

NORAIRE[®]

Heat Pump Boiler

AIR TO WATER

Installation & Operating Instructions

Model: EB-HPH*

Application – This is a heating only product. There are no provisions for cooling mode operation

- Radiant in-floor heating – Single zone or multiple zone.
- Baseboard heating – Special “High Temperature Operation”
- Hydronic water to air coil above an air handler – Special “High Temperature Operation”
- Indirect domestic hot water (water to water heat exchanger) – Special “High Temperature Operation”
- Mixture of the above scenarios (max of one high temperature zone per application)

Accessories

- From the factory, this unit will interface with two thermostats, two pumps / zone valves, a single stage heat pump compressor, an internal or external electric boiler, an external gas boiler, and special power company interface for load shedding applications.

Important Installer Information

- The NorAire Heat Pump system must be installed by an experienced HVAC installer. Sufficient knowledge of refrigerant line set installation, system charging, and heating performance testing is required to perform warranty validation.
- Heat Pump Outdoor Unit – manual NI217 contains installation information specific to the heat pump ODU brand supplied by Electro Industries. Please visit www.electromn.com for installation information specific to other brands.

DO NOT DESTROY THIS MANUAL. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICE TECHNICIAN.



**ELECTRO
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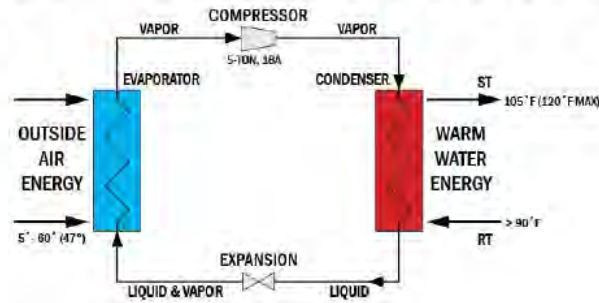
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| | XX017 |

AIR TO WATER

Is there heat in winter air?

Yes, but the refrigeration cycle is required to capture and transfer this "heat".



With the Heat Pump Boiler the outside air energy is converted to hot water and as a bonus the system is 332% efficient.

Basic Efficiency Information

$$\text{Coefficient of Performance (COP)} = \frac{\text{Heated Energy Output}}{\text{Net Input Energy}}$$

$$\text{Efficiency \%} = \text{COP} \times 100$$

NorAire Heat Pump Boiler

$$\text{Output Energy (Btu/h)} = 500 \times (\text{ST} - \text{RT}) \times \text{GPM}$$

$$\text{Net Input Energy (Btu/h)} = \text{Compressor Watts} \times 3.412$$

$$\text{Output vs. Input Difference} = \text{Captured Air Energy} - \text{Internal Losses}$$

Example, Mpls:

$$\text{Output @47° OT} = 500 \times (105° - 91°) \times 8 = 56,000$$

$$\text{Input @47° OT} = 17.2\text{A} \times 240 \times 3.41 = 14,076 \text{ (COP} = 3.98\text{)}$$

$$\text{Output @10°} = 500 \times (98° - 90°) \times 8 = 32,000$$

$$\text{Input @10°} = 17.8\text{A} \times 240 \times 3.41 = 14,567 \text{ (COP} = 2.20\text{)}$$

Boost (EB modulating) is only 16,000 Btu/h or 4.7 kW average

Various COP's

| | |
|--------------------------------|------|
| Old Oil Boiler | 0.50 |
| Open Flame Flue | 0.75 |
| Direct Vent Gas | 0.87 |
| Condensing Gas | 0.95 |
| Electric Heat (Electro-Boiler) | 1.00 |
| HPB, 5-Ton at 47° F | 3.89 |
| HPB, 5-Ton at 30° F | 3.78 |
| HPB, 5-Ton at 10° F | 2.28 |
| Below HP Lockout (5° F) | 1.00 |

$$*\text{Annual COP} = \frac{\text{Weather Bin Hours (per 5° bins)} \times \text{BTU Energy}}{\text{Input BTU for each weather bin cell}}$$

NorAire Concept

NorAire is an air source heat pump that produces hot water. NorAire takes heat energy from the outside air and uses a refrigeration to water heat exchanger to transfer that heat energy into water, then distributed in a variety of ways to heat your home.

What Makes NorAire Versatile? NorAire is a highly efficient, intelligent multi-stage heating system (ASHP, electric boiler and or external gas boiler). It monitors heat pump run time, outdoor temperature, return temperature, outlet temperature, and a variety of potential system faults. It also monitors multiple room thermostats, controls circulating pumps and stages in the various heating sources to operate either together or independently, all while maintaining a comfortable temperature to the space, and maintaining a high level of energy efficiency. An integrated 2-zone control allows for built-in system flexibility, including the option to prioritize a zone and define the zone as high temperature electric boiler assist with priority allowing one zone to service baseboard heat or indirect domestic hot water while using the other zone for low temperature applications such as in-floor radiant heating. All of this is customizable via the product display.

Operating Sequence

This represents a unique and very significant part of the NorAire Heat Pump Boiler philosophy and design. The NorAire as a single package provides total heating comfort throughout the entire heating season. Using a combination of outdoor and hydronic system temperature sensing, it has the ability to anticipate the BTU's required during a thermostat heat call. To achieve maximum efficiency and comfort, NorAire will follow three operational sequences and user defined settings. **All preset values and system settings can be adjusted through the interactive display.**

Sequences I and II occur above heat pump lockout, Sequence III occurs below heat pump lockout.

Sequence I – At the start of a heat call, the heat pump is energized to begin heating the water in the hydronic system. The water temperature will be a directly related to the heat pump BTU output. Typical maximum water temperatures are 110° F to 115° F and will vary based on outdoor temperature and the BTU load of the system. For applications with an internal Electro-Boiler, a boost timer will also start. If the boost timer ends during the heat call, NorAire will begin Sequence II.

Sequence II - Boost Mode time out. Once the boost timer has expired and it is apparent the heat pump alone will not satisfy the heat call, NorAire will begin staging electric elements (working with the heat pump) to boost the outlet temperature to a desired set point. The set point temperature is determined by adding a preset Boost Mode differential value to the return water temp. NorAire will continue to stage and modulate elements, working along with the heat pump to maintain the desired outlet temperature until the thermostat is satisfied. NorAire calculated water temperature example:

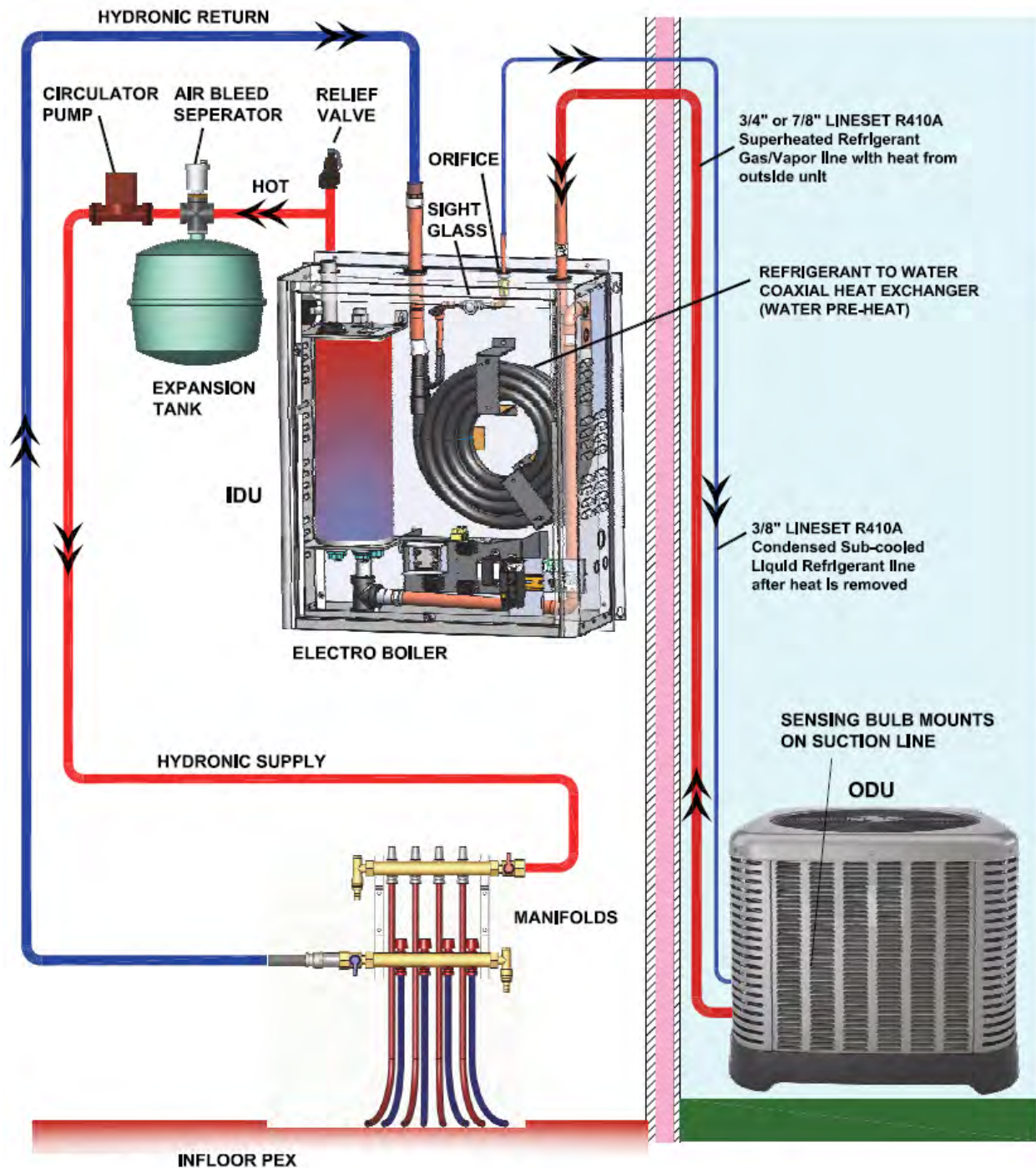
- Boost Mode begins
- Return water temp = 80° F
- Differential Temperature setting = 10° F (factory default)
- Desired outlet temperature will equal 90° F

As the space is heated, the return water temperature will tend to shift upward. The desired outlet water temperature will also shift upward until it reaches a preset “Max Boost DT” value.

Sequence III – Outdoor temperature falls below lockout temperature. At this point, the NorAire controller will shut the outdoor unit down and reference a variable known as “Heat Source Below Lockout”. This variable determines which heat source to use to heat the space when outdoor temperature is below lockout value. If this variable is set to “Electro-Boiler” (factory default), the built-in (or external) Electro-Boiler will be the heat source selected. If the variable is set to “External Gas Boiler”, the external gas boiler is used to heat the space.

NOTE: Once the outdoor temperature drops below lockout and NorAire disables the outdoor unit and transitions to whichever source is selected (Heat Source Below Lockout), a 4°F rise in outdoor temperature is required before the NorAire controller will switch back to heat pump operation (Boost Mode) **during the same heat call.**

Basic System Overview



ART-459

Handling & Storage

Receiving

It is the receiver's (person and/or company signing off on the receiving Bill of Lading) responsibility to inspect for shipping damage. All shipping claims must be made by the receiver.

Storage

This NorAire product packed or unpacked, shall not be exposed to rain, snow, or other adverse environment. This product is designed for in-building storage and installation only. As much as possible this Noraire unit must be covered with plastic throughout the construction phase to avoid accumulation of dust and moisture on the components and the complete control box. The receiver and installing contractor are responsible for maintaining the cleanliness and quality of this unit until installation is complete and approved by the user/end customer.

Safety Consideration

WARNING

| |
|--|
| BEFORE PERFORMING SERVICE OR MAINTENANCE OPERATIONS ON A SYSTEM, TURN OFF MAIN POWER SWITCHES TO THE INDOOR UNIT. IF APPLICABLE, TURN OFF THE ACCESSORY HEATER POWER SWITCH. ELECTRICAL SHOCK COULD CAUSE PERSONAL INJURY. |
|--|

Installing and servicing electric heating equipment can be hazardous due to high voltage and electrical components. Only trained and qualified service personnel should install, repair or service heating and air conditioning equipment. Untrained personnel can perform the basic maintenance functions of cleaning coils and cleaning and replacing filters. All other operations should be performed by trained service personnel. When working on heating and air conditioning equipment, observe precautions in the literature, tags and labels attached to the unit and other safety precautions that may apply, such as the following safety measures:

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use a quenching cloth for brazing operations.
- Have a fire extinguisher available for all brazing operations.

Product Configurator

E B - H P H - 5 - 2 0

| | | | | | | | | | | |
|---------------------|---|--|---|---|---|--|---|--|---|---|
| 1 | 2 | | 3 | 4 | 5 | | 6 | | 7 | 8 |
| Model Number Digits | | | | | | | | | | |

| Series | Type | Nominal Ton Size | Auxiliary kW Options |
|--------------------|---------------------------------|---------------------|----------------------|
| 1, 2, 3, 4 | 5 | 6 | 7, 8 |
| EB-HP = Air Source | H = Heating | 3 = 3-Ton | 00 = No AUX Heat |
| | C = Heating or Cooling (future) | 4 = 4-Ton | 10 = 10kW |
| | | 5 = 5-Ton | 15 = 15kW |
| | | | 20 = 20kW |

Specification Table

| | <u>Units</u> | <u>3-Ton</u> | <u>4-Ton</u> | <u>5-Ton</u> |
|------------------------------|-----------------------|----------------|-------------------|------------------------|
| Heating capacity, EB ④⑤⑥⑦ | Btu/h | 34,000 (10 kW) | 51,000 (15 kW) | 68,000 (20 kW) |
| Heating capacity, HP ①②③ | Btu/h | 33,300 | 44,400 | 59,100 |
| Heating capacity, HP @ 47° F | Btu/h | 27,300 | 40,400 | 49,700 |
| Power voltage | Volts/60Hz | 240, 1 phase | 240, 1 phase | 240, 1 phase |
| IDU source breakers | Amps | (1) 60A | (1) 60A & (1) 30A | (2) 60A |
| IDU EL boiler total amps | Amps | 42 | 63 | 84 |
| IDU non-EL boiler | Amps | 1 | 2 | 2 |
| ODU total amps | Amps | 15.1 | 21.3 | 27.7 |
| ODU minimum circuit ampacity | Amps | 18.6 | 26.3 | 34.3 |
| ODU delay fuse max 2P | Amps | 30 | 45 | 60 |
| ODU compressor RLA data | Amps | 14.1 | 19.8 | 26.2 |
| ODU compressor LRA data | Amps | 77 | 109 | 134 |
| ODU noise level | dB | 74 | 75 | 75 |
| IDU/ODU width | Inches | 26.5/31 | 26.5/31 | 26.5/31 |
| IDU/ODU height | Inches | 30/45 | 30/45 | 30/45 |
| IDU/ODU depth | Inches | 11/32 | 11/32 | 11/32 |
| Line sets | Inches | 3/8 and 3/8 | 3/8 and 3/8 | 3/8 and 3/8 |
| Max line set | Feet | 75 | 75 | 75 (1-1/8", 50 and up) |
| Max vertical separation | Feet | 25 | 25 | 25 |
| R-410A ODU factory charge | Ounces | See nameplate | See nameplate | See nameplate |
| Water connection | NPT, female | 1" | 1" | 1" |
| Maximum water flow | GPM per minute | 7 | 10 | 10 |
| Nominal water flow ② | GPM per minute | 6 | 8 | 8 |
| Minimum water flow | GPM per minute | 3 | 3.5 | 3.5 |
| Internal pressure drop | Ft of head, Rated GPM | 2.3 | 2.4 | 3 |
| IDU shipping weight | Pounds | 162 | 162 | 162 |
| ODU shipping weight | Pounds | 158 | 193 | 201 |

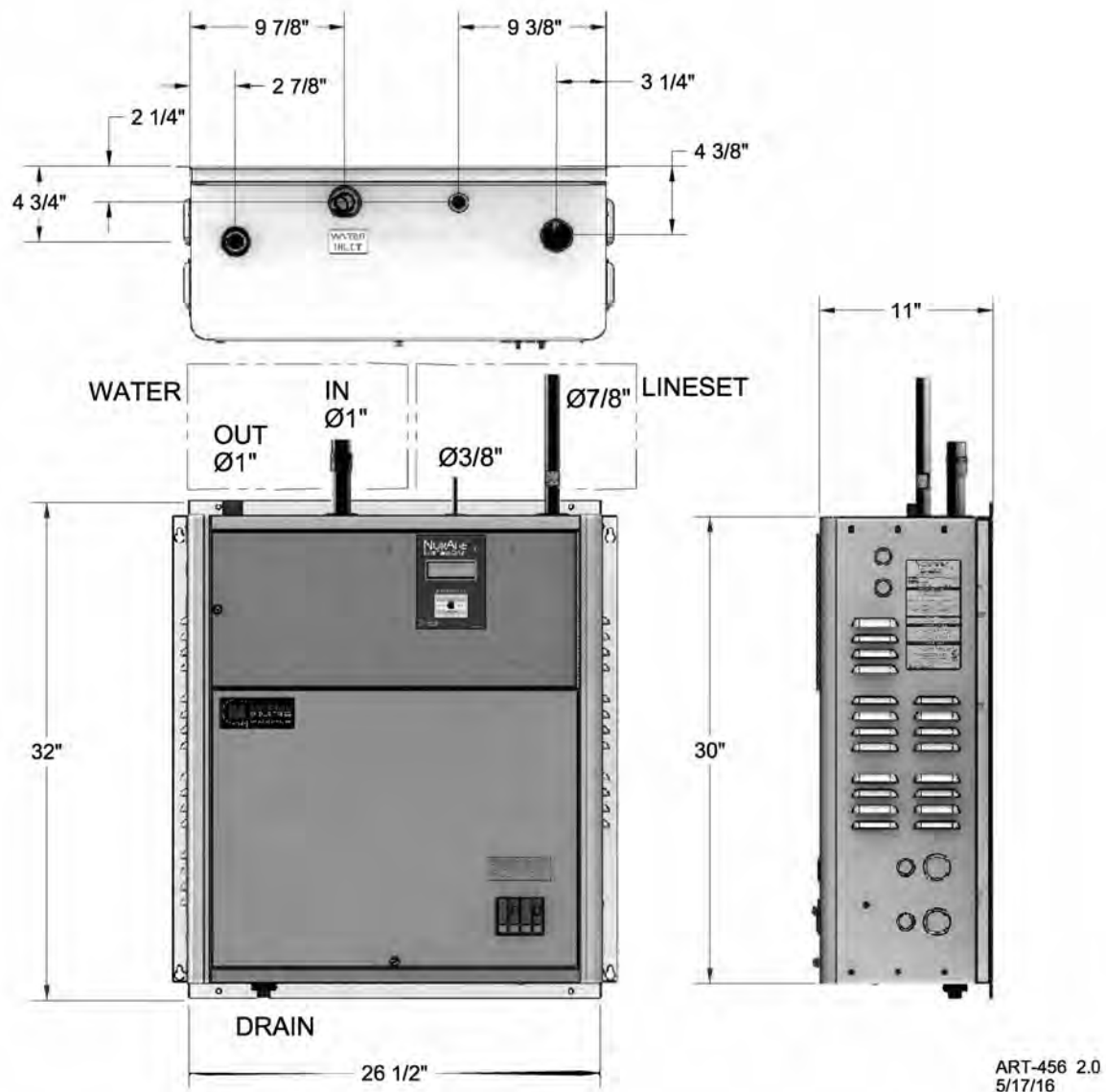
① HEATING CAPACITY AT 60° F ODU OUTSIDE AIR ② LOAD CONDITIONS, HYDRONIC RETURN 90° F AND NOMINAL GPM

③ TYPICAL RETURN TO SUPPLY TEMP RISE SHOULD BE 10° TO 15° F ④ ELECTRO-BOILER ENTERING TEMP IS HP COIL OUTPUT, 90° TO 110° F

⑤ TYPICAL ELECTRO-BOILER TEMP RISE SHOULD BE 10° TO 20° F ⑥ ELECTRO-BOILER IS DISABLED ABOVE HPBP AND MODULATES BETWEEN HPBP AND SWOVER (BOOST)

⑦ ELECTRO-BOILER SIZE DETERMINES BTU/H RATING AT COOLEST TEMP ⑧ DATA MAY BE UPDATED WITHOUT NOTICE

Dimensional Drawing



Installation Requirements

1. All installation work must be performed by trained, qualified contractors or technicians. Electro Industries sponsors installation and service schools/Webinars to assist the installer. **Visit our Website at www.electromn.com for upcoming training.**



WARNING

ALL ELECTRICAL WIRING MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE AND LOCAL ELECTRIC CODES, ORDINANCES, AND REGULATIONS.



WARNING

OBSERVE ELECTRIC POLARITY AND WIRING COLORS. FAILURE TO OBSERVE COULD CAUSE ELECTRIC SHOCK AND/OR DAMAGE TO THE EQUIPMENT.



CAUTION

This unit can only be used for its intended design as described in this manual. Any internal wiring changes, modifications to the circuit board, modifications or bypass of any controls, or installation practices not according to the details of this manual will void the product warranty, the safety certification label, and manufacturer product liability. Electro Industries cannot be held responsible for field modifications, incorrect installations, and conditions which may bypass or compromise the built-in safety features and controls.



CAUTION

This unit shall not be operated (either heating section or blower) until the interior of the structure is completed and cleaned. This also means all duct work must be complete with filter, etc. Manufacturer's warranty is void if this unit is operated during structure construction.



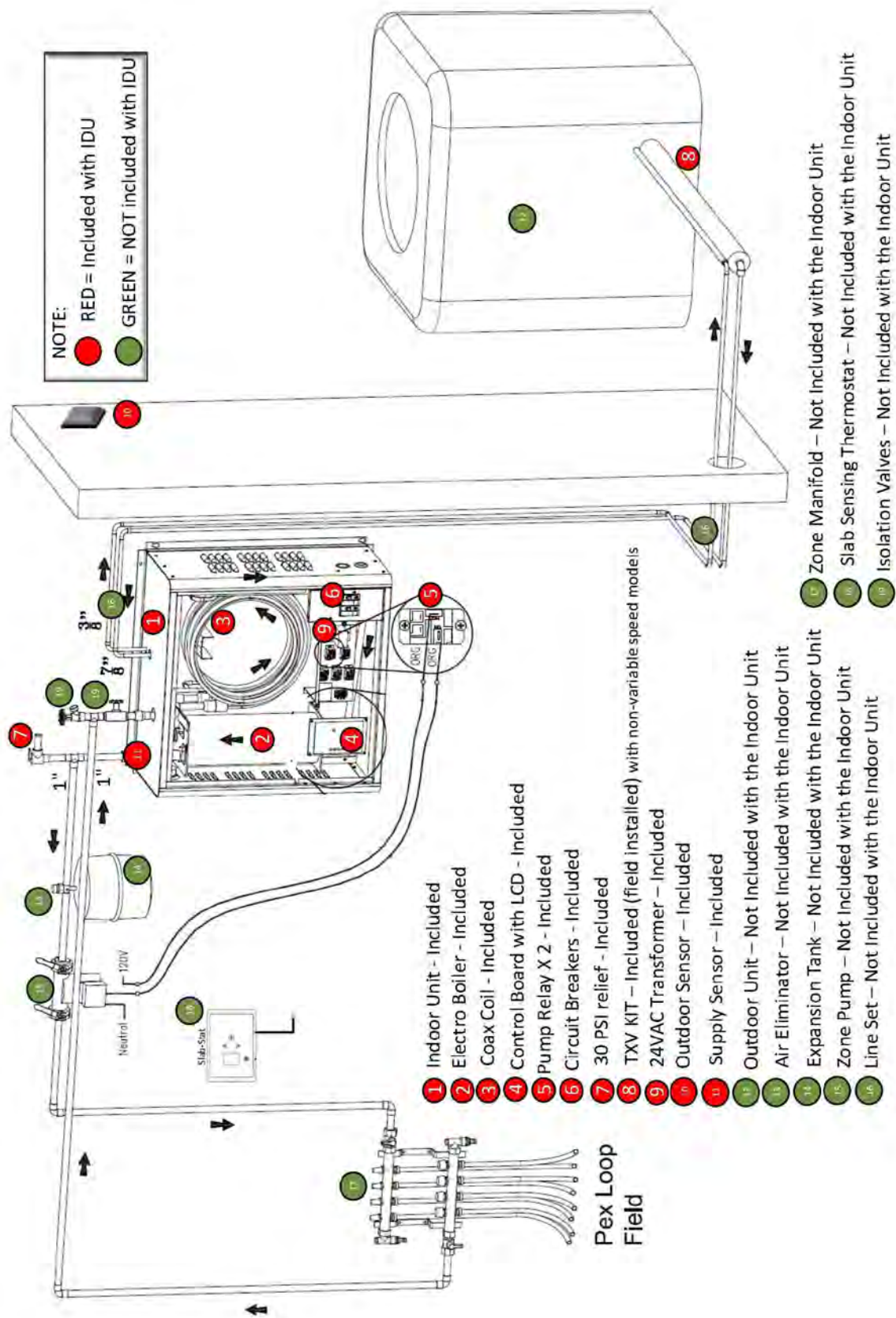
CAUTION

Hazards or unsafe practices could result in property damage, product damage, severe personal injury and/or death.

2. Remember, safety is the installer's responsibility and the installer must know this product well enough to instruct the end user on its safe use.

At Electro Industries, the safety of the installer and the end user is of highest priority. Remember, safety is the installer's responsibility and the installer must know this product well enough to instruct the end user on its safe use. Professional installers should be trained and experienced in the areas of handling electrical components, sheet metal products, and material handling processes. Use them.

Installation Overview



ART-481

Mechanical Installation

1. To ensure proper heat transfer efficiency, it is important that the system is properly designed to have correct amount of water flow (GPM).
2. It is very important to install this system using the correct pipe and to use “full port” fittings as shown below.
3. For models including the integrated boiler, install pressure relief valve per attached BX902 drawing.
4. Install expansion tank, air separator with air bleed, and circulating pump in the outlet water piping as referenced in the mechanical installation overview section above.
5. Fill system with water/glycol when all boiler piping is complete (do not use more than 50/50 water to glycol).
6. Install refrigeration line set piping that connects the outdoor unit to the indoor unit.
 - a. Please refer to the outdoor unit installation manual for specific installation instructions relating directly to the outdoor unit.
7. Refer to the **Refrigerant Charging Procedure** below.

"Full Port" VERSUS "Half Port" fittings

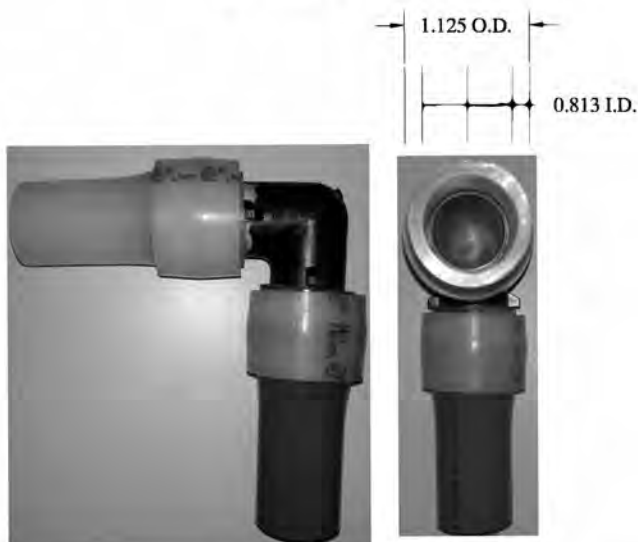
* When piping for your EB-HP system, make sure you use "Full Port" fittings.



1" Elbow
Full-Port



1" Elbow
Half-Port



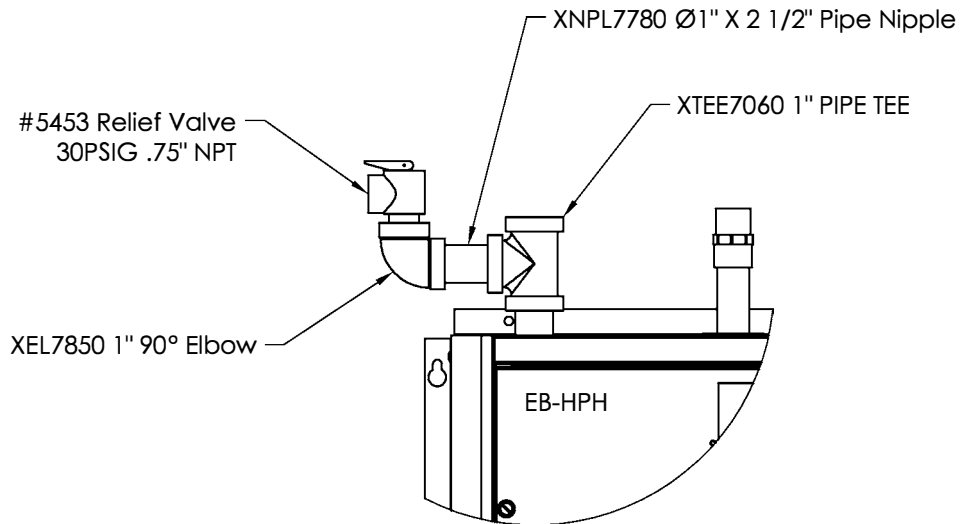
1" PEX Elbow
Full-Port



1" PEX Elbow
Half-Port

ART-480 1.0

RELIEF KIT



ELECTRO INDUSTRIES, INC.
MONTICELLO, MN 55362

BX902
Rev D 11-5-18

ODU External TXV Installation

Reference detailed drawing BX903.

NOTE: If the heat pump you are installing has a factory installed TXV, *do not install* the TXV provided with the NorAire unit.

Give special attention to the following:

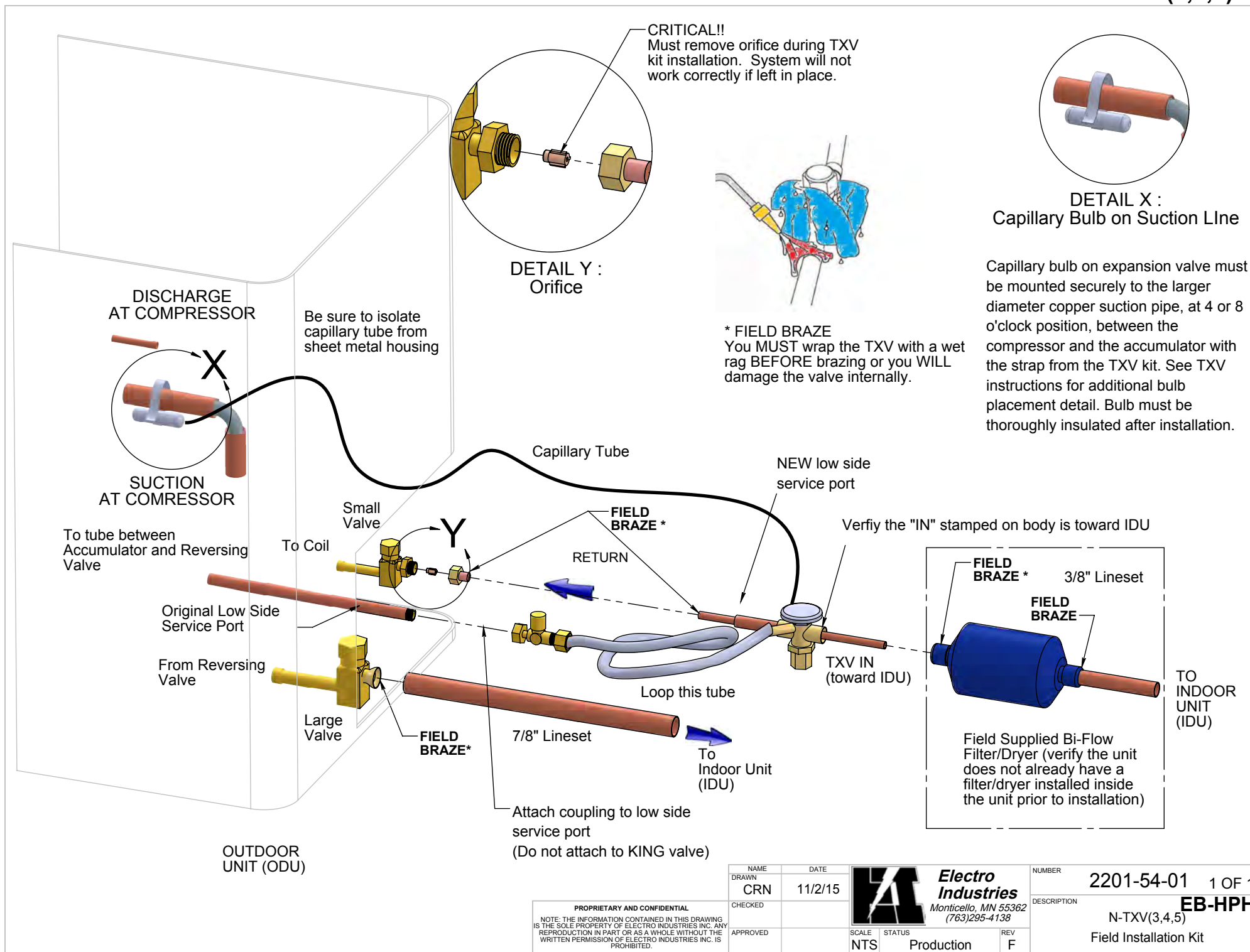
1. Remove ODU orifice/piston at the small valve line set connection (detail Y).
2. The supplied external TXV is orientated and installed in the liquid or small line set at the ODU small valve as shown.
3. Inside, identify the compressor suction pipe and install the TXV capillary tube temperature bulb as shown (detail X).
4. Bulb must be thoroughly insulated after installation.
5. Ensure nitrogen flow is used with the line set connection/brazing.
6. A wet rag must be used during TXV brazing.

Purge and evacuation comments:

1. Vacuum pump is connected to either ODU line set valve service port.
2. Evacuate system to less than 500 microns.

Procedure for finishing TXV ¼" tube tee adapter to ODU low side service port:

1. This process is similar to "purging" a gauge set hose.
2. Route the ¼" tube flare nut at its final location and close to the ODU low side service port.
3. Connect flare nut to the service port and using wrenches tighten the flare nut to the service port.
4. Attach low side gauge set hose to new low side service port next to the TXV, the purge low side refrigerant hose.
5. Open line set valves and continue with the "Refrigerant Charging Instructions", next page.



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| | |
|---------------|---------|
| NAME DRAWN | DATE |
| CRN | 11/2/15 |
| CHECKED | |
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| | | |
|--------------|----------------------|----------|
| SCALE NTS | STATUS Production | REV F |
|--------------|----------------------|----------|

| | | |
|-------------|---|--------|
| NUMBER | 2201-54-01 | 1 OF 1 |
| DESCRIPTION | EB-HPH N-TXV(3,4,5) Field Installation Kit | |

Refrigerant Charging Instructions

1. Prior to charging the system with refrigerant, ensure proper pressure leak test and evacuation have been performed on the system.
2. Depending upon length of line set, additional refrigerant charge may be required. Refer to the outdoor unit's installation manual.
3. To achieve proper system performance, it is important to verify system water flow and refrigerant charge.
4. Verify you have the "Nominal" amount of water flow BEFORE checking the refrigerant charge.
5. Ideal refrigerant charging conditions are between 35 and 60 degrees F.
6. DO NOT just charge the refrigeration system until the sight glass is clear/full. You could end up overcharging the refrigeration system. The refrigerant sight glass is to be used as a reference point only.
7. Refer to "Calculation Examples for Superheat and Subcooling" drawing CS102 for proper attachment of gauges and thermocouples to calculate your superheat and subcooling using your PT (pressure temperature) chart.
8. Calculate your water temperature rise across your COAX coil using the thermocouples as shown on drawing CS102.
9. Use the data you have calculated and gathered: outdoor temperature, temperature rise, low and high refrigerant pressures, superheat, subcooling, and amps on the "Capacity and Performance" chart to help determine if your system is properly charged by comparing your numbers to the charts. They should be relatively close.
10. Observe the number of bubbles in your sight glass. A properly charged system may still have some bubbles showing. If your sight glass is completely white with bubbles, you may still need to add refrigerant to the system. Double check your calculated numbers again to verify them with the "Capacity and Performance" chart.
11. ADDING REFRIGERANT: Once you have verified your calculations and have determined that the refrigerant charge is still low, proceed with the following.
12. When adding refrigerant to the system, it is important to only add refrigerant in 4-ounce increments. Make sure you let the system stabilize for 10 minutes before adding any more refrigerant or taking any readings to calculate your data on the "Capacity and Performance" chart.
13. Repeat step 13 listed above until your calculated data from the information you have been gathering is relatively close to the information listed on the "Capacity and Performance" chart to achieve the proper refrigerant charge in the system.

Note: With an empty refrigeration system due to leaks or needed service repairs, refer to the outdoor unit factory nameplate refrigerant charge weight/amount.

Note: Pressure tap caps must be installed and tight at all times.

Calculation Examples for Superheat and Subcooling/Temperature Rise

R410A Refrigerant

Calculating Superheat Example:

- 1) Measure SUCTION PRESSURE (low pressure = 117 psi)
- 2) Use PT (Pressure/Temperature chart) to convert psi to temperature, 117 psi=39°F
- 3) Measure the temperature of the copper pipe with your thermocouple near the TXV capillary bulb by the compressor, SEE POINT (A).
- 4) Using the two temperatures above, calculate the amount of superheat as follows:

$$\begin{array}{rcl} \text{Thermocouple Temp} & - & \text{PT chart temp} = \text{Superheat Temp} \\ 46^\circ\text{F} & - & 39^\circ\text{F} = 7^\circ\text{F} \end{array}$$

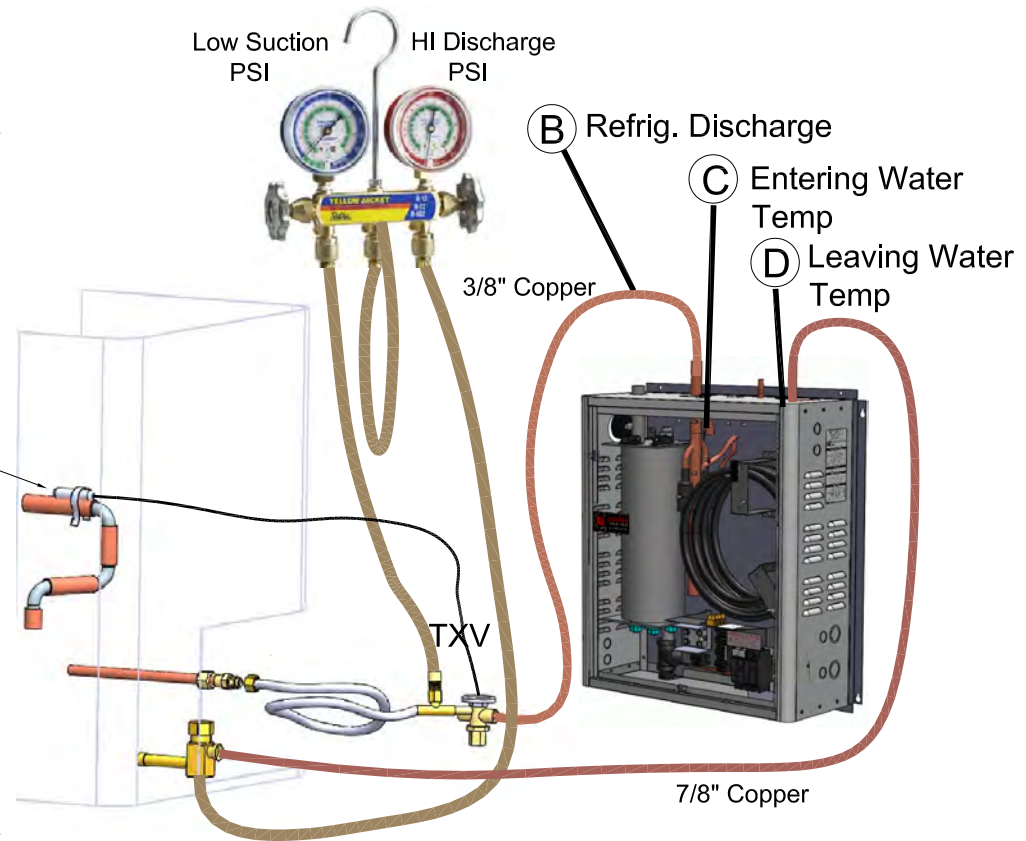
Suction temperature at TXV bulb (A)

Calculating Subcooling Example:

- 1) Measure DISCHARGE PRESSURE (HI pressure = 391 psi)
- 2) Use PT (Pressure/Temperature chart) to convert psi to temperature, 391 psi=115°F
- 3) Measure the temperature of the copper pipe with your thermocouple at the outlet of the coaxial heat exchanger located in the inside of the boiler, SEE POINT (B). Temp = 98°F

- 4) Using the two temperatures above, calculate Sub Cooling:

$$\begin{array}{rcl} \text{PT chart temp} & - & \text{Thermocouple Temp at point (B)} = \text{Sub Cooling} \\ 115^\circ\text{F} & - & 98^\circ\text{F} = 17^\circ\text{F} \end{array}$$



Calculating Temperature Rise Example:

- 1) Measure entering water at COAX coil (C)
- 2) Measure leaving water at COAX coil (D)
- 3) Subtract: (C) - (D) = Temperature Rise

Pressure/Temperature Conversion Chart for R-410A

| PRESSURE (PSIG) | TEMP °F | PRESSURE (PSIG) | TEMP °F | PRESSURE (PSIG) | TEMP °F | PRESSURE (PSIG) | TEMP °F | PRESSURE (PSIG) | TEMP °F |
|--------------------|------------|--------------------|------------|--------------------|------------|--------------------|------------|--------------------|------------|
| 60 | 8.5 | 180 | 63.5 | 300 | 96.3 | 420 | 120.6 | 540 | 140.0 |
| 62 | 9.9 | 182 | 64.2 | 302 | 96.8 | 422 | 120.9 | 542 | 140.3 |
| 64 | 11.2 | 184 | 64.8 | 304 | 97.2 | 424 | 121.3 | 544 | 140.6 |
| 66 | 12.5 | 186 | 65.5 | 306 | 97.7 | 426 | 121.6 | 546 | 140.9 |
| 68 | 13.8 | 188 | 66.1 | 308 | 98.1 | 428 | 122.0 | 548 | 141.2 |
| 70 | 15.1 | 190 | 66.8 | 310 | 98.6 | 430 | 122.3 | 550 | 141.4 |
| 72 | 16.3 | 192 | 67.4 | 312 | 99.0 | 432 | 122.7 | 552 | 141.7 |
| 74 | 17.5 | 194 | 68.0 | 314 | 99.5 | 434 | 123.0 | 554 | 142.0 |
| 76 | 18.7 | 196 | 68.7 | 316 | 99.9 | 436 | 123.4 | 556 | 142.3 |
| 78 | 19.8 | 198 | 69.3 | 318 | 100.4 | 438 | 123.7 | 558 | 142.6 |
| 80 | 21.0 | 200 | 69.9 | 320 | 100.8 | 440 | 124.1 | 560 | 142.9 |
| 82 | 22.1 | 202 | 70.5 | 322 | 101.2 | 442 | 124.4 | 562 | 143.2 |
| 84 | 23.2 | 204 | 71.1 | 324 | 101.7 | 444 | 124.8 | 564 | 143.5 |
| 86 | 24.3 | 206 | 71.7 | 326 | 102.1 | 446 | 125.1 | 566 | 143.7 |
| 88 | 25.4 | 208 | 72.3 | 328 | 102.5 | 448 | 125.4 | 568 | 144.0 |
| 90 | 26.5 | 210 | 72.9 | 330 | 103.0 | 450 | 125.8 | 570 | 144.3 |
| 92 | 27.5 | 212 | 73.5 | 332 | 103.4 | 452 | 126.1 | 572 | 144.6 |
| 94 | 28.6 | 214 | 74.1 | 334 | 103.8 | 454 | 126.5 | 574 | 144.9 |
| 96 | 29.6 | 216 | 74.7 | 336 | 104.2 | 456 | 126.8 | 576 | 145.1 |
| 98 | 30.6 | 218 | 75.3 | 338 | 104.7 | 458 | 127.1 | 578 | 145.4 |
| 100 | 31.6 | 220 | 75.8 | 340 | 105.1 | 460 | 127.5 | 580 | 145.7 |
| 102 | 32.6 | 222 | 76.4 | 342 | 105.5 | 462 | 127.8 | 582 | 146.0 |
| 104 | 33.5 | 224 | 77.0 | 344 | 105.9 | 464 | 128.1 | 584 | 146.2 |
| 106 | 34.5 | 226 | 77.5 | 346 | 106.3 | 466 | 128.5 | 586 | 146.5 |
| 108 | 35.4 | 228 | 78.1 | 348 | 106.7 | 468 | 128.8 | 588 | 146.8 |
| 110 | 36.4 | 230 | 78.7 | 350 | 107.2 | 470 | 129.1 | 590 | 147.1 |
| 112 | 37.3 | 232 | 79.2 | 352 | 107.6 | 472 | 129.4 | 592 | 147.3 |
| 114 | 38.2 | 234 | 79.8 | 354 | 108.0 | 474 | 129.8 | 594 | 147.6 |
| 116 | 39.1 | 236 | 80.3 | 356 | 108.4 | 476 | 130.1 | 596 | 147.9 |
| 118 | 40.0 | 238 | 80.9 | 358 | 108.8 | 478 | 130.4 | 598 | 148.2 |
| 120 | 40.9 | 240 | 81.4 | 360 | 109.2 | 480 | 130.7 | 600 | 148.4 |
| 122 | 41.7 | 242 | 81.9 | 362 | 109.6 | 482 | 131.1 | 602 | 148.7 |
| 124 | 42.6 | 244 | 82.5 | 364 | 110.0 | 484 | 131.4 | 604 | 149.0 |
| 126 | 43.4 | 246 | 83.0 | 366 | 110.4 | 486 | 131.7 | 606 | 149.2 |
| 128 | 44.3 | 248 | 83.5 | 368 | 110.8 | 488 | 132.0 | 608 | 149.5 |
| 130 | 45.1 | 250 | 84.1 | 370 | 111.2 | 490 | 132.3 | | |
| 132 | 45.9 | 252 | 84.6 | 372 | 111.6 | 492 | 132.7 | | |
| 134 | 46.7 | 254 | 85.1 | 374 | 112.0 | 494 | 133.0 | | |
| 136 | 47.5 | 256 | 85.6 | 376 | 112.3 | 496 | 133.3 | | |
| 138 | 48.3 | 258 | 86.1 | 378 | 112.7 | 498 | 133.6 | | |
| 140 | 49.1 | 260 | 86.6 | 380 | 113.1 | 500 | 133.9 | | |
| 142 | 49.9 | 262 | 87.1 | 382 | 113.5 | 502 | 134.2 | | |
| 144 | 50.7 | 264 | 87.7 | 384 | 113.9 | 504 | 134.5 | | |
| 146 | 51.5 | 266 | 88.2 | 386 | 114.3 | 506 | 134.9 | | |
| 148 | 52.2 | 268 | 88.7 | 388 | 114.7 | 508 | 135.2 | | |
| 150 | 53.0 | 270 | 89.2 | 390 | 115.0 | 510 | 135.5 | | |
| 152 | 53.7 | 272 | 89.6 | 392 | 115.4 | 512 | 135.8 | | |
| 154 | 54.5 | 274 | 90.1 | 394 | 115.8 | 514 | 136.1 | | |
| 156 | 55.2 | 276 | 90.6 | 396 | 116.2 | 516 | 136.4 | | |
| 158 | 55.9 | 278 | 91.1 | 398 | 116.5 | 518 | 136.7 | | |
| 160 | 56.6 | 280 | 91.6 | 400 | 116.9 | 520 | 137.0 | | |
| 162 | 57.4 | 282 | 92.1 | 402 | 117.3 | 522 | 137.3 | | |
| 164 | 58.1 | 284 | 92.6 | 404 | 117.6 | 524 | 137.6 | | |
| 166 | 58.8 | 286 | 93.0 | 406 | 118.0 | 526 | 137.9 | | |
| 168 | 59.5 | 288 | 93.5 | 408 | 118.4 | 528 | 138.2 | | |
| 170 | 60.2 | 290 | 94.0 | 410 | 118.7 | 530 | 138.5 | | |
| 172 | 60.8 | 292 | 94.5 | 412 | 119.1 | 532 | 138.8 | | |
| 174 | 61.5 | 294 | 94.9 | 414 | 119.5 | 534 | 139.1 | | |
| 176 | 62.2 | 296 | 95.4 | 416 | 119.8 | 536 | 139.4 | | |
| 178 | 62.9 | 298 | 95.8 | 418 | 120.2 | 538 | 139.7 | | |

NorAire Heat Pump Boiler – Capacity & Performance

| Size | OT Air, ° F | MINIMUM FLOW 3 GPM, 90° F RT | | | | | | NOMINAL FLOW 6 GPM, 90° F RT | | | | | | MAXIMUM FLOW 7 GPM, 90° F RT | | | | | |
|--------------|----------------|---------------------------------|------|---------|----------|------|------|---------------------------------|------|---------|-----------|------|------|---------------------------------|------|---------|----------|-------|------|
| | | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP |
| 3-TON | 60 | 32.4 | 21.6 | 417/126 | 5.2/16.5 | 11.7 | 3.38 | 33.3 | 11.1 | 350/125 | 10.6/14.9 | 10.1 | 4.03 | 33.3 | 9.5 | 354/127 | 9.2/14.8 | 10.15 | 4.01 |
| | 47 | 27.4 | 18.3 | 397/107 | 4.5/19.9 | 11.3 | 2.96 | 27.3 | 9.1 | 351/104 | 5.1/13.2 | 10.3 | 3.24 | 27.2 | 7.8 | 345/101 | 9.1/13.3 | 10.2 | 3.26 |
| | 35 | 24.4 | 16.3 | 384/91 | 5.1/15.4 | 11.2 | 2.67 | 23.7 | 7.9 | 338/89 | 5.9/12.3 | 10.1 | 2.87 | 24.5 | 7.0 | 335/87 | 6.4/12.4 | 10.15 | 2.94 |
| | 25 | 19.8 | 13.2 | 361/74 | 4.7/14.6 | 10.8 | 2.24 | 21.0 | 7.0 | 326/73 | 5.1/9.8 | 10.0 | 2.57 | 20.4 | 5.8 | 325/73 | 5.3/8.7 | 10.0 | 2.49 |
| | 15 | 16.9 | 11.3 | 348/61 | 5.8/12.3 | 10.6 | 1.94 | 18.1 | 6.0 | 324/60 | 6.5/8.5 | 10.0 | 2.21 | 17.7 | 5.1 | 319/60 | 6.2/7.9 | 10.0 | 2.16 |
| | 10 | 16.0 | 10.7 | 338/54 | 4.5/9.8 | 10.5 | 1.87 | 15.8 | 5.3 | 318/55 | 6.1/7.7 | 10.0 | 1.94 | 15.6 | 4.5 | 316/54 | 6.2/7.1 | 9.9 | 1.92 |

| Size | OT Air, ° F | MINIMUM FLOW 3.5 GPM, 90° F RT | | | | | | NOMINAL FLOW 8 GPM, 90° F RT | | | | | | MAXIMUM FLOW 10 GPM, 90° F RT | | | | | |
|--------------|----------------|-----------------------------------|------|---------|----------|------|------|---------------------------------|------|---------|-----------|------|------|----------------------------------|------|---------|----------|------|------|
| | | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP |
| 4-TON | 60 | 43.4 | 24.8 | 458/120 | 5.4/33.3 | 17.5 | 3.03 | 44.4 | 11.1 | 397/119 | 10.8/26.3 | 15.5 | 3.50 | 44.5 | 8.9 | 380/116 | 6.8/22.1 | 15.0 | 3.62 |
| | 47 | 35.0 | 20.0 | 435/103 | 7.4/31.4 | 16.8 | 2.54 | 40.4 | 10.1 | 386/103 | 7.1/24.7 | 15.2 | 3.25 | 40.0 | 8.0 | 368/100 | 4.5/22.3 | 14.6 | 3.34 |
| | 35 | 32.2 | 18.4 | 418/86 | 4.3/28.4 | 16.2 | 2.42 | 36.0 | 9.0 | 374/88 | 4.8/22.5 | 14.9 | 2.95 | 36.0 | 7.2 | 366/83 | 5.3/21.1 | 14.8 | 2.97 |
| | 25 | 32.0 | 18.3 | 411/73 | 6/29.1 | 16.0 | 2.44 | 28.8 | 7.2 | 366/70 | 5.9/21.9 | 14.8 | 2.38 | 29.0 | 5.8 | 365/73 | 4.2/20.5 | 14.7 | 2.41 |
| | 15 | 25.5 | 14.6 | 397/61 | 5.1/27 | 15.7 | 1.98 | 25.6 | 6.4 | 360/59 | 4.9/20.1 | 14.6 | 2.14 | 24.0 | 4.8 | 359/59 | 6.3/18.2 | 14.6 | 2.00 |
| | 10 | 21.5 | 12.3 | 381/55 | 4.9/24.0 | 15.3 | 1.72 | 22.4 | 5.6 | 360/54 | 4.5/19.5 | 14.6 | 1.87 | 22.5 | 4.5 | 348/53 | 4.2/17.3 | 14.4 | 1.90 |

| Size | OT Air, ° F | MINIMUM FLOW 3.5 GPM, 90° F RT | | | | | | NOMINAL FLOW 8 GPM, 90° F RT | | | | | | MAXIMUM FLOW 10 GPM, 90° F RT | | | | | |
|--------------|----------------|-----------------------------------|------|---------|----------|------|------|---------------------------------|------|---------|----------|------|------|----------------------------------|------|---------|---------|-------|------|
| | | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP | Btu/h | Rise | Press | SH/SC | Amps | COP |
| 5-TON | 60 | 55.6 | 31.8 | 461/116 | 4.1/12.7 | 27.8 | 2.44 | 59.1 | 14.8 | 391/117 | 6.8/17.0 | 23.4 | 3.09 | 54.5 | 10.9 | 351/110 | 6.3/7.7 | 21.0 | 3.17 |
| | 47 | 46.9 | 26.8 | 421/94 | 6.1/17.6 | 25.5 | 2.25 | 49.7 | 12.4 | 369/91 | 3.8/16.1 | 22.5 | 2.70 | 47.6 | 9.5 | 349/92 | 3.8/8.8 | 21.4 | 2.71 |
| | 35 | 42.7 | 24.4 | 414/80 | 4.0/13.2 | 25.4 | 2.05 | 45.0 | 11.3 | 359/79 | 4.1/16.4 | 22.2 | 2.48 | 42.7 | 8.6 | 338/77 | 3.8/7.9 | 21.01 | 2.48 |
| | 25 | 36.5 | 20.9 | 400/67 | 4.8/14.2 | 24.8 | 1.80 | 39.6 | 9.9 | 348/66 | 7.4/14.6 | 22.0 | 2.20 | 38.9 | 7.8 | 326/65 | 5.0/8.4 | 20.67 | 2.29 |
| | 15 | 32.9 | 18.8 | 374/57 | 5.6/12.1 | 23.6 | 1.70 | 33.4 | 8.4 | 343/55 | 4.9/13.1 | 21.9 | 1.87 | 33.1 | 6.6 | 323/53 | 4.4/7.8 | 20.65 | 1.95 |
| | 10 | 29.7 | 17.0 | 363/51 | 5.6/11.8 | 23.0 | 1.58 | 31.8 | 8.0 | 333/51 | 4.8/10.9 | 21.5 | 1.81 | 30.0 | 6.0 | 321/48 | 4.6/5.9 | 20.7 | 1.77 |

$$500 \times \text{GPM} \times \text{Differential} = \text{Btu/h}$$

$$\frac{\text{Btu/h}}{\text{Amps} \times \text{Volts} \times 3.41} = \text{COP}$$

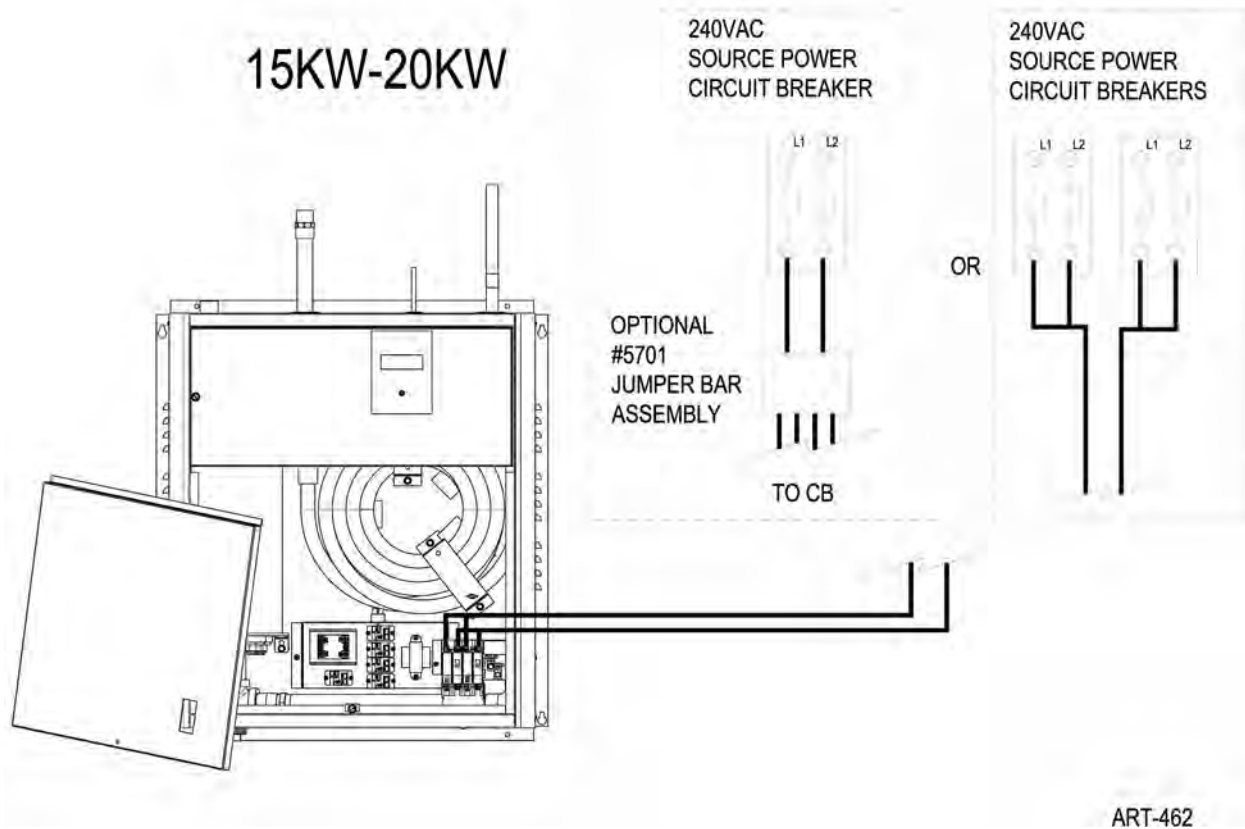
$$\frac{\text{Volts} \times \text{Amps} \times 3.41}{500 \times \Delta T} = \text{GPM}$$

NOTE: Data readings shown above were taken using a Nordyne ODU and are for reference purposes only, your results may vary.

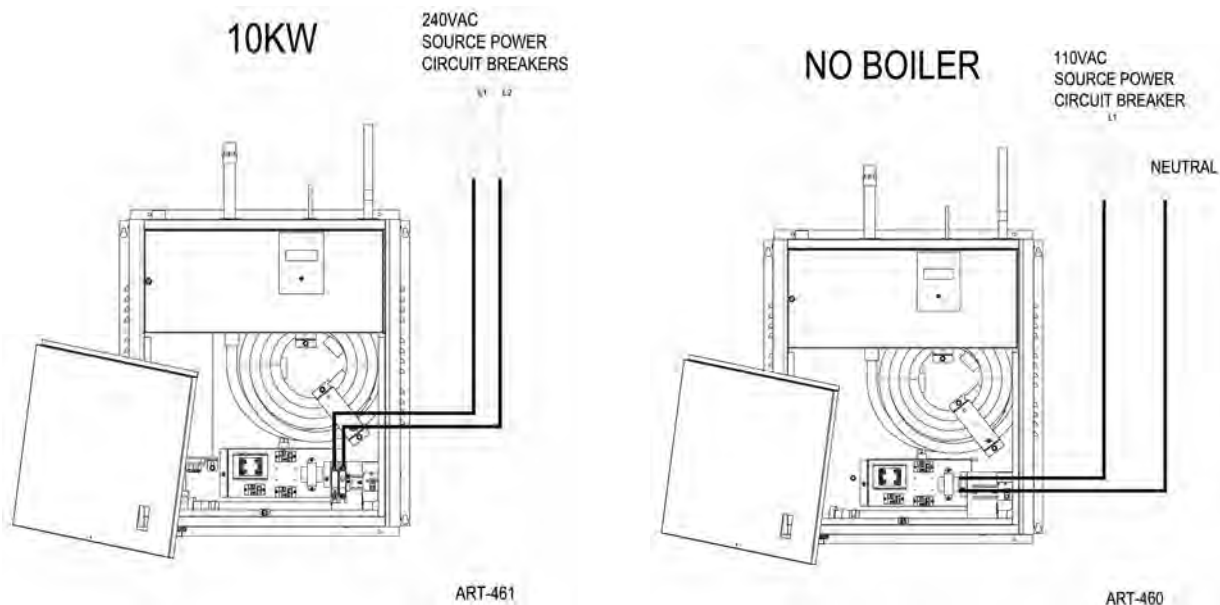
Electrical Hookup

Panel breaker sizes – based upon the installed unit capacity, specification pages show model number/amps/kW, service from appropriate size panel breaker based on NEC code.

Note: NorAire unit includes a factory provided circuit breaker. This **qualifies** as the local disconnect at the product or appliance.



Note: Single feed bus kit is available for 15kW and 20kw models, order part number 5701.



Transformer power – internal transformer has primary taps for 120, 208, 240 volts, 60 hertz, single phase.

- 120 – black and white
- 208 – black and red
- 240 – black and orange

Note: Transformer is factory wired for 240 VAC.

Electrical Data – Indoor Unit

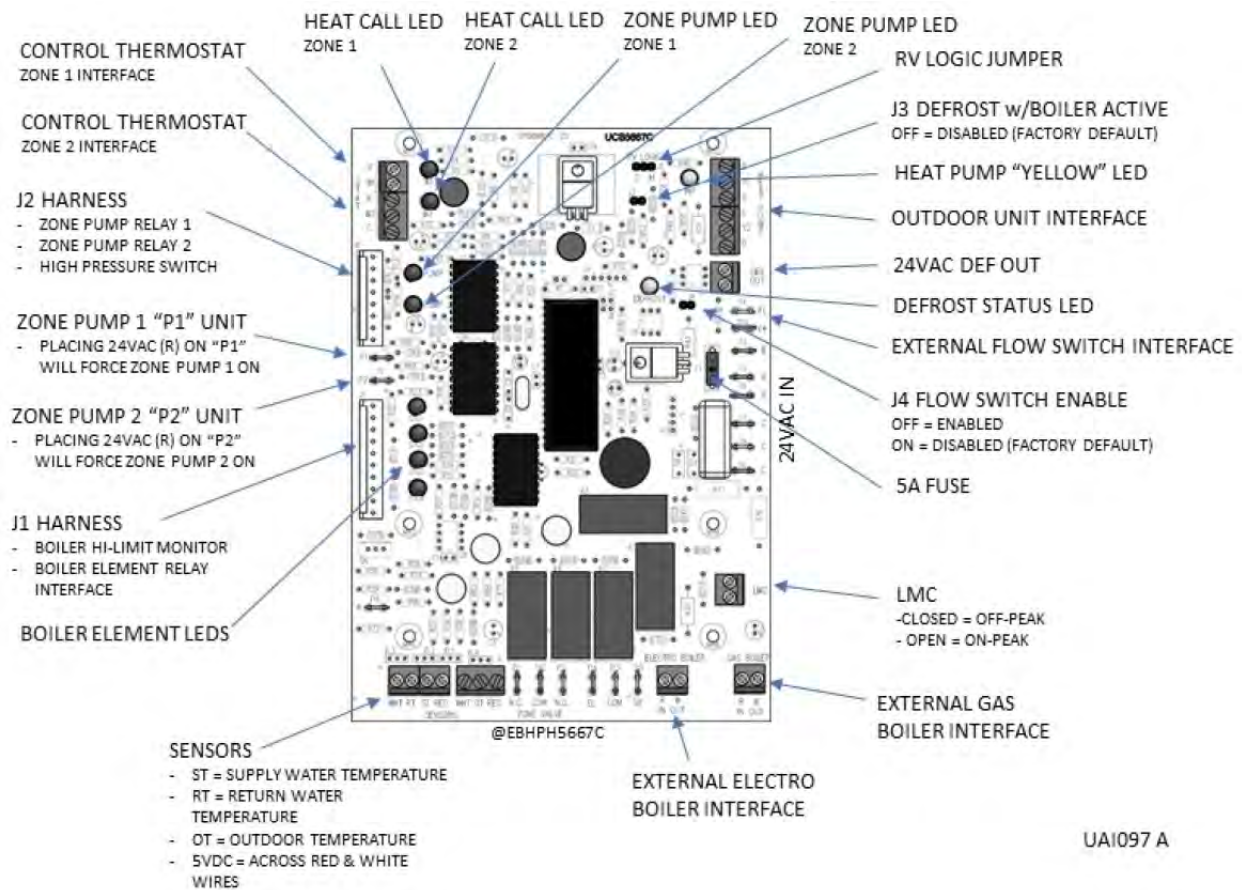
| | Units | EB-HPH-*-10 | EB-HPH-*-15 | EB-HPH-*-20 |
|-------------------------------|--------------|------------------|----------------------|----------------------|
| Power voltage | Volts/60Hz | 208/240, 1 phase | 208/240, 1 phase | 208/240, 1 phase |
| Element current | Amps | 37/42 | 55/63 | 73/84 |
| kW | Kilowatts | 7.7/10 | 11.5/15 | 15.2/20 |
| Heating capacity | Btu/h x 1000 | 26.3/34.1 | 39.1/51.2 | 51.8/68.2 |
| Circuit breakers (disconnect) | Size | 2-pole 30A | 2-pole, 30A and 60A* | 2-pole, 60A and 60A* |

*Square D single feed bus adapter available, Electro part number 5701.

Electrical Data – Outdoor Unit

See manufacturer's installation manual for details. In reference to electrical power, RLA, LRA, etc. the ODU manufacturer's installation manual takes precedence over the above Specification Table.

Circuit Board Layout



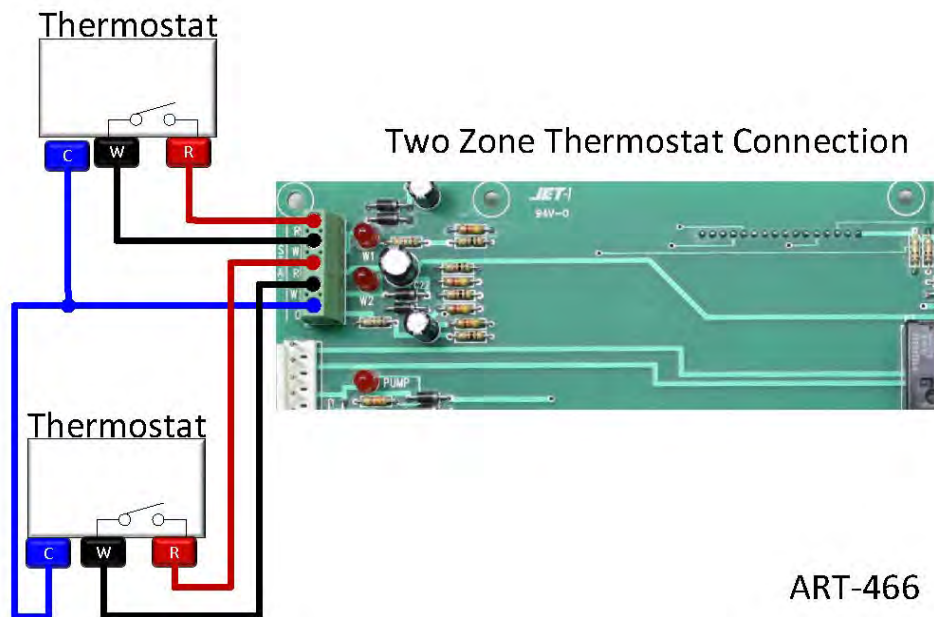
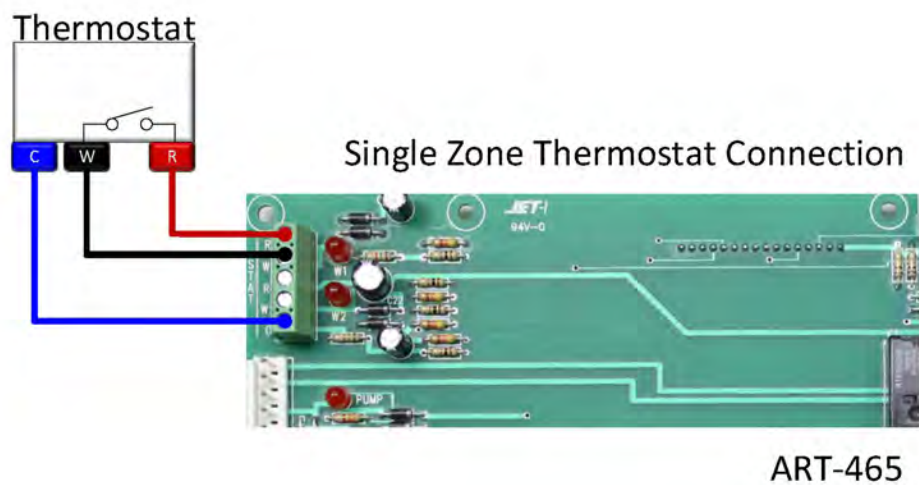
UAI097 A

Control Wiring Information

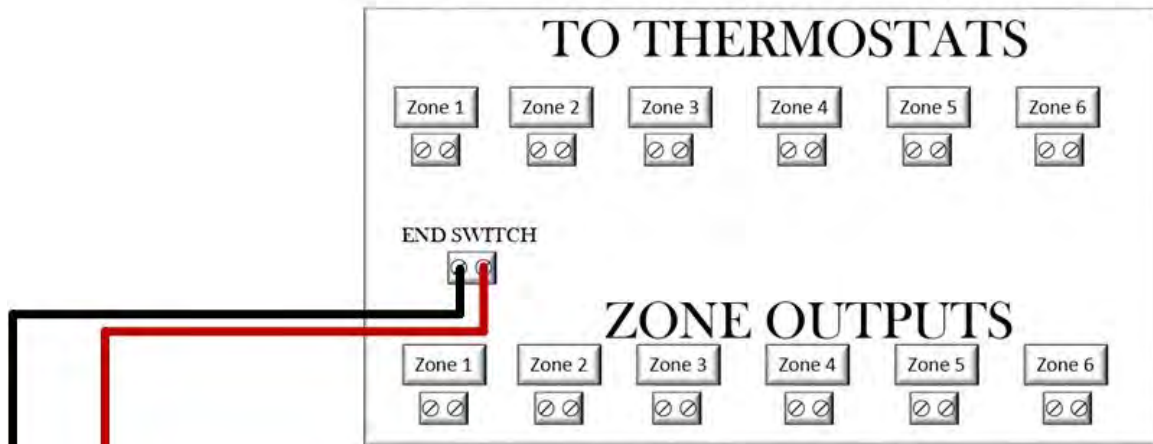
There are multiple options designed into the control module for this NorAire air unit.

- **Single zone system** - accomplished by connecting a room thermostat to the R & W1 (some thermostats require a common) terminals on the board.
- **Two zone system** accomplished by connecting two separate room thermostats to the R & W1 terminals and R & W2 (some thermostats require a common) on the board.
- **Greater than two zones** accomplished by connecting an isolated, dry end switch (external zone controller) to the R & W1 terminals on the board.
- **Buffer tank aqua stat** - accomplished by connecting an isolated, dry end switch (buffer tank aqua stat) to the R & W1 terminals on the board.
- **Buffer tank controller** - accomplished by connecting an isolated, dry end switch (buffer tank aqua stat) to the R & W1 terminals on the board.

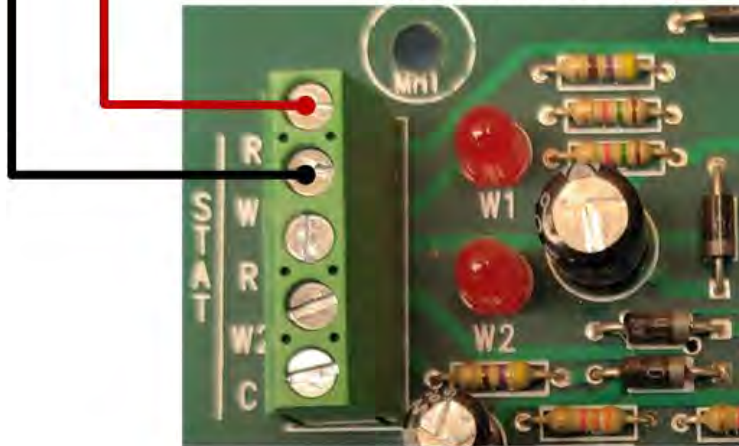
Note: A switch closure between R & W (1, 2) will result in the NorAire declaring an active heat demand.



GENERIC ZONE CONTROLLER TO THERMOSTATS

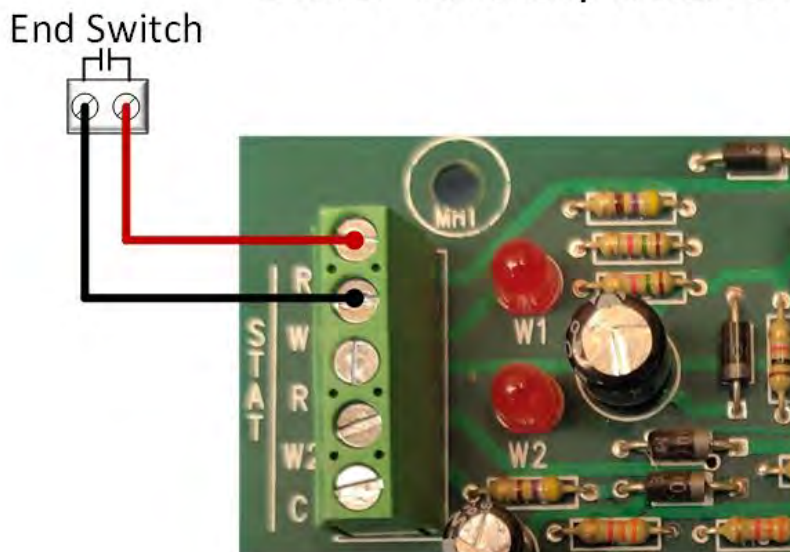


External Zone Controller Connection



ART-467

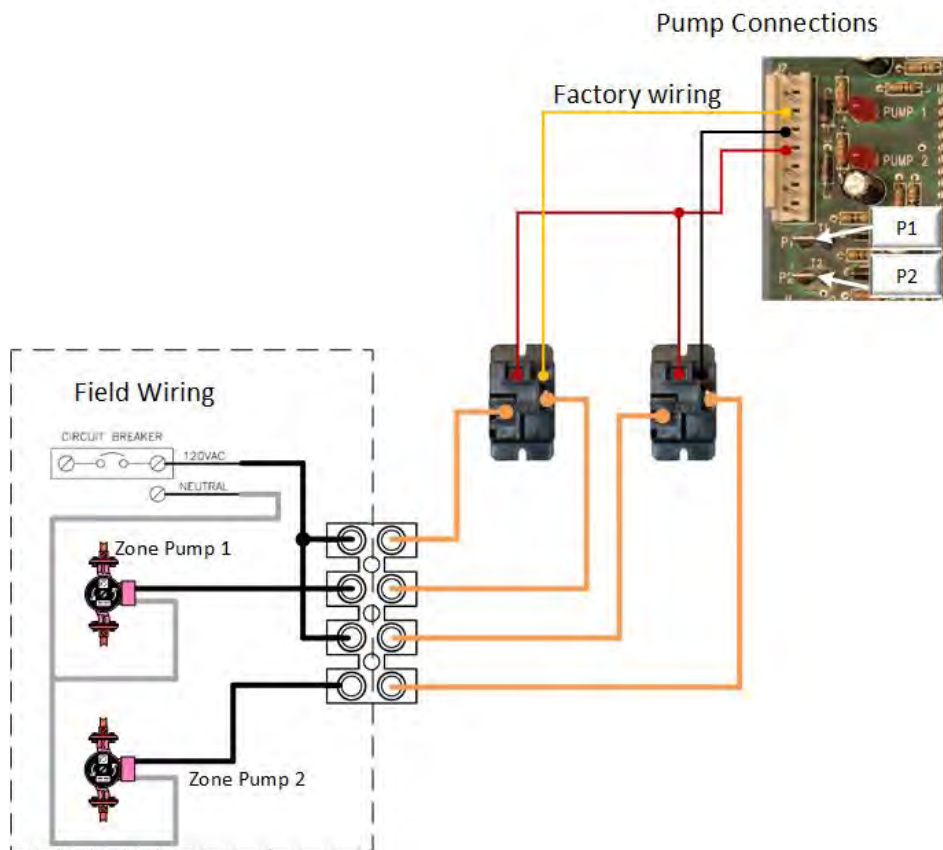
Buffer Tank Aquastat Connection



ART-468

Zone Pump Control

The control will interface up to two hydronic zone pumps based on thermostat inputs. The interface from the control to the pumps is via two internal pump relays. These relays are dry contacts and require an external 120VAC power source to energize the pump(s).



ART-469

Note: Variable Speed Pump – this should not be required, there is no internal control provision.

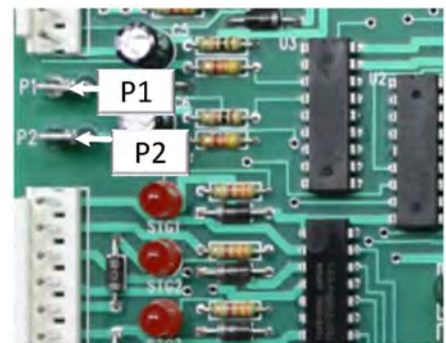
Zone Pump Override Input

P1 Tab

An external contact from R to “P1” tab forces internal pump relay for zone pump 1 on. This will override any internal software sequence.

P2 Tab

An external contact from R to “P2” tab forces internal pump relay on. This will override any internal software sequence.



ART-470

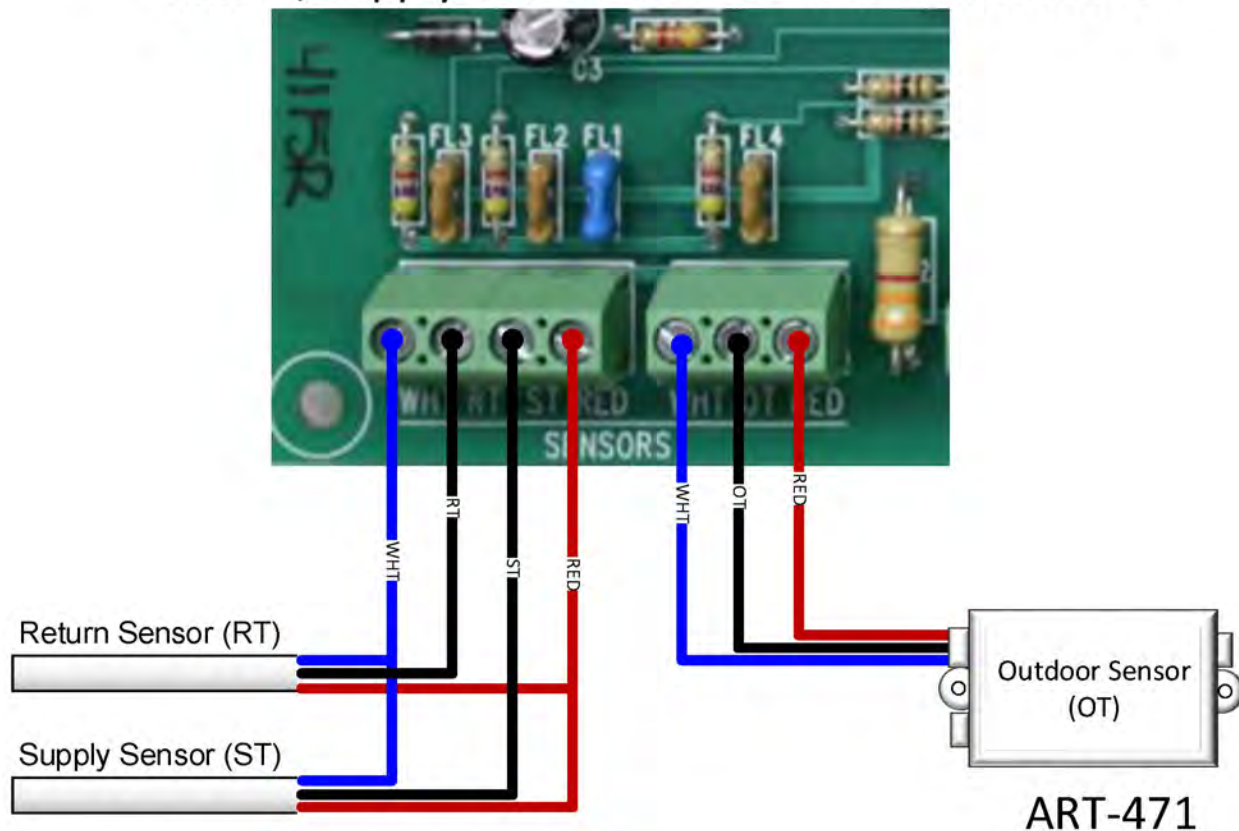
Temperature Sensor Connections

The controller includes three temperature sensors. Return sensor (RT), supply sensor (ST) and an outdoor sensor (OT). The sensors are factory wired and should be wired as detailed below.

- Red is +5VDC
- Black is communication signal (digital)
- White is Common

The outdoor sensor comes from the factory at 25'. It is permissible to add an additional 25' of stranded cable. Do not exceed a total of 50' for the outdoor sensor.

Return, Supply and Outdoor Sensor Connections



NOTE: If a sensor is no longer functioning, the front LCD Display will show sensor = BAD. System response to faulty sensor depends on which sensor is faulty and how the NorAire controller is configured from the product display.

Outdoor Sensor

The outdoor sensor comes from the factory at 25'. It is permissible to add an additional 25' of stranded cable. Do not exceed a total of 50' for the outdoor sensor.

Extend sensor to an outdoor location properly sampling the outdoor temperature. The south side should be avoided unless there is a position which will shade the sun. Use care in selecting the location so sensor does not pick up false temperature from the heat pump outdoor unit, refrigerant lines sets, dryer vent, reflection from steel siding, etc. Also, do not install the sensor in a plastic box because it will falsely trap and pick up radiant sun temperature.

Outdoor Unit (ODU) Connections

Located on the upper right hand corner of the NorAire controller is a 6 place terminal strip labeled “HEAT PUMP”. This is where the ODU interfaces (low voltage wiring) to the IDU. This allows the IDU to control the ODU based on various system variables.

R is 24VAC

Y is compressor contactor

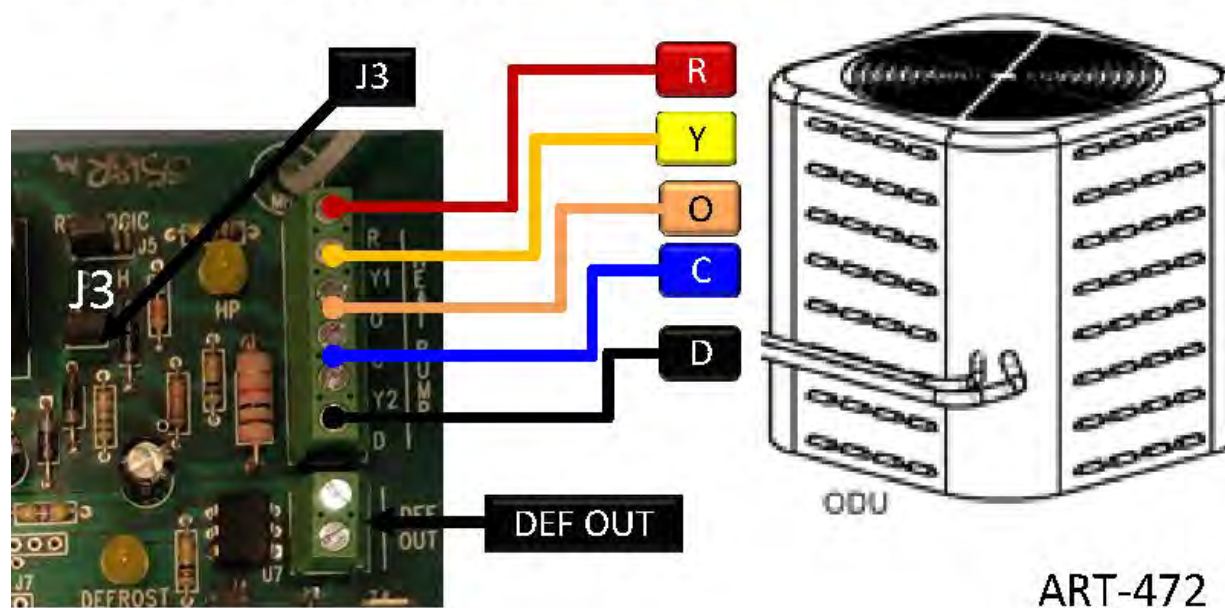
O is reversing valve

C is 24VAC common

D is Defrost

NOTE: Defrost is an input to the IDU and an output from the ODU

Indoor Unit (IDU) to Outdoor Unit Connections



Defrost NOTE: The NorAire controller has nothing to do with starting or ending a defrost cycle. “D” input in the diagram above is an optional hookup. If connected, J3 will determine what the NorAire does with this defrost input.

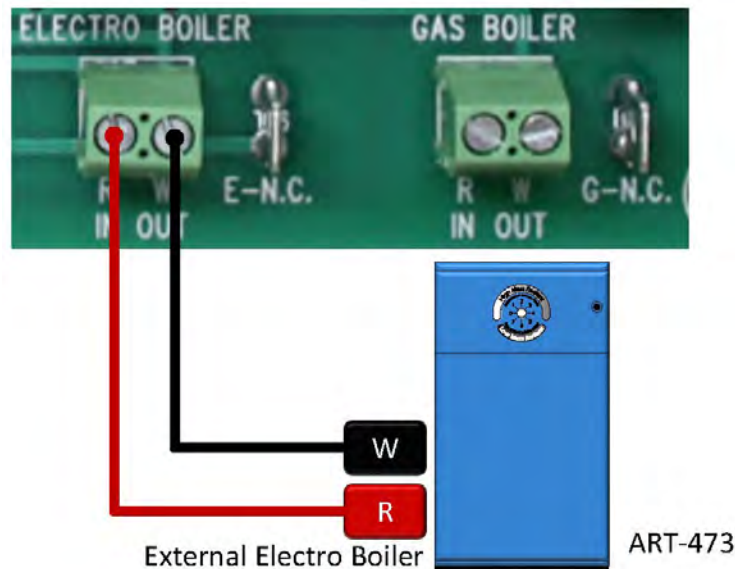
J3: This jumper is used to enable or disable the Electro-Boiler while the heat pump is in defrost. With the jumper ON, the Electro-Boiler will go to full output whenever the heat pump is in defrost. With the jumper OFF, the Electro-Boiler will not be used during defrost (unless in BOOST mode at the time of defrost). Factory default is OFF.

J5 RV Logic: The NorAire control board determines when to energize the heat pump reversing valve. On heat pump brands that require the reversing valve to be energized on a heat call, place jumper on J5 between center pin and H. Factory default should be used for all other brands (jumper between center pin and C).

“DEF OUT”: If special circumstances arise where the system is struggling to adequately defrost. A bypass can be added to “short circuit” the NorAire return and supply during defrost to speed up the process. “DEF OUT” would be used to drive the mechanism needed to initiate this bypass sequence during defrost. This is not needed in most applications.

External Electro-Boiler Connections

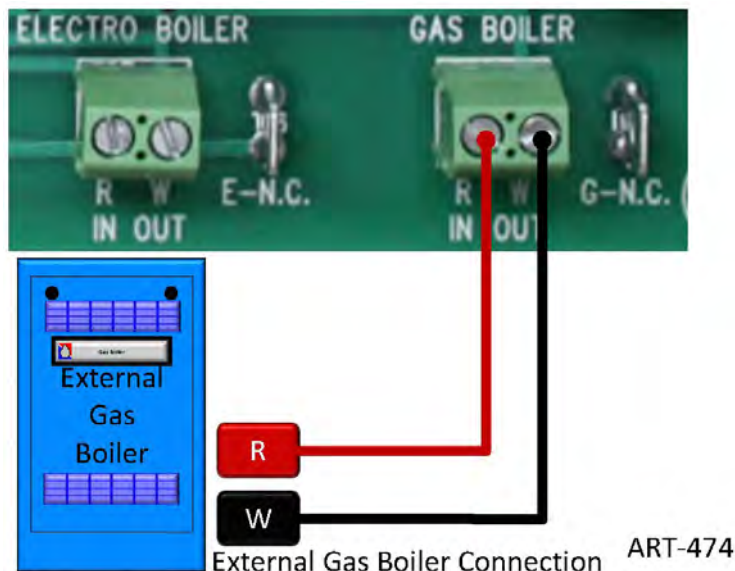
If you are interfacing this NorAire IDU with an existing, external Electro Industries boiler, you will need to make a connection as shown below.



Note: The terminal block labeled “ELECTRO-BOILER” is a dry contact and simply closes R and W to the external boiler. This provides isolation for the various system transformers.

External Gas Boiler Connections

If you are interfacing this NorAire IDU with an external fossil fuel boiler, you will need to make a connection as shown below.

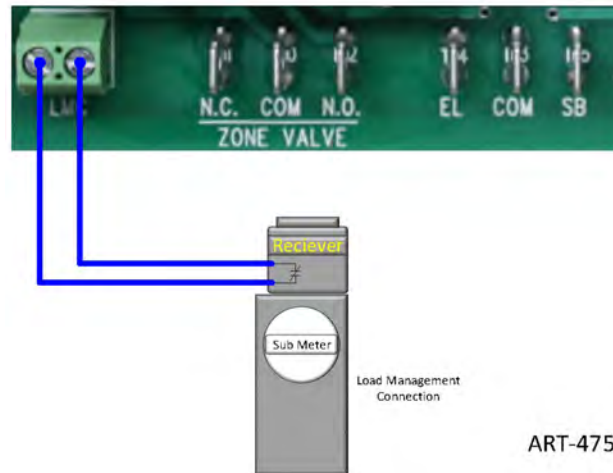


Note: The terminal block labeled “GAS BOILER” is a dry contact and simply closes R and W to the external boiler. This provides isolation for the various system transformers.

Load Management Connection

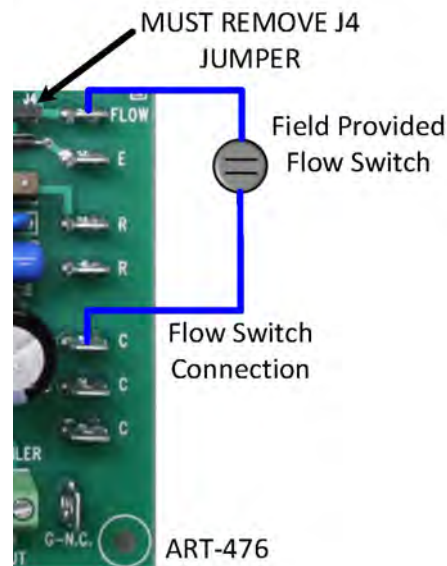
If this system is being interfaced to a dual fuel or off-peak metering equipment, make the connection as shown below.

Note: The LMC circuit is a powered circuit and must be connected to a dry contact. If an external power source is connected to this circuit, intermittent operation or circuit board failure can be expected.



Flow Switch Hookup

This NorAire does NOT include a system flow switch. If one is required, it must be added in the field. Connect as shown below. NOTE: J4 jumper must be removed.



Safety Flow Switch Option

The standard IDU does not come with an interlocking flow switch. The control board has a hookup provision for this kit. The compressor has high pressure protection if there is no water flow, but if there is no water flow during defrost and the ODU has an extended defrost time, it is feasible the heat exchanger coax coil could freeze and be damaged.

- Optional kit is 6027-75
- Connect the two wires to the spade tab labeled “FLOW” (T4) and any C tab
- In addition, there is a jumper above the “FLOW” tab labeled J4, this must be pulled off

Hardware Setup

J5 RV Logic: The NorAire control board determines when to energize the heat pump reversing valve. On heat pump brands that require the reversing valve to be energized on a heat call, place jumper on J5 between center pin and H. Factory default should be used for all other brands (jumper between center pin and C).

J4: This jumper is used to tell the NorAire whether or not an external flow switch has been added to the system (whether or not to monitor it). If the jumper is ON, this is an indication that there is no external flow switch to monitor. If the jumper is OFF, this indicates there is an external flow switch which needs to be monitored. Factory default is ON.

J3: This jumper is used to enable or disable the Electro-Boiler while the heat pump is in defrost. With the jumper ON, the Electro-Boiler will go to full output whenever the heat pump is in defrost. With the jumper OFF, the Electro-Boiler will not be used during defrost (unless in BOOST mode at the time of defrost). Factory default is OFF.

Software Setup

The NorAire product includes a few software setup variables which need to be considered upon installation.

Note: When changing system modes via product display, system must be power cycled in order for change to take effect.

System Configuration Display: This is where you set the mode of the NorAire unit.

System Mode 1.) NorAire:

By far most applications will be configured to “NORAIRE”. This is the setting which allows the heat pump portion and Electro-Boiler portion of the NorAire system to work together to create a heating system which very intelligently balances efficiency and comfort for the user.

System Mode 2.) Gas Boiler:

If this heating system includes and is interfaced with an external gas boiler, the NorAire portion (heat pump and Electro-Boiler) of the system can be bypassed and all heat calls will call on the gas boiler to heat the space. This may be useful if there is an issue with the electric portion of the heating system or there is a large fluctuation in heating rates.

System Mode 3.) Electro-Boiler:

If this heating system includes and is interfaced with an internal or external Electro-Boiler, the heat pump portion of the system can be bypassed and all heat calls will call on the Electro-Boiler to heat the space. This may be useful if heat is needed in the space but the ODU is not yet installed.

System Mode 4.) Heat Pump:

In this mode the heat pump is the only heat source, this setting will ensure that when OT > LOCKOUT and LMC circuit is closed that the only heating source used in the system is the heat pump.

NOTE: In Heat Pump Only mode, high temp priority setting is not valid and may create uncomfortable conditions. If using high temp priority with the ODU, the System Configuration Display must be set to NorAire when electric boiler backup is used.

User Settings

Lockout Temp, Lockout Temp Range = -25° – 50°F default 5°F

If the heat pump is on and the outdoor temperature drops below lockout value, the heating system will shut down the heat pump and transition to lockout mode. The selected “heat source below lockout” setting determine the backup heating source upon thermostat demand. While in lockout, the outdoor temperature will be monitored and if it rises to lockout value +4. The system will transition back to using the heat pump. If the thermostat satisfies while in lockout, the system will continue to use back up until outdoor temperature is 1° greater than lockout value.

Heating <, Heat Source below lockout range = ELE or GAS default ELE

Corresponding to the above lockout temperature, the NorAire system will switch to either Electric Boiler (ELE) or to Gas backup system.

Warm Weather OT, Warm Weather Shut Down Range = 40 – 90°F default Disabled (DIS)

This monitor is always active regardless of whether or not a heat active condition exists. If the outdoor temperature is greater than Warm Weather shut down value for 10 seconds, NorAire unit will shut down all heating operation for both zone inputs including pumps and remain in this idle state until the outdoor temperature is 4° less than the shutdown value.

Boost Mode (NorAire Only)

Allows the internal electric boiler to be used with the heat pump to deliver an acceptable temperature delivery to the space while maintaining the highest possibly efficiency. The electric boiler is held off until boost time expires.

Boost Time, Boost Time Range 0-199 min default 30 min

Boost time is the amount of time in minutes before the internal Electro-Boiler is activated to boost the water temperature output.

Boost Differential, Boost Differential Range 6-40°F, Default = 10°F

In order to keep a constant temperature differential across the heat exchanger coil, the boost differential value is added to the return water temperature to determine the target discharge temperature.

OT Auto-Boost, Auto-Boost Range -25-50°F, Default Disabled (DIS)

If system is set to NorAire, when the heat pump is turned on and the outdoor temperature is less than the auto boost selection, the system will immediately transfer into Boost Mode activating the electric boiler. External display will show “AUTO_BOOST”.

MAX Boost DT, Max Boost DT Range = 90-120°F, Default = 110°F

While in Boost Mode, the set point temperature is determined by adding the selected boost differential value to the return water temperature of the NorAire system. If the return water temperature and boost differential temperature are such that it causes the set point to be above the Max Boost DT variable, the Max Boost DT variable will become the set point.

Zone Setup, Zone 1 Priority = NO or YES, Default =NO

If Zone 1 priority is set to yes and thermostat 1 is calling for heat, the system will be turned on. Any call from zone 2 will be ignored. Zone 2 pumps or zone valves will be de energized or locked out while zone one priority is active.

Priority Time, Priority Time Range = 10-299 min or Disabled (DIS), Default 240 min

This is the length of time zone 2 will be locked out while zone 1 is in a priority call. Once the time has run out, Zone 2 will then be allowed to operate as needed.

Zone 1 High Temp, Zone 1 High Temp Range = NO or YES, Default NO

In zone 1 high temp priority mode, NorAire will target a higher output temperature, default value 160°F this can be used for radiator heating (higher temp needs) in the same location.

It is important to note the temperatures above 120°F will only be reached by using the internal electric boiler.

Zone 1 High Desired Temp DT, Zone 1 High DT Range = 0-199°F, Default 160°F

Zone 1 High DT is the desired temperature based on application.

Post Purge, POST PURGE = Enabled (ENA) or Disabled (DIS), Default Disabled

If the system thermostats are satisfied and customer has selected to enable (ENA) the POST PURGE function, the controller will allow the pumps to continue for 30 seconds after the satisfied heat call. No post purge exists if system is switching to SB (standby) and pumps are disabled in SB.

Pump 1 in SB, Pump 1 in SB = Enabled (ENA) or Disabled (DIS)

If in standby or load control and the thermostat is calling for heat, if Pump 1 in SB is set to ENA (Enabled), the board will energize the pump 1 relay. If set to DIS (Disabled), the board will not energize the pump 1 relay. When disabled, the external back up boiler must use its own pump.

Pump 2 in SB, Pump 2 in SB = Enabled (ENA) or Disabled (DIS)

If in standby or load control and the thermostat is calling for heat, if Pump 2 in SB is set to ENA (Enabled), the board will energize the pump 2 relay. If set to DIS (Disabled), the board will not energize the pump 2 relay. When disabled, the external back up boiler must use its own pump.

Pump Exerciser, Pump Exe = Enabled (ENA) or Disabled (DIS)

If enabled and either pump has not been turned on for 3 days, it will be turned on for 10 seconds.

EL Boiler DT, EL Boiler DT Range = 70-180°F, Default = 130°F

This is the internal electric boiler desired output temperature. When only the internal electric boiler is active (no heat pump) this will be the outlet temperature set point.

Element Stage Disable

Outdoor Temp Staging limits are used to activate only a minimum number of elements. As the outdoor temperature drops, the NorAire will enable additional elements. If the outdoor temperature is greater than stage temperature, that stage will not be enabled. This helps improve the efficiency of the system allowing maximum usage of the heat pump.

Stage 1 OT DIS = 130°F

Stage 2 OT DIS = 40°F

Stage 3 OT DIS = 20°F

Stage 4 OT DIS = 20°F

CT STG DISABLE, CT Stage Disable Range = NONE, Stage 2 or Stage 3, Default = Stage 2

NorAire is designed for use in a load shedding application to minimize overloading of a home's electric service panel. An external current sensing switch monitoring a higher amperage appliance can be wired between "R" and "A" on the NorAire control board. When the CT switch activates internal electric elements of the NorAire will be disabled. Stage 1 cannot be disabled, a maximum of two stages can be disabled.

CT STG DISABLE, CT Stage Disable Range = NONE, Stage 3 or Stage 4, Default = Stage 3

Same as above, this setting allows you to disable more than one stage

External ELE Setup, External ELE Timer Range = 1-18 hours or disabled (DIS), Default = DIS

The external electric boiler is activated by the "Electric Boiler" terminals on the control board. If enabled, this timer will start at the completion of the Purge Sequence. Once this timer expires the system will shut down the heat pump and switch to electric boiler operation. Timer will reset when thermostat satisfies.

External Gas Setup, External Gas Timer Range = 1-18 hours or disabled (DIS)

The external gas boiler is activated by the “Gas Boiler” terminals on the control board. If enabled, this timer starts at the completion of the purge sequence. Once this timer expires the system will switch to gas boiler operation. Timer will reset when thermostat satisfies.

Safety Settings

Minimum Return Temp, MIN RT Temp Range = 40-60°F, Default = 50°F

This applies to the heat pump operation, if the return water temperature is below the set point, heat pump operation will shut down and only the electric boiler will operate. Fault code RT TOO LOW will also display on the Home screen. Ideally, return water temperature will need to be at 75 degrees or greater to allow system to operate efficiently.

Maximum Return Temp, Max RT Range = 90-120°F, Default = 110°F

If water temperature exceeds Max RT limit, heating system will shut down but allow the pumps to remain on as to help clear the excessive heat. High return water temperatures will cause an increase in refrigerant pressures and decrease in the heat pump efficiency.

Anti-Cycle Delay, Anti -Cycle Delay Range = 1-10 minutes, Default = 5 minutes

If configured to use a heat pump, Anti-Cycle Delay (ACD) will start upon power up and after every room thermostat cycle (both thermostats off). While in ACD, all thermostat inputs will be ignored and the system will be 100% idle.

Sensor Offsets

Normally not required, but the NorAire has the ability to offset the Supply Temp, Return Temp, and Outdoor Temp sensors.

Fault Counter

List of system faults and how many occurrences there have been. Bottom of the list is a Clear Faults List, which will reset the counts to 0. Examples, High Pressure, RT too High, Boiler High limit, Loss of Flow, RT too Low, Bad OT, Bad RT, Bad ST, etc. See FAULTS in the “LCD Display Lines 4, VARIOUS INFORMATION” table.

Timer Status

During heating call, all enabled timers will be display BOOST IN, GAS IN, ELE IN, PRIORITY.

Factory Reset

Reset NorAire system to *all factory defaults*. Power cycle is required to complete the process.

| LCD Display Line 1, MODES | |
|----------------------------------|--|
| OFF | If there are no active heat call to the NorAire unit, the LCD will display a mode of “OFF”. This means no heat is being generated from the heating system. |
| ACD | ACD is short for “Anti-Cycle Delay”. While the NorAire is in the ACD mode, it will ignore any and all inputs until this countdown timer expires. The intension is to eliminate compressor short cycling scenarios. |
| PUMP PURGE | At the beginning of a heat call, the system pump activates for 30 seconds before the heat pump or boiler (gas or electric). |
| HP ONLY | Indicates that the heat pump portion of the NorAire system is running by itself (not being supplemented). This mode is used when the “NORAIRE” mode (pre-BOOST) or the “HP ONLY” mode is selected. |
| BOOST | Indicates NorAire controller is operating both the heat pump portion of the NorAire system as well as the Electro-Boiler portion of the NorAire. They are running together with the Electro-Boiler supplementing the heat pump. This mode is only applicable when the “NORAIRE” mode is selected. |
| EL BOILER ONLY | Indicates the NorAire is using the Electric boiler portion of the NorAire system only (heat pump not on). This mode is used when the “NORAIRE” mode or the “EL BOILER ONLY” mode is selected. Example, this mode is active is when outdoor temperature is below LOCKOUT value (and HEAT SOURCE BELOW LOCKOUT is set to EL BOILER). |
| SB BOILER ONLY | Indicates the NorAire is calling on the external gas boiler to operate. This mode is used when the “NORAIRE” mode or the “GAS BOILER ONLY” mode is selected. Example, this mode is active is when outdoor temperature is below LOCKOUT value (and HEAT SOURCE BELOW LOCKOUT is set to GAS BOILER). |
| EL BOILER/HP | Indicates that the NorAire is calling on both the Electro-Boiler and the heat pump portions of the NorAire system in an effort to provide high temperature water to zone 1. Special setup is required for Zone 1 priority temperature setup. This mode is only used when the “NORAIRE” mode is selected. |
| SB BOILER/HP | Indicates that the NorAire is calling on both the external gas boiler and the heat pump portions of the NorAire system in an effort to provide high temperature water to zone 1. Special setup is required for Zone 1 Priority Temperature operation. This mode is only used when the “NORAIRE” mode is selected. |
| LOAD CONTROL | Indicates that the LMC (load management circuit) is open meaning the power company is actively controlling the electric portion of heating system (on-peak). This mode is used in all scenarios regardless of display setting. |
| WARM WEATHER SHUTDOWN | Indicates the outdoor temperature is above warm weather set point. Once outdoor temperature is 4° less than the warm weather shutdown value, the NorAire system will begin heating. |

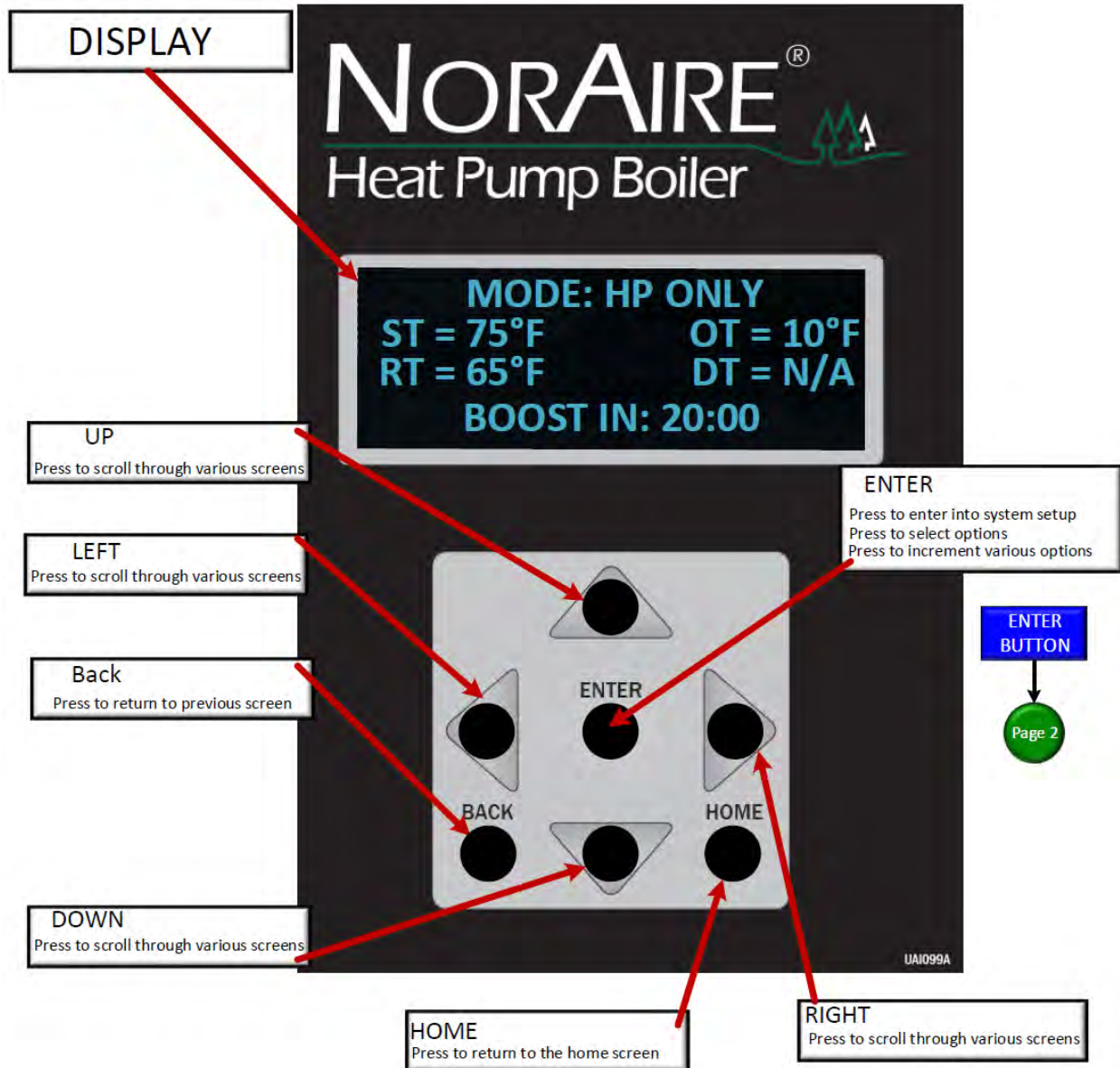
| LCD Display Lines 2 & 3, TEMPERATURES | |
|--|---|
| ST | ST is short for “Supply Sensor Temperature”. This is the temperature of the water as it leaves the NorAire unit. If the ST sensor is not working, the LCD will display “BAD” after the ST on the LCD display. |
| OT | OT is short for “Outdoor Sensor Temperature”. This is the outdoor temperature. If the OT sensor is not working, the LCD will display “BAD” after the OT on the LCD display. With a faulty OT sensor, the ODU is disabled and the “Heat Source Below Lockout” is used. |
| RT | RT is short for “Return Sensor Temperature”. This is the temperature of the water as it enters the NorAire unit. If the RT sensor is not working, the LCD will display “BAD” after the RT on the LCD display. With a faulty RT sensor, the ODU is disabled and the “Heat Source Below Lockout” is used. |
| DT | DT is short for “Desired Temperature”. This is applicable only when the electric boiler is enabled. In BOOST mode or EL BOILER ONLY mode. DT is the desired water temperature leaving the NorAire unit. |

| LCD Display Lines 4, VARIOUS INFORMATION | |
|---|--|
| BOOST IN | This is a countdown timer used only with NorAire mode. When this countdown timer expires, the NorAire will transition from “HP ONLY” mode to “BOOST” mode. |
| HT RESUMES OT < (SET POINT) | When activated, this is a software monitor of the outdoor temperature sensor. If the OT sensor is reading a value less than the Warm Weather setting, the heat pump and boiler, if active, will be shut down. The system will return to its previous heat mode once the outdoor temperature is 4° lower than the warm weather value. The Warm Weather value is adjustable from the display. If using zone 1 priority high temp for domestic hot water, Warm Weather Shutdown will need to be disabled. Factory default setting is disable. |
| FAULTS | System faults are communicated via line 4 of the LCD display. The below is a run through of the 5 possible faults. |
| HIGH PRESSURE | There is a mechanical high pressure switch located in the IDU. This is 500psi. If this high pressure switch opens while the heat pump is active, you will see the heat pump shut down (if in BOOST, Electro-Boiler will shut down also) and a 10 minute ACD will start. The heat pump (and electric boiler if was in BOOST) will be reactivated upon the expiration of this 10 minute ACD (provided the high pressure switch has closed). |
| RT TOO HIGH | This is a software monitor of the return water temperature sensor. If the RT sensor is reading a value > the RT TOO HIGH setting (factory default 110°F), the heat pump (and boiler if in BOOST mode) will be shut down and a 10 minute ACD will start. The heat pump (and electric boiler if was in BOOST) will be reactivated upon the expiration of this 10 minute ACD AND the RT is 5° < the RT TOO HIGH value. The RT TOO HIGH value is adjustable via the display. |
| LOSS OF FLOW | This is an indication that the field provided flow switch (if added) has opened or has failed to close for some reason. If the LOSS OF FLOW fault is active, the current heat source being used (heat pump, Electro-Boiler, or gas boiler) will be shut down and a 10 minute ACD will start. The heating source being called upon at the time will be reactivated upon the expiration of this 10 minute ACD (provided the flow switch has closed). |
| BOILER HL | This is an indication that the factory provided Electric boiler high limit has opened for some reason. Usually due to lack of flow (GPM) through the NorAire system. |
| RT TOO LOW | This is a software monitor of the return water temperature sensor. If the RT sensor is reading a value < the RT TOO LOW setting (factory default 50°F), the heat pump will shut down and the electric boiler will be activated until the RT is 20° > than the RT TOO LOW setting. Once this condition is met, the NorAire will shift into boost mode. The RT TOO LOW value is adjustable via the product display. |

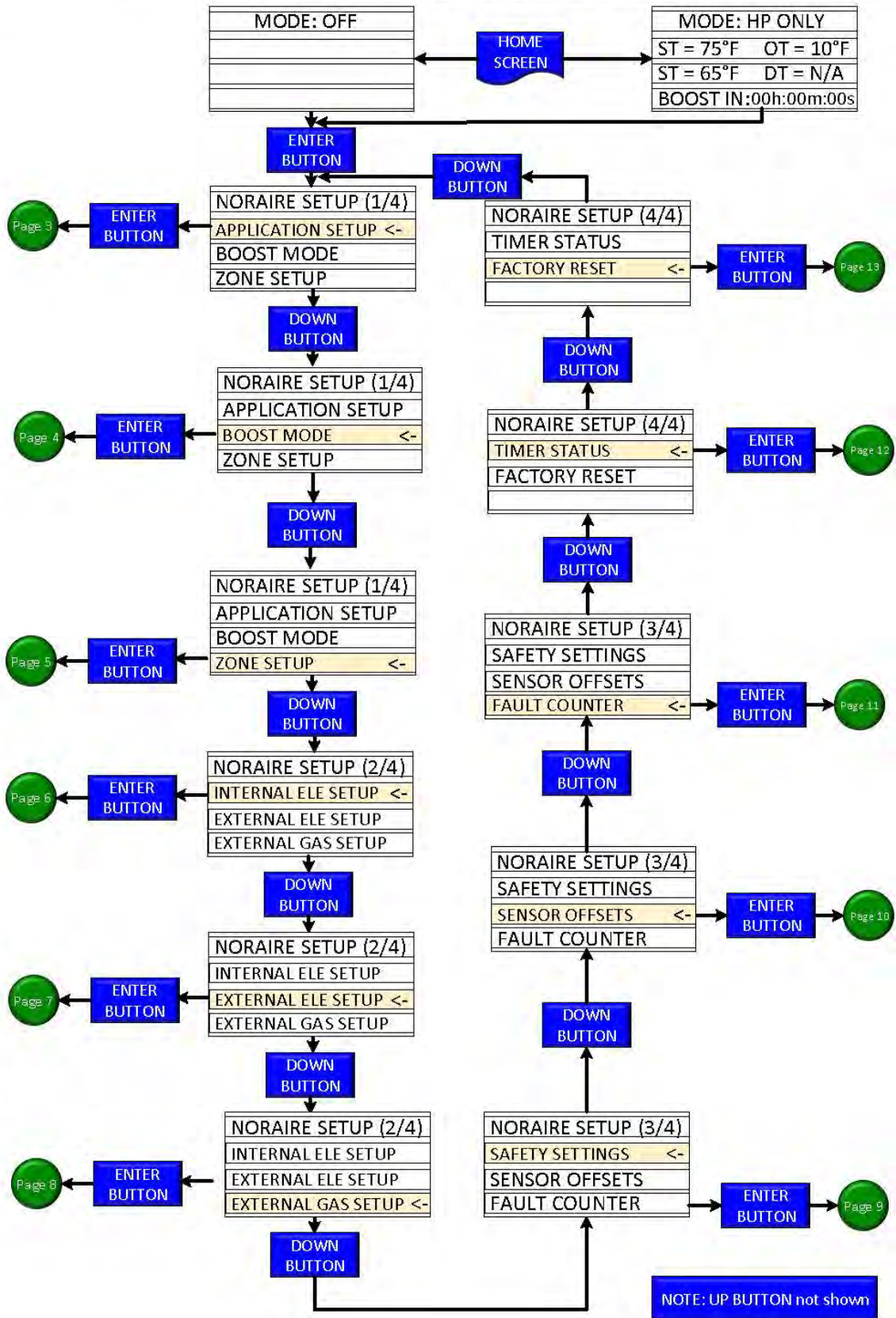
Understanding the NorAire Product Display

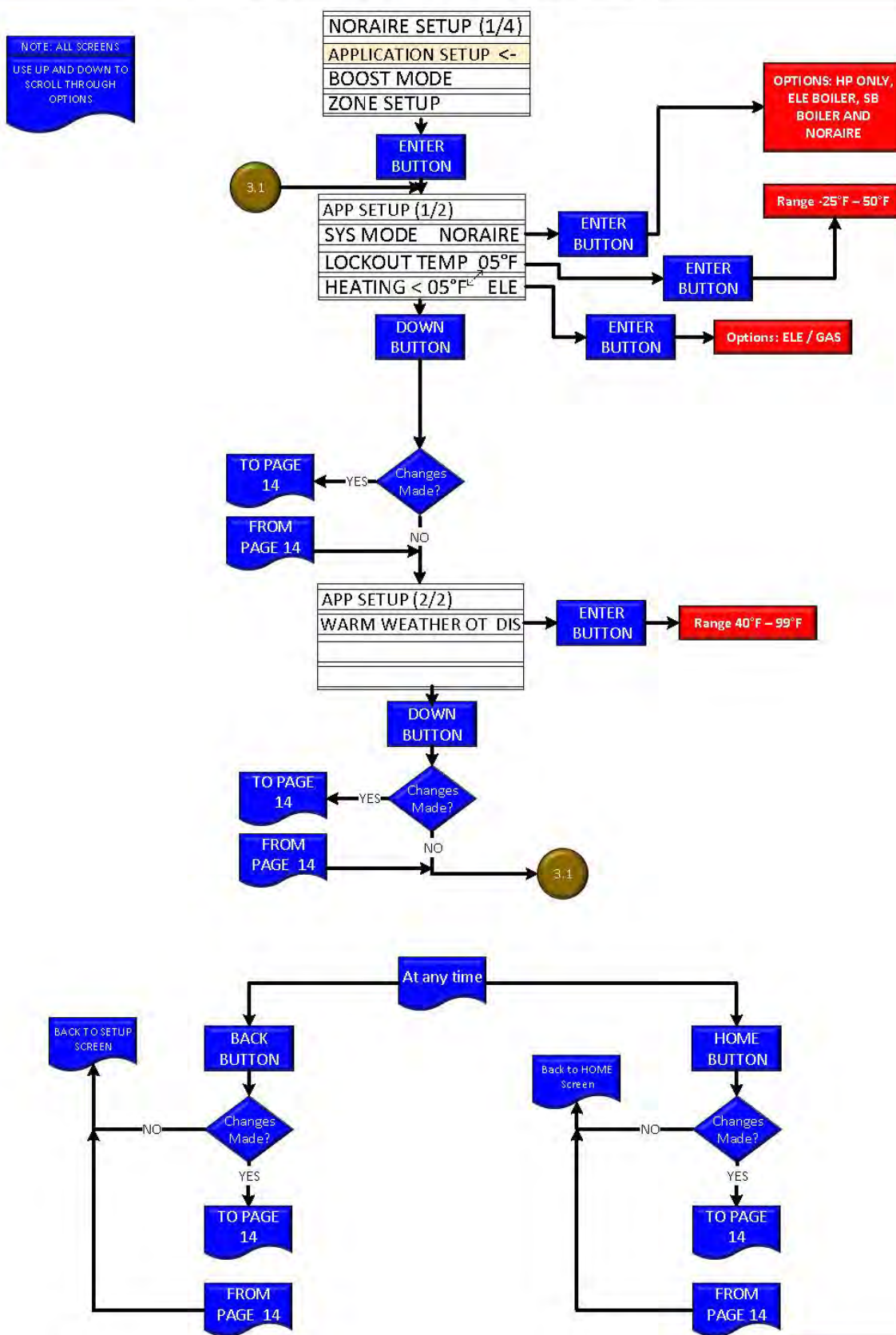
The NorAire includes a 4-line OLED display for system status, setup and configuration. The product display allows you to customize this product to meet specific requirements of the building.

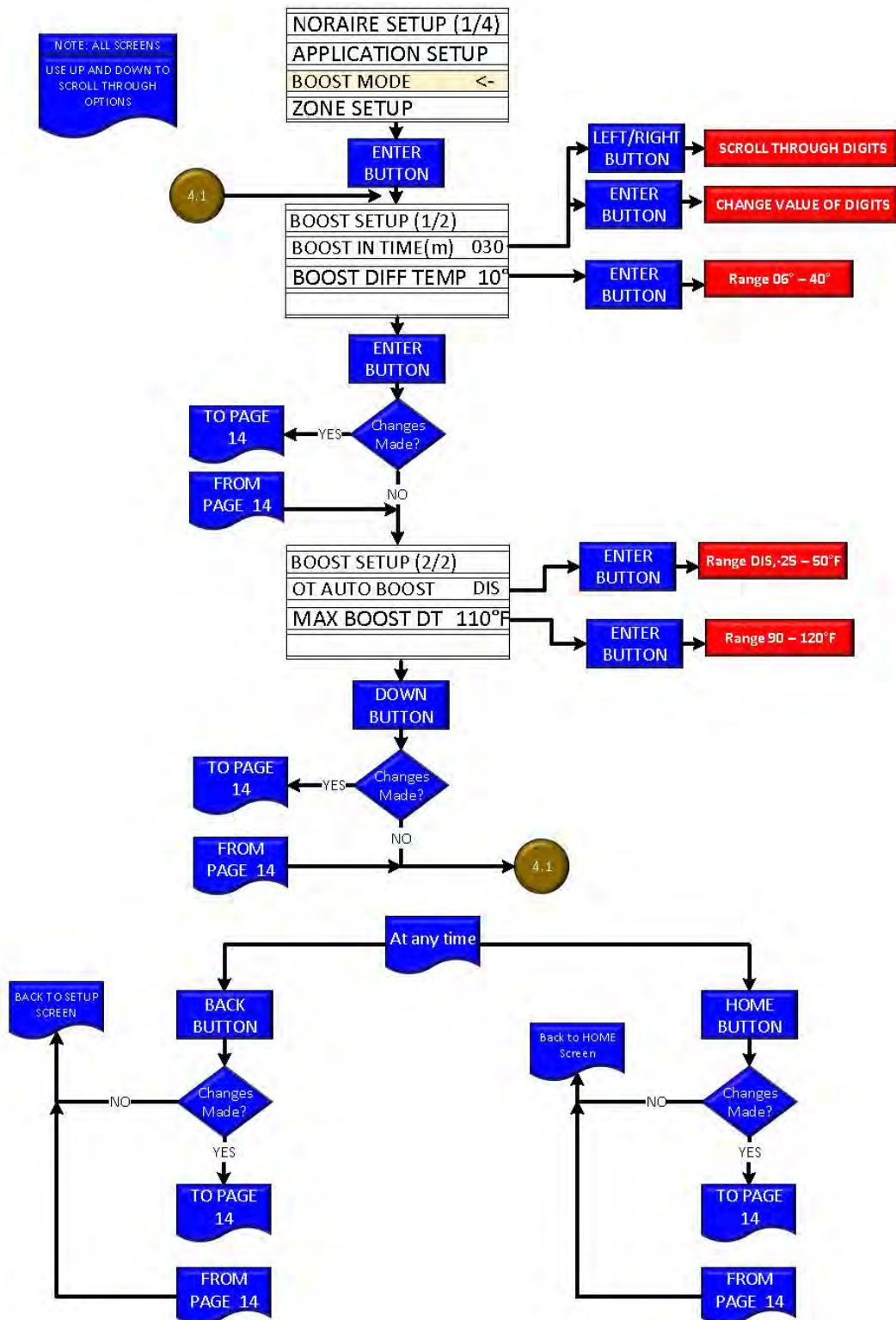
NOTE: It is best to make changes while the NorAire is **NOT** actively operating. Satisfy all thermostats before reconfiguring the unit.

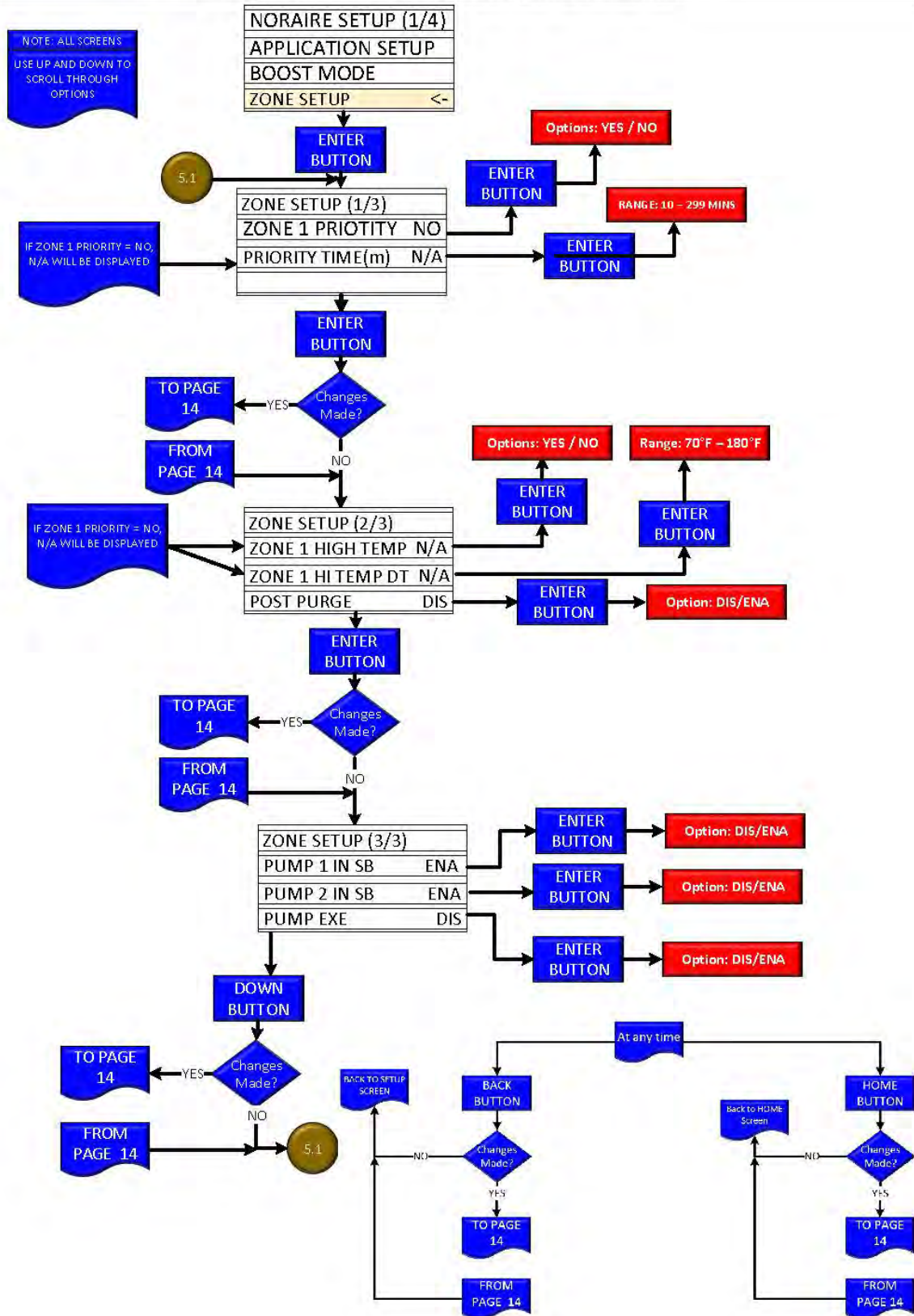


| LINE | Description |
|------|---|
| 1 | Mode – Displays the current mode. |
| 2 | Temperatures – Displays Supply Temperature (ST) and Outdoor Temperature (OT) |
| 3 | Temperatures – Displays Return Temperature (RT) and Desired Temperature (DT) |
| 4 | MISC Data – Displays active system faults as well as various system timers. |

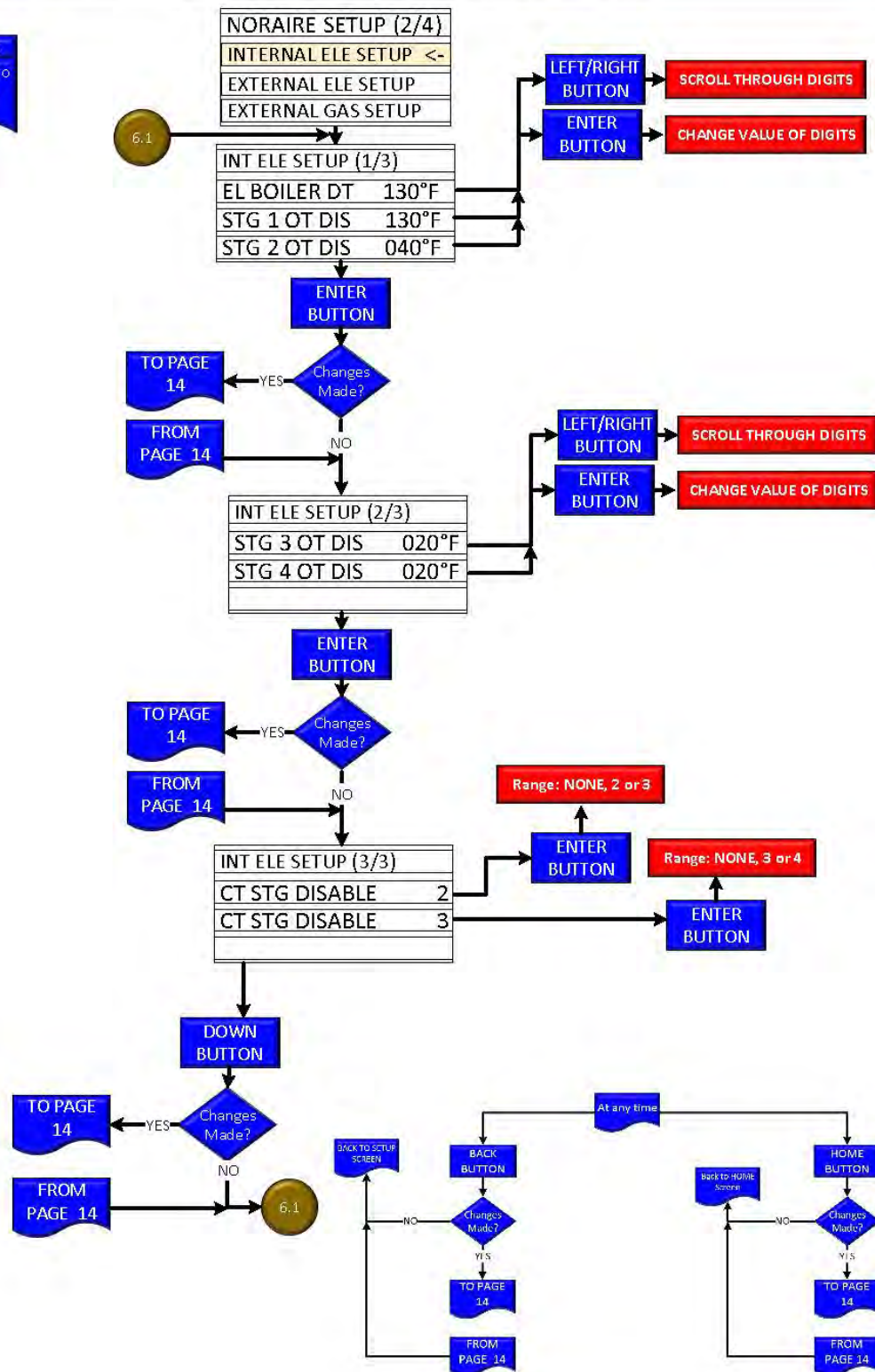




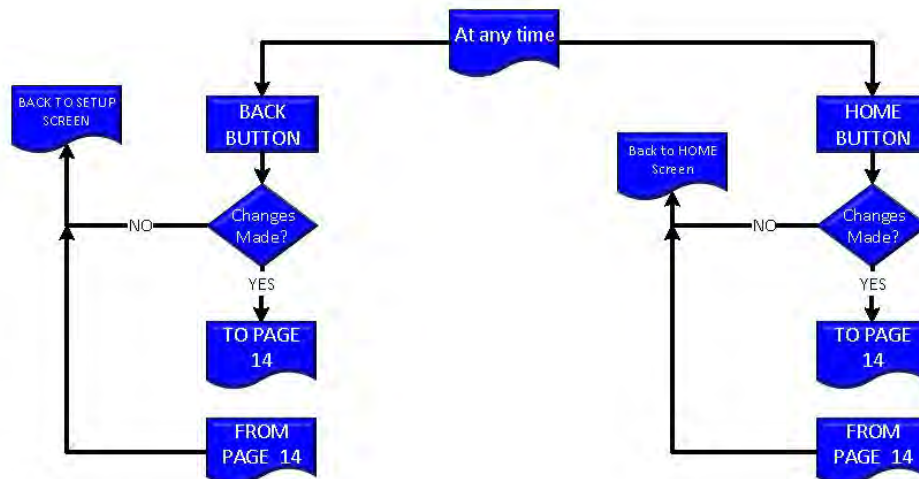
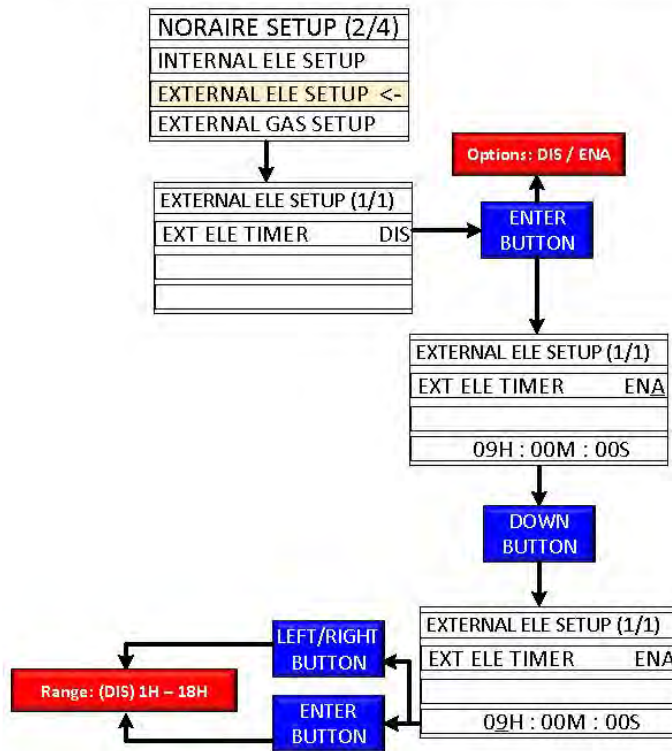




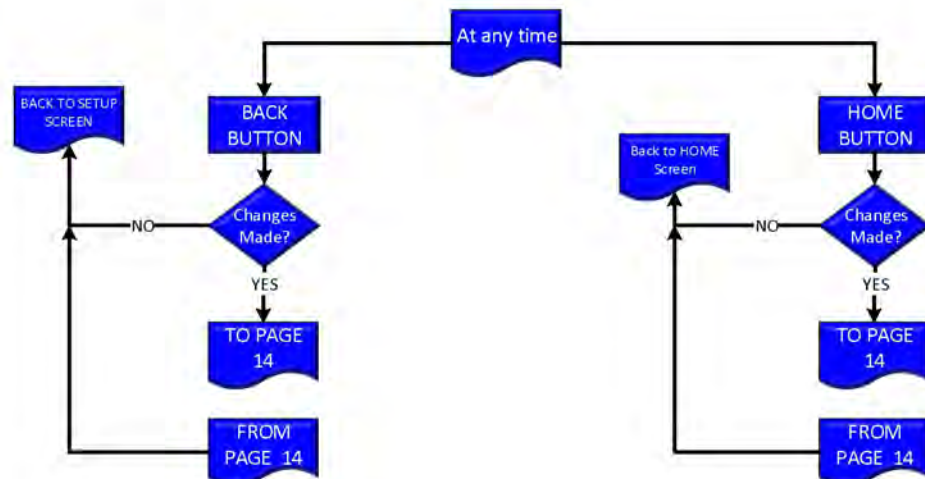
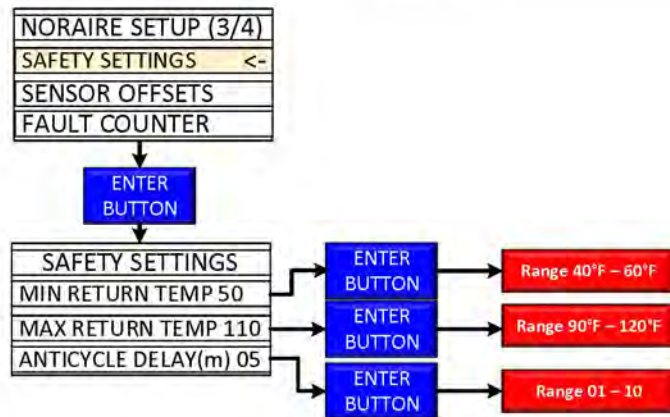
NOTE: ALL SCREENS
USE UP AND DOWN TO
SCROLL THROUGH
OPTIONS

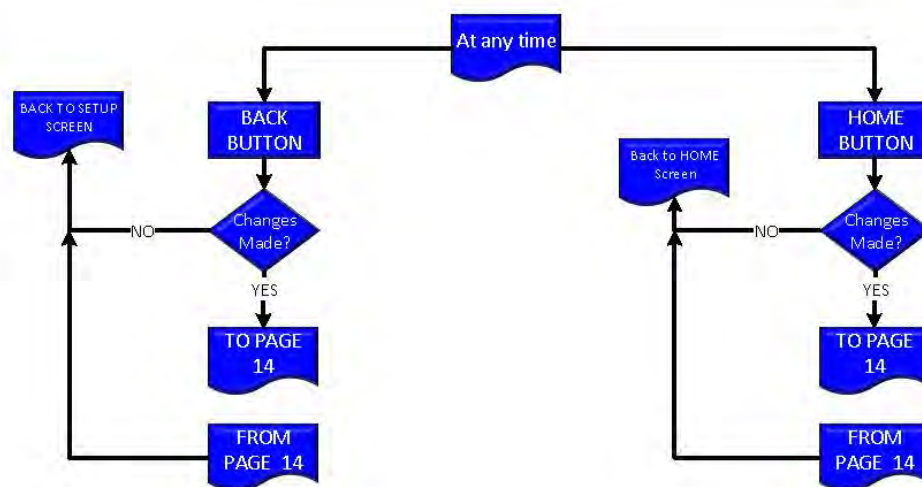
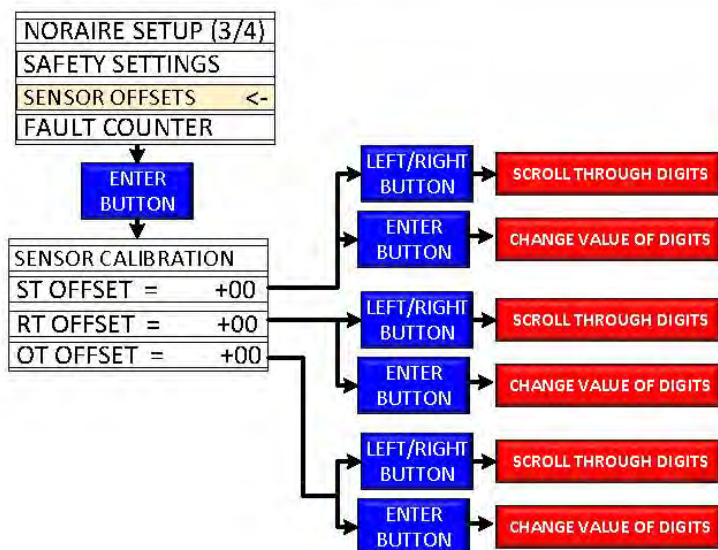


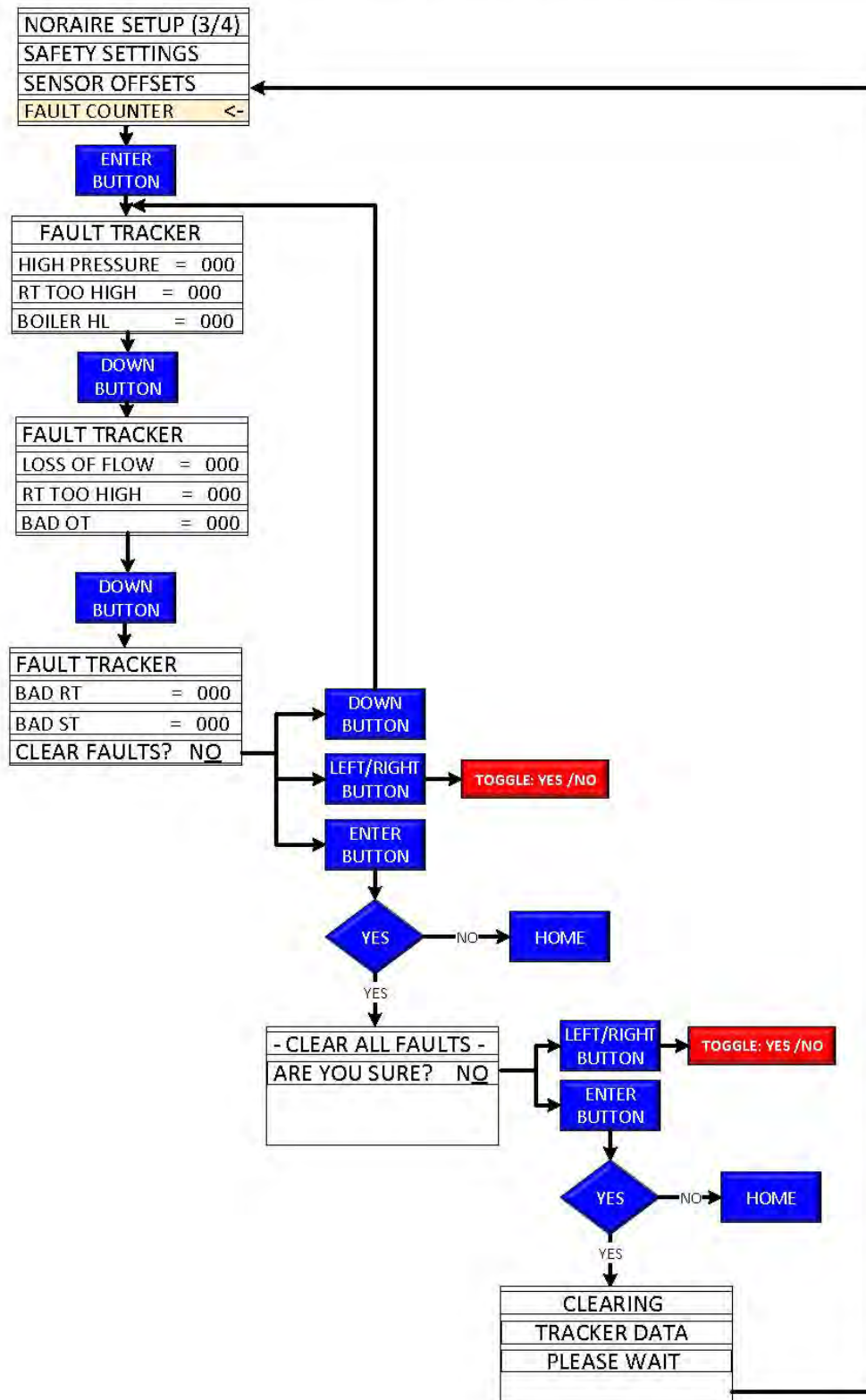
NOTE: ALL SCREENS
USE UP AND DOWN TO
SCROLL THROUGH
OPTIONS







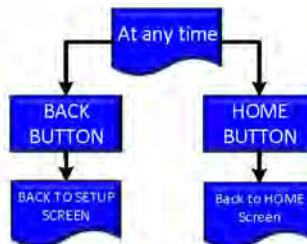


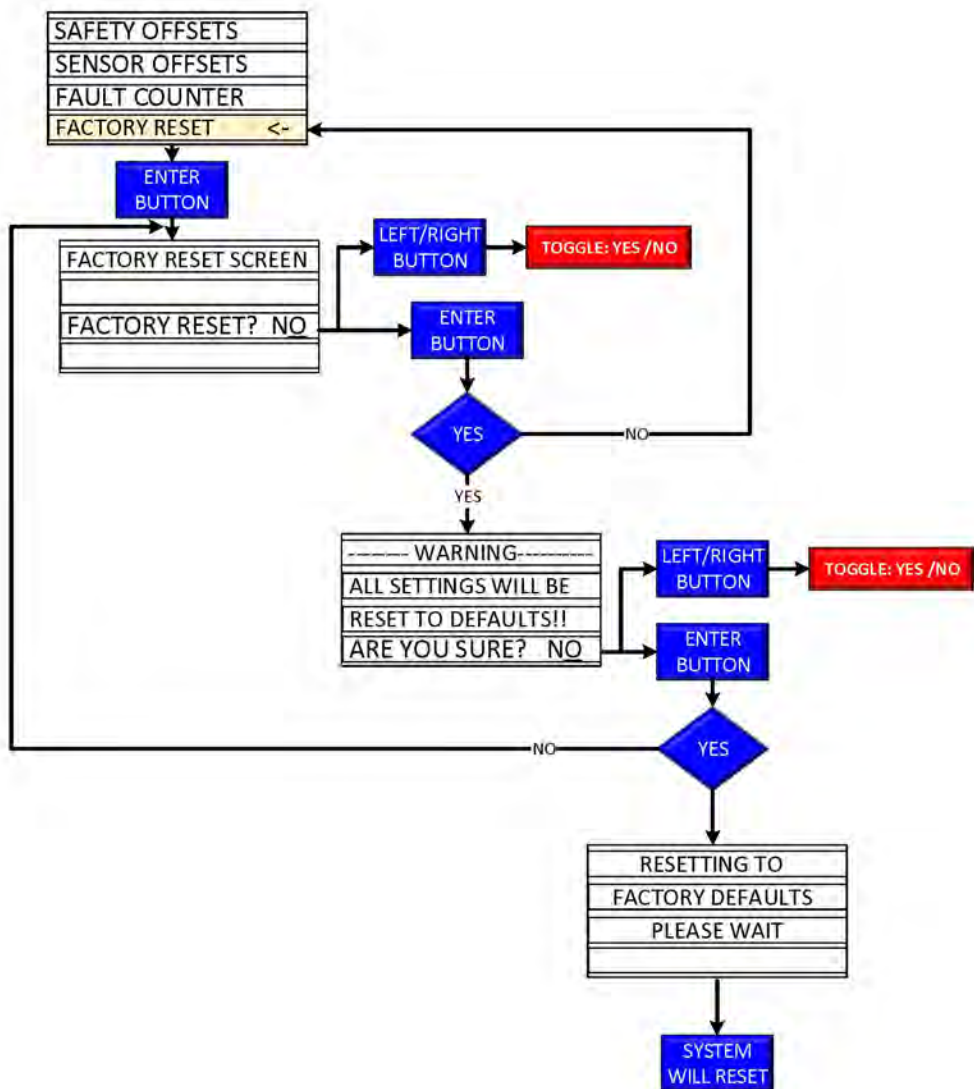


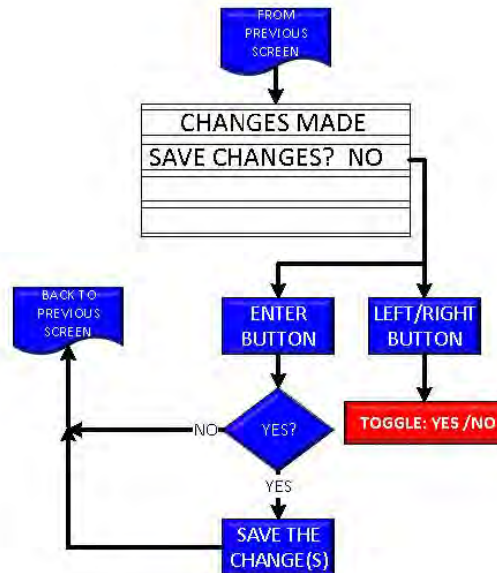
| | |
|---------------------|----|
| NORAIRE SETUP (4/4) | |
| TIMER STATUS | <- |
| FACTORY RESET | |
| | |



| | |
|-----------|-------------|
| BOOST IN: | 00h:00m:00s |
| GAS IN: | 00h:00m:00s |
| ELE IN: | 00h:00m:00s |
| PRIORITY: | 00h:00m:00s |







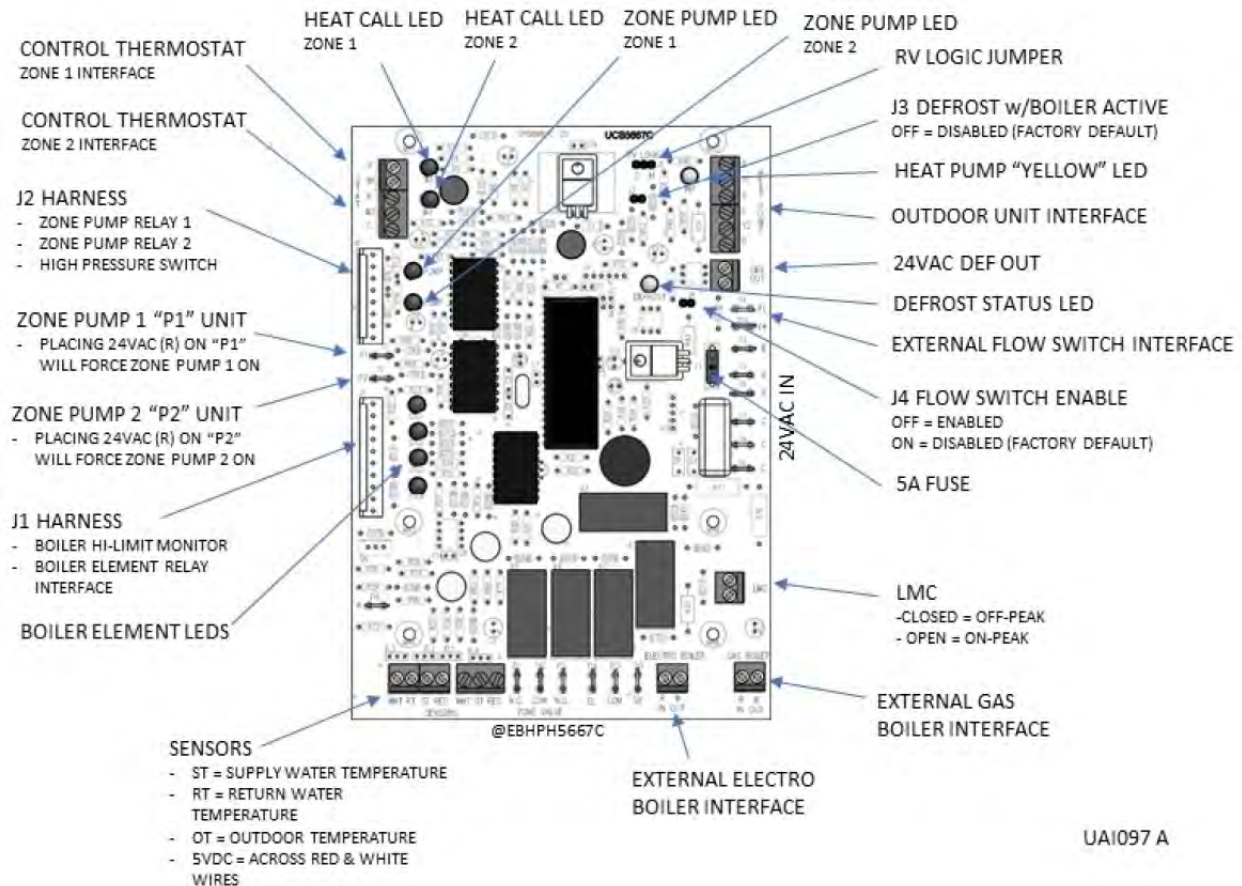
Start Up Inspection & Observations

1. Connect your refrigerant gauges and make sure all thermocouples are securely attached in the proper locations.
2. Verify the system is filled with correct water/glycol mixture and shows 8 – 10 PSI on the pressure gauge.
3. Verify refrigeration valves on the outdoor unit are both open.
4. Verify the system configuration product display is the correct mode for your application.
5. Verify power is turned on and the correct voltage is being fed to both the indoor and outdoor units using your voltmeter.
6. Verify front display on indoor unit is active
7. Give the system a heat call (close R & W on the control board). The indoor unit has a 5-minute anti-cycle delay (ACD) timer built in to protect the compressor from short cycling. The display shows time remaining.
8. Verify your circulating pump is running and you have flow.
9. Once the outdoor unit starts, let it run and stabilize for 15 minutes before taking and data measures to perform your calculating verifying correct charge and performance.
10. Refer to the **Refrigerant Charging Instructions** before adding any refrigerant to the system and for specific charging instructions to achieve proper system performance.
11. Compare calculated data to the **Capacity and Performance Chart**.
12. Once you have gathered and calculated the data needed for the **Warranty Sheet**, complete the sheet and send in for warranty activation.
13. Disconnect all test data equipment and make sure caps are installed on refrigeration access ports on the outdoor unit before leaving jobsite.

Additional Hookup or Special Equipment Concerns

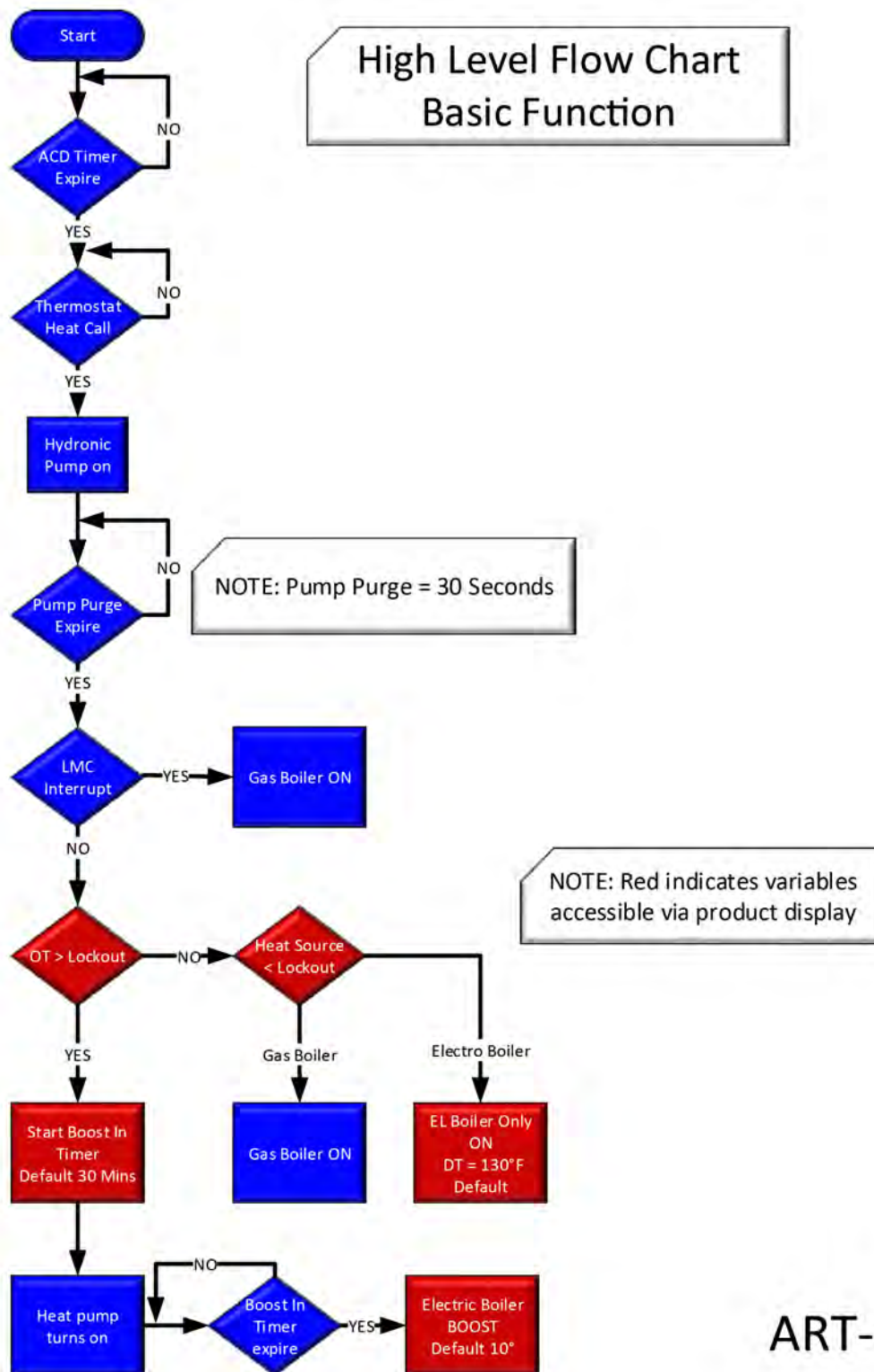
Override Electric Element Staging, “E” Tab Input – during an active turn on cycle, spade terminal labeled “E” can be jumpered to R (24VAC HOT) to bring on all four electric element stages and bypasses any temperature sensing or stage modulation functions.

Operational Indicators



Troubleshooting

General Operation:



| Troubleshooting | Solution |
|--|--|
| Display is blank and nothing is turning on | <ul style="list-style-type: none"> • This unit includes a 2A fuse located on the control board, verify it is in good working condition. • If 2A fuse is open, replace. • If 2A fuse is not open, check the primary and secondary side of the transformer to ensure power is available. • If good secondary voltage is detected, disconnect all low voltage wires (not including 24VAC secondary side of transformer) from the control module. If screen is still blank, replace board. If screen illuminates and displays “ACD”, there is an issue with low voltage wiring. |
| Unit is not producing heat | <ul style="list-style-type: none"> • Check unit display. Display should show “ACD”, “OFF” or an Active mode screen. • If screen is blank, see steps above. • If screen displays “OFF”, unit is not being told to turn on. Verify field low voltage wiring is correct (R & W1 and R & W2) • If screen displays active “Mode” screen, compare the ST and DT, if $ST \geq DT$, this NorAire unit will not engage the electric elements. • If DT displays “N.A”, this indicates that either the heat pump or external gas boiler should be running. LCD line 1 (MODE) should indicate this. Check appropriate heat source as indicated by the above statement. • Line 4 of the LCD display does indicate active system faults. Reference this as well. NOTE the Electro Industries App does have a “Fault Monitor” section where you can see history of faults. |
| Unit is not outputting adequate water temperature | <ul style="list-style-type: none"> • Check the above comments first. • Note that when in “Heat Pump Only” operation (see LCD line 1 MODE), the outdoor temperature will determine the heat pump output capacity. You may need to adjust the “Boost In” time along with “Stage Disables” to better align this NorAire operation to meet the building requirements (enter into “Boost” faster). • Note that when in “Boost Mode” operation (See LCD line 1 MODE), the NorAire will reference the setting called “Differential Temperature” (adjustable with App) to formulate a desired output temperature ($RT + \text{“Differential Temperature”} = DT$). Factory default is 10°. If this is not a large enough differential, use the App to increase the “Differential Temperature” value. Also note that “Stage Disables” are used in “Boost Mode”. Make note of the outdoor temperature as you’re troubleshooting in this scenario. • The NorAire has special sequence in reacting to a faulty outdoor temperature sensor and/or faulty return temperature sensor. It will essentially “limp along” in an effort to draw attention to itself without creating a no heat situation. If LCD displays “OT = BAD” or “RT = BAD”. Replace appropriate sensor and cycle power to the unit to restore full NorAire operation. |
| Visible oil spot | <ul style="list-style-type: none"> • If an oil spot is noticed at either the outdoor or indoor unit, this is likely a sign of a refrigerant leak. Report to installing contractor. |

Accessories

Zone Controller

| | |
|----------|--|
| EB-ZEA-1 | 4 ZONES INTERFACE ZONE PUMPS OR VALVES WITH XFMR |
| EB-ZEA8 | 8 ZONE INTERFACE ZONE PUMPS WITH XFMR |
| EB-ZES8 | 8 VALVES INTERFACE ZONE VALES NO XFMR |

Accessories

| | |
|---------|---|
| 6083 | Line Set, Filter/Dryer |
| 5701 | Single Feed Adapter for Two CB, Square D |
| EE-5051 | Zone Pump Relay, 24V Coil, with Enclosure |
| 6211 | Flow Meter, Vertical 1", 2-16 GPM |
| 6027-75 | Flow Switch |

Replacement Parts

| Part Number | Description |
|-------------|---|
| UFUSE0443 | Controller Fuse, Plug-In 2A |
| 6064 | Sight Glass, 3/8" |
| 5456A | Temperature/Pressure Gauge, 320°/75 psi |
| 5652 | Circuit Breaker, 60A |
| 5650 | Circuit Breaker, 30A |
| 4038KIT | SSR 50A, 24VDC |
| 6040-500 | Hi Pressure Limit, 500 psig |
| 5541 | 40VA Transformer |
| 5453 | Water Pressure Relief |
| EBMVS** | Boiler Vessel Assembly |
| 5526 | Boiler Element, 5 kW |
| 5535 | Boiler Hi-Limit, Manual Reset |
| 5537 | Boiler Hi-Limit, Auto Reset |
| 5127 | Boiler Stage Relays |
| WFS5 | Temperature Sensors – RT, ST |
| WFS25F | Temperature Sensor – Outdoor (OT) |
| EBHPH5667 | NorAire Control Board |
| | Condenser Coil Assembly, S-3 |

Electro Industries, Inc. Residential Limited Product Warranty

Effective November 1, 2009

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

Electro Industries, Inc. will cover labor costs according to the Repair / Replacement Labor Allowance Schedule for a period of ninety (90) days from the date of original purchase, to the original owner, at the original installation site. The Repair / Replacement Labor Allowance is designed to reduce the cost of repairs. This Repair / Replacement Labor Allowance may not cover the entire labor fee charged by your dealer / contractor.

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

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

TWENTY YEAR (20) LIMITED WARRANTY ON SPIN FIN ELEMENTS

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

FIVE YEAR (5) LIMITED WARRANTY ON OPEN WIRE ELEMENTS

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



CONDITIONS AND LIMITATIONS:

1. This warranty is limited to residential, single family dwelling installations only. Any commercial or multi-unit dwelling installations fall under the Electro Industries Commercial Limited Product Warranty.
2. Electro Industries, Inc. shall not be liable for performance related issues resulting from improper installation, improper sizing, improper duct or distribution system, or any other installation deficiencies.
3. If at the time of a request for service the original owner cannot provide an original sales receipt or a warranty card registration then the warranty period for the product will have deemed to begin the date the product is shipped from the factory and **NOT** the date of original purchase.
4. The product must have been sold and installed by a licensed electrician, plumbing, or heating contractor.
5. The application and installation of the product must be in compliance with Electro Industries, Inc. specifications, as stated in the installation and instruction manual, and all state, provincial and federal codes and statutes. If not, the warranty will be null and void.
6. The purchaser shall have maintained the product in accordance with the manual that accompanies the unit. Annually, a qualified and licensed contractor must inspect the product to assure it is in proper working condition.
7. All related heating components must be maintained in good operating condition.
8. All lines must be checked to confirm that all condensation drains properly from the unit.
9. Replacement of a product or product part under this limited warranty does not extend the warranty term or period.
10. Replacement product parts are warranted to be free from defects in material and workmanship for ninety (90) days from the date of installation. All exclusions, conditions, and limitations expressed in this warranty apply.
11. Before warranty claims will be honored, Electro Industries, Inc. shall have the opportunity to directly, or through its authorized representative, examine and inspect the alleged defective product or product parts. Remedies under this warranty are limited to repairing or replacing alleged defective product or product parts. The decision whether to repair or, in the alternative, replace products or product parts shall be made by Electro Industries, Inc. or its authorized representative.

THIS WARRANTY DOES NOT COVER:

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

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

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