use for charging. Preferred charging method is using approach temperatures in cooling.

## Table 12c: Model 048 Operational Data - Cooling Mode

| Troubleshooting Data - Cooling Mode, Full Load Operation* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | Entering Water Temp., DB deg. F | Entering Air Temp., DB deg. F | GPM/ ton | Liquid Line Press., psi | Suction Line Press., psi | Subcooling | Superheat | Water Temp. Rise, deg. F | Air Temp. Drop, deg F | | |
| | | | | | | | | | 375 CFM/ ton | 400 CFM/ ton | 425 CFM/ ton |
| 048 | 50 | 70 - 85 | 1.5 | 213 - 233 | 127 - 147 | 10 - 14 | 11 - 15 | 20 - 24 | 23 - 27 | 21 - 25 | 20 - 24 |
| | | | 2.25 | 186 - 206 | 127 - 147 | 5 - 9 | 12 - 16 | 13 - 17 | 23 - 27 | 21 - 25 | 20 - 24 |
| | | | 3 | 172 - 192 | 127 - 147 | 3 - 7 | 12 - 16 | 9 - 13 | 23 - 27 | 21 - 25 | 20 - 24 |
| | 60 | | 1.5 | 256 - 276 | 129 - 149 | 12 - 16 | 10 - 14 | 20 - 24 | 22 - 26 | 21 - 25 | 19 - 23 |
| | | | 2.25 | 229 - 249 | 129 - 149 | 8 - 12 | 11 - 15 | 12 - 16 | 22 - 26 | 21 - 25 | 19 - 23 |
| | | | 3 | 215 - 235 | 129 - 149 | 6 - 10 | 11 - 15 | 9 - 13 | 22 - 26 | 21 - 25 | 20 - 24 |
| | 70 | | 1.5 | 299 - 319 | 131 - 151 | 15 - 19 | 10 - 14 | 19 - 23 | 22 - 26 | 20 - 24 | 19 - 23 |
| | | | 2.25 | 273 - 293 | 131 - 151 | 11 - 15 | 11 - 15 | 12 - 16 | 22 - 26 | 20 - 24 | 19 - 23 |
| | | | 3 | 259 - 279 | 131 - 151 | 8 - 12 | 11 - 15 | 9 - 13 | 22 - 26 | 21 - 25 | 19 - 23 |
| | 80 | | 1.5 | 343 - 363 | 133 - 153 | 18 - 22 | 10 - 14 | 19 - 23 | 21 - 25 | 20 - 24 | 19 - 23 |
| | | | 2.25 | 316 - 336 | 133 - 153 | 13 - 17 | 10 - 14 | 12 - 16 | 22 - 26 | 20 - 24 | 19 - 23 |
| | | | 3 | 302 - 322 | 133 - 153 | 11 - 15 | 11 - 15 | 8 - 12 | 22 - 26 | 20 - 24 | 19 - 23 |
| | 90 | | 1.5 | 386 - 406 | 135 - 155 | 20 - 24 | 9 - 13 | 19 - 23 | 21 - 25 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 359 - 379 | 135 - 155 | 16 - 20 | 10 - 14 | 12 - 16 | 21 - 25 | 20 - 24 | 18 - 22 |
| | | | 3 | 345 - 365 | 134 - 154 | 14 - 18 | 10 - 14 | 8 - 12 | 21 - 25 | 20 - 24 | 18 - 22 |

## Table 12d: Model 060 Operational Data - Cooling Mode

| Troubleshooting Data - Cooling Mode, Full Load Operation* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | Entering Water Temp., DB deg. F | Entering Air Temp., DB deg. F | GPM/ ton | Liquid Line Press., psi | Suction Line Press., psi | Subcooling | Superheat | Water Temp. Rise, deg. F | Air Temp. Drop, deg F | | |
| | | | | | | | | | 375 CFM/ ton | 400 CFM/ ton | 425 CFM/ ton |
| 060 | 50 | 70 - 85 | 1.5 | 202 - 222 | 120 - 140 | 15 - 19 | 14 - 18 | 19 - 23 | 21 - 25 | 20 - 24 | 18 - 22 |
| | | | 2.25 | 179 - 199 | 119 - 139 | 10 - 14 | 15 - 19 | 12 - 16 | | | |
| | | | 3 | 168 - 188 | 118 - 138 | 8 - 12 | 16 - 20 | 9 - 13 | | | |
| | 60 | | 1.5 | 237 - 257 | 122 - 142 | 16 - 20 | 12 - 16 | 19 - 23 | 21 - 25 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 215 - 235 | 121 - 141 | 11 - 15 | 13 - 17 | 12 - 16 | | | |
| | | | 3 | 203 - 223 | 121 - 141 | 9 - 13 | 14 - 18 | 8 - 12 | | | |
| | 70 | | 1.5 | 277 - 297 | 124 - 144 | 17 - 21 | 12 - 16 | 19 - 23 | 20 - 24 | 19 - 23 | 18 - 22 |
| | | | 2.25 | 254 - 274 | 124 - 144 | 13 - 17 | 13 - 17 | 12 - 16 | | | |
| | | | 3 | 242 - 262 | 123 - 143 | 10 - 14 | 14 - 18 | 8 - 12 | | | |
| | 80 | | 1.5 | 320 - 340 | 126 - 146 | 18 - 22 | 11 - 15 | 18 - 22 | 20 - 24 | 18 - 22 | 17 - 21 |
| | | | 2.25 | 297 - 317 | 126 - 146 | 14 - 18 | 13 - 17 | 11 - 15 | | | |
| | | | 3 | 285 - 305 | 125 - 145 | 12 - 16 | 14 - 18 | 8 - 12 | | | |
| | 90 | | 1.5 | 366 - 386 | 128 - 148 | 19 - 23 | 12 - 16 | 18 - 22 | 19 - 23 | 18 - 22 | 17 - 21 |
| | | | 2.25 | 344 - 364 | 128 - 148 | 15 - 19 | 13 - 17 | 11 - 15 | | | |
| | | | 3 | 332 - 352 | 127 - 147 | 12 - 16 | 14 - 18 | 8 - 12 | | | |

* Pressures are for reference only--Do not use for charging. Preferred charging method is using approach temperatures in cooling.

## Table 12e: Model 072 Operational Data - Cooling Mode

| Troubleshooting Data - Cooling Mode, Full Load Operation* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | Entering Water Temp., DB deg. F | Entering Air Temp., DB deg. F | GPM/ ton | Liquid Line Press., psi | Suction Line Press., psi | Subcooling | Superheat | Water Temp. Rise, deg. F | Air Temp. Drop, deg F | | |
| | | | | | | | | | 375 CFM/ ton | 400 CFM/ ton | 425 CFM/ ton |
| 072 | 50 | 70 - 85 | 1.5 | 200 - 220 | 113 - 133 | 13 - 17 | 16 - 20 | 18 - 22 | 19 - 23 | 17 - 21 | 16 - 20 |
| | | | 2.25 | 179 - 199 | 112 - 132 | 10 - 14 | 18 - 22 | 11 - 15 | 19 - 23 | 17 - 21 | 16 - 20 |
| | | | 3 | 168 - 188 | 111 - 131 | 8 - 12 | 20 - 24 | 8 - 12 | 19 - 23 | 17 - 21 | 16 - 20 |
| | 60 | | 1.5 | 236 - 256 | 115 - 135 | 14 - 18 | 14 - 18 | 17 - 21 | 19 - 23 | 17 - 21 | 16 - 20 |
| | | | 2.25 | 214 - 234 | 114 - 134 | 11 - 15 | 16 - 20 | 11 - 15 | 19 - 23 | 17 - 21 | 16 - 20 |
| | | | 3 | 203 - 223 | 113 - 133 | 9 - 13 | 18 - 22 | 8 - 12 | 18 - 22 | 17 - 21 | 16 - 20 |
| | 70 | | 1.5 | 274 - 294 | 118 - 138 | 15 - 19 | 13 - 17 | 17 - 21 | 18 - 22 | 17 - 21 | 16 - 20 |
| | | | 2.25 | 253 - 273 | 117 - 137 | 11 - 15 | 15 - 19 | 11 - 15 | 18 - 22 | 17 - 21 | 16 - 20 |
| | | | 3 | 242 - 262 | 116 - 136 | 10 - 14 | 16 - 20 | 7 - 11 | 18 - 22 | 17 - 21 | 16 - 20 |
| | 80 | | 1.5 | 316 - 336 | 120 - 140 | 16 - 20 | 12 - 16 | 17 - 21 | 18 - 22 | 17 - 21 | 15 - 19 |
| | | | 2.25 | 295 - 315 | 119 - 139 | 12 - 16 | 14 - 18 | 11 - 15 | 18 - 22 | 17 - 21 | 15 - 19 |
| | | | 3 | 284 - 304 | 118 - 138 | 10 - 14 | 15 - 19 | 7 - 11 | 18 - 22 | 16 - 20 | 15 - 19 |
| | 90 | | 1.5 | 362 - 382 | 123 - 143 | 17 - 21 | 11 - 15 | 17 - 21 | 17 - 21 | 16 - 20 | 15 - 19 |
| | | | 2.25 | 341 - 361 | 121 - 141 | 13 - 17 | 13 - 17 | 10 - 14 | 17 - 21 | 16 - 20 | 15 - 19 |
| | | | 3 | 329 - 349 | 121 - 141 | 11 - 15 | 14 - 18 | 7 - 11 | 17 - 21 | 16 - 20 | 15 - 19 |

* Pressures are for reference only--Do not use for charging. Preferred charging method is using approach temperatures in cooling.

## Table 13: Refrigeration Troubleshooting

| System Faults | Mode | Discharge Pressure | Suction Pressure | Superheat | Subcooling | Air TD | Water TD | Compressor Amps |
|---|---|---|---|---|---|---|---|---|
| Under Charge | Heat | Low | Low | High | Low | Low | Low | Low |
| | Cool | Low | Low | High | Low | Low | Low | Low |
| Over Charge | Heat | High | High/Normal | Normal | High | High | Normal | High |
| | Cool | High | High/Normal | Normal | High | Normal | High | High |
| Low Air Flow | Heat | High | High/Normal | Normal | High/Normal | High | Low | High |
| | Cool | Low | Low/Normal | Low | Normal | High | Low | High/Normal |
| Low Source Water Flow | Heat | Low | Low/Normal | Low | Normal | High | Low | High/Normal |
| | Cool | High | High/Normal | Normal | High/Normal | High | Low | High |
| Low Load Water Flow | Heat | High | High/Normal | Normal | High/Normal | High | Low | High |
| | Cool | Low | Low/Normal | Low | Normal | High | Low | High/Normal |
| Restricted TXV | Heat | High | Low | High | High | Low | Low | Low |
| | Cool | High | Low | High | High | Low | Low | Low |
| TXV Stuck Open | Heat | Low | High/Normal | Low | Low | Low | Low | High |
| | Cool | Low | High/Normal | Low | Low | Low | Low | High |
| Inadequate Compression | Heat | Low | High | High/Normal | Low/Normal | Low | Low | Low |
| | Cool | Low | High | High/Normal | Low/Normal | Low | Low | Low |

## Section 14: Forms - Troubleshooting

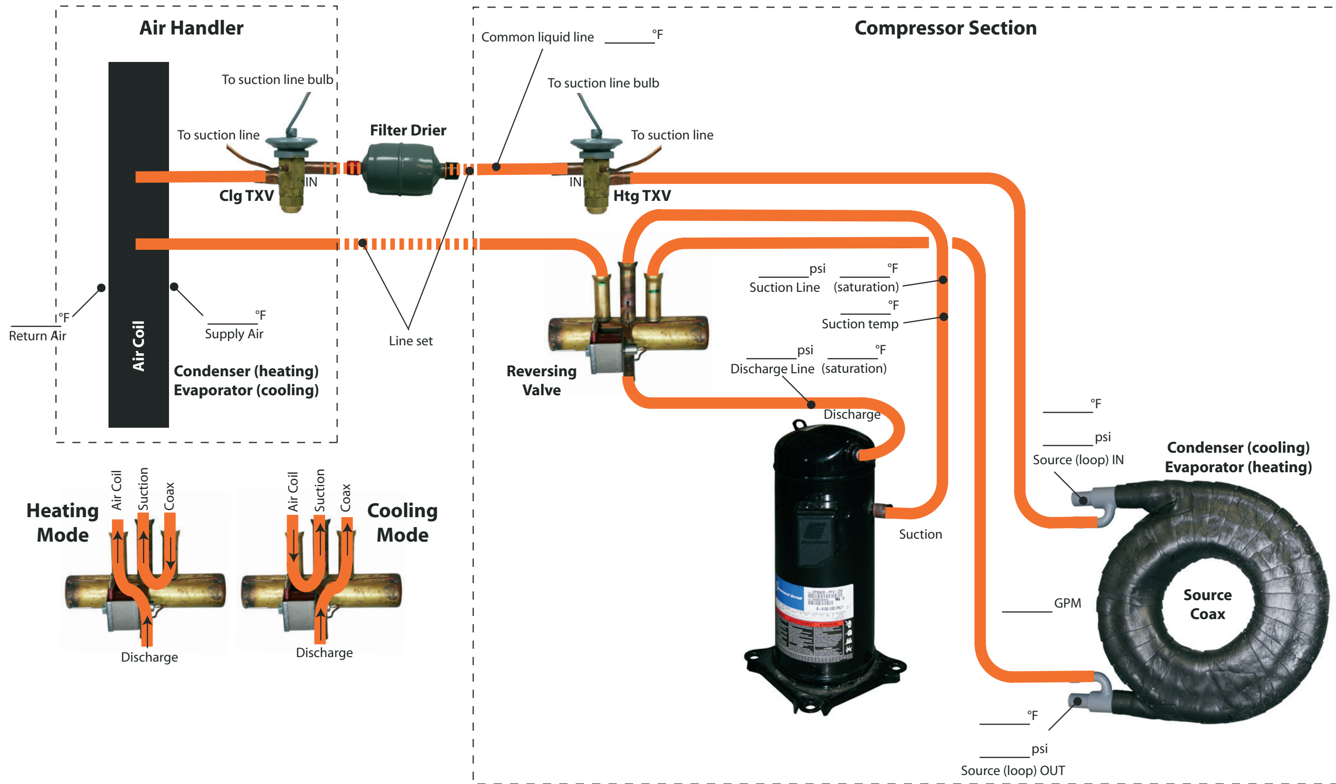
Customer/Job Name:________________________ Date:________________

Model #:________________________ Serial #:________________________

Antifreeze Type:________________________

**HE or HR = GPM x TD x Fluid Factor**
**(Use 500 for water; 485 for antifreeze)**

**SH = Suction Temp. - Suction Sat.**
**SC = Disch. Sat. - Liq. Line Temp.**




Cut along this line

**EQUIPMENT START-UP FORM**

Customer Name:________________________________________

Customer Address:________________________________________

Model #:________________________ Serial #:________________________

Dealer Name:________________________________________

Distributor Name:________________________ Start-up Date:____________________

Cut along this line

**Loop Type: Open Closed** (Circle One)

| **Flow Rate** | **Cooling** | | **Heating** | | **Unit Electrical Data** | **Cooling** | | **Heating** | |
|---|---|---|---|---|---|---|---|---|---|
| Source Water Pressure In | | PSI | | PSI | Line Voltage | | V | | |
| Source Water Pressure Out | | PSI | | PSI | Total Unit Amps | | A | | A |
| Source Water Pressure Drop | | PSI | | PSI | Compressor Amps | | A | | A |
| Flow Rate | | GPM | | GPM | Wire Size | | GA | | |
| *Check pressure drop chart for GPM | | | | | Circuit Breaker Size | | A | | |

| **Source Water Temp. Difference** | **Cooling** | | **Heating** | |
|---|---|---|---|---|
| Source Water Temperature In | | ºF | | ºF |
| Source Water Temperature Out | | ºF | | ºF |
| Source Water Temperature Difference | | ºF | | ºF |
| | | | | |
| **Heat of Rejection/Extraction** | **Cooling** | | **Heating** | |
| Heat of Rejection | | BTU/HR | | |
| Heat Of Extraction | | | | BTU/HR |

**Heat of Extraction/Rejection = GPM X Water Temp. Difference X 500 (Water - Open Loop)**
**Heat of Extraction/Rejection = GPM X Water Temp. Difference X 485 (Water & Antifreeze - Closed Loop)**

| **Load Water Temp. Difference** | **Cooling** | | **Heating** | |
|---|---|---|---|---|
| Load Water Temperature In | | ºF | | ºF |
| Load Water Temperature Out | | ºF | | ºF |
| Load Water Temperature Difference | | ºF | | ºF |
| **Air Temperature Difference** | **Cooling** | | **Heating** | |
| Supply Air Temperature | | ºF | | ºF |
| Return Air Temperature | | ºF | | ºF |
| Air Temp. Difference | | ºF | | ºF |
| *Confirm auxiliary heaters are de-energized for the above readings. | | | | |
| **Auxiliary Heat Operation Only** | | | **Heating** | |
| Supply Air Temperature | | | | ºF |
| Return Air Temperature | | | | ºF |
| Air Temp. Difference | | | | ºF |
| **Auxiliary Heat Electrical Data** | | | **Heating** | |
| Line Voltage | | | | V |
| Total Amperage (Full kW - All Stages) | | | | A |
| Wire Size | | | | GA |
| Breaker Size | | | | A |
| CFM = (Watts X 3.413) ÷ (Air Temp. Difference X 1.08) | | | | |
| Watts = Volts X Auxiliary Heater Amps | | | | |

Installer/Technician:________________________ Date:________________

## Equipment Start-Up Process

**Check the following before power is applied to the equipment**
Caution: Do not start-up the unit until the new structure is ready to be occupied

**Electrical:**

- ☐ Geothermal unit high voltage wiring is installed correctly
- ☐ Geothermal unit high voltage wiring and breaker are the correct size
- ☐ Auxiliary electric heaters are wired and installed correctly
- ☐ Circulating pumps are wired and fused (if necessary) correctly
- ☐ Low voltage wiring is correct and completely installed

**Plumbing:**

- ☐ Pipe and pump sizes are correct
- ☐ Air is purged from all lines
- ☐ Antifreeze is installed
- ☐ All valves are open, including those on the flow center
- ☐ Condensate is trapped and piped to the drain

**Ductwork:**

- ☐ Filter is installed and clean
- ☐ Packaging is removed from the blower assembly
- ☐ Blower turns freely
- ☐ Canvas connections installed on supply plenum & return drop

## Equipment Start-Up

1. Energize geothermal unit with high voltage.
2. Set the thermostat to “Heat” or “Cool.” Adjust set point to energize the unit. System will energize after delays expire (typically a five minute delay).
3. Check water flow with a flow meter (non-pressurized) or pressure drop conversion (pressurized). Pressure drop tables must be used to convert the pressure drop to GPM. The pressure drop can be obtained by checking water pressure in and water pressure out at the P/T ports.
4. Check the geothermal unit’s electrical readings listed in the Unit Electrical Data table.
5. Check the source water temperature in and out at the P/T ports (use insertion probe). Allow 10 minutes of operation before recording temperature drop.
6. Calculate the heat of extraction or heat of rejection.
7. Check the temperature difference of the load coax (water-to-water) or air coil (water-to-air). P/T ports are recommended for use on the load side, but the line temperatures can be used to check the temperature difference.
8. Change the mode of the thermostat and adjust the set point to energize the unit. Check the data in opposite mode as the previous tests. Amp draws as well as temperature differences and flow rate should be recorded.
9. Check auxiliary heat operation by adjusting the thermostat set point 5°F above the room temperature in “Heat” mode or set thermostat to “Emergency." Record voltage, amperage, and air temperature difference.

# WARRANTY ORDER & CLAIM

**PHONE:** 618.664.9010 **FAX:** 618.664.4597 **EMAIL:** WARRANTY@ENERTECHGEO.COM

**ALL WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 10 DAYS OF INSTALLATION**

COMPANY NAME ______________________ (Form submitter) DATE __________

PHONE __________ FAX __________ EMAIL ______________________

ORDERED BY ______________________ JOB NAME/PO # ______________

UNIT *Model #* ______________________ *Serial #* ______________

INSTALL DATE[2] __________ FAILURE DATE __________

SHIP TO ______________________ HOMEOWNER ADDRESS ______________________
*(If different than company)*

*Required if claim is for defective flow center*

FLOW CENTER MODEL # __________ FLOW CENTER SERIAL # __________

**FAILURE CODES, DESCRIPTION AND LABOR REIMBURSEMENT MUST BE FOUND IN WARRANTY MANUAL**

| FAILURE CODE | DESCRIPTION | DOA HOURS **OR** | FLAT RATE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

SERVICE LABOR ALLOWANCE ☐ *NO* ☐ *YES* ☐ *DOA*

DO YOU NEED PARTS ORDERED? ☐ *NO* ☐ *YES*
*(If no, and replacement was purchased from another vendor, attach copy of bill if reimbursement is needed[3].)*

OTHER NOTES ______________________

**FOR ENERTECH USE ONLY**

SRO# ______________________ CREDIT MEMO# ______________________

**1)** See warranty coverage summary sheet for labor allowances, conditions and exclusions, etc. **2)** Warranty start date is ship date from Enertech facility unless proof of startup is presented. **3)** Outsourced warranty replacement parts will be reimbursed in the form of credit for the part only. Credit will be no more than the standard equivalent part cost through Enertech. **4)** Factory pre-approval is required for anything outside the scope of this document. **5)** Fuses, hose kits and items not mentioned on Warranty Coverage Summary are not covered under this program.

# WARRANTY REGISTRATION

**PHONE:** 618.664.9010 **FAX:** 618.664.4597 **EMAIL:** WARRANTY@ENERTECHGEO.COM

**ALL WARRANTY REGISTRATIONS SHOULD BE SUBMITTED WITHIN 10 DAYS OF INSTALLATION**

MODEL NUMBER ____________________ SERIAL NUMBER ____________________ BRAND ________________

DATE OF SALE ________________ DELIVERY DATE __________________ INSTALL DATE __________________

## APPLICATION

☐ *RESIDENTIAL NEW CONSTRUCTION* ☐ *RESIDENTIAL GEO REPLACEMENT* ☐ *RESIDENTIAL RETROFIT*

☐ *MULTI-FAMILY (CONDO/TOWNHOME/MULTI-PLEX)* ☐ *COMMERCIAL* ☐ *OTHER* ________________________________

## USE

☐ *SPACE CONDITIONING* ☐ *DOMESTIC WATER HEATING* ☐ *RADIANT HEAT* ☐ *SWIMMING POOL* ☐ *SNOW MELT*

☐ *OTHER* ________________________________________________________________

*Note: Check all that apply*

## SOURCE

☐ *CLOSED LOOP (HORIZONTAL, VERTICAL, POND/LAKE)* ☐ *OPEN LOOP (WELL WATER)* ☐ *OTHER* ____________________

## SUPPLEMENTAL / EMERGENCY

☐ *NONE* ☐ *ELECTRIC* ☐ *GAS* ☐ *PROPANE* ☐ *OIL* ☐ *WOOD* ☐ *OTHER* ____________________________________

PURCHASER-USER ______________________________________________ PHONE ____________________

ADDRESS __________________________________ CITY ________________ STATE/PROV ________________

POSTAL CODE _____________ EMAIL (OPTIONAL) ______________________________________________

**WE HAVE SUPERVISED THE INSTALLATION AND START-UP IN ACCORDANCE WITH ENERTECH MANUFACTURING, LLC. INSTALLATION INSTRUCTIONS.**

THIS UNIT IS PERFORMING ☐ SATISFACTORILY ☐ NOT SATISFACTORILY, IF NOT EXPLAIN ________________

______________________________________________________________________________________

**TO THE BEST OF MY KNOWLEDGE THE ABOVE INFORMATION IS ACCURATE AND I REQUEST THE WARRANTY TO BE PUT INTO EFFECT.**

DEALER (INSTALLER) ______________________________________________________ DATE _____________

CUSTOMER / END USER _____________________________________________________ DATE _____________

DEALER (INSTALLER) EMAIL ____________________________________________________________________

**MAIL THIS FORM TO:**
ENERTECH GLOBAL LLC
2506 SOUTH ELM STREET
GREENVILLE, IL 62246

**FAX THIS FORM TO:**
ENERTECH GLOBAL LLC
618.664.4597

**OR REGISTER ONLINE AT WWW.ENERTECHGEO.COM**