

# Waterside Economizer





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# Waterside Economizer

According to the U.S. Energy Information Administration, HVAC systems consume 25% to 49% of a typical office building's energy use. Improving the efficiency of the HVAC system makes a major impact on overall energy use and provides significant savings to the building owner. Adding an economizer to an HVAC system makes cooling more energy efficient by using resources such as cool air or water in place of operating a compressor. Depending on design conditions, economizers can provide up to 100% of cooling load requirements.

WaterFurnace waterside economizer option allows the use of a building's interior loop water to provide "free" cooling. It works by passing air through a coil cooled by loop water rather than through a coil cooled by mechanical refrigeration. The economizer contains a water-to-air heat exchanger, a 3-way valve, and controls that manage the flow of water through the heat exchanger. The economizer is mounted in line with the heat pump's return air flow. When cooling is required and the building loop water temperature is below the economizer setpoint, typically 45°F, water is passed through the economizer. Air is drawn through the cool economizer and the heat pump's compressor is turned off. Cooling is then provided by the economizer, reducing energy use.



## WaterFurnace Advantage

The greatest benefit of the WaterFurnace waterside economizer is energy savings. A heat pump's compressor consumes the majority of power required to provide cooling. Turning the compressor off provides substantial savings. An added benefit is improved life of the compressor through lower run hours and less cycling. When mandated by code, the waterside economizer can also help buildings comply with ASHRAE Standard 90.1. See "WaterFurnace Code Review" for information on the requirement of economizers on WSHPs.

Waterside economizers have advantages over airside economizers as well. Because they are not directly subject to outdoor air conditions, waterside economizers can provide longer operating hours and better humidity control. They also have fewer mechanical components and are less prone to failure. Airside economizers can fail in the open position, leading to much higher energy costs.

## Typical Applications

Candidates for waterside economizers include commercial buildings that have simultaneous heating and cooling loads. For example, during cool weather a building may require heating around the perimeter and at the same time require cooling for the core space. The perimeter heating will cool the loop water which in turn flows through the economizers that are cooling the core space. The heat absorbed from the core space is then put back into the loop, providing higher efficiencies for both heating and cooling. Waterside economizers are also a good fit for buildings where it is difficult to use an airside economizer. An example of this would be a multi-story building using separate air handlers for each floor and no central air delivery system.

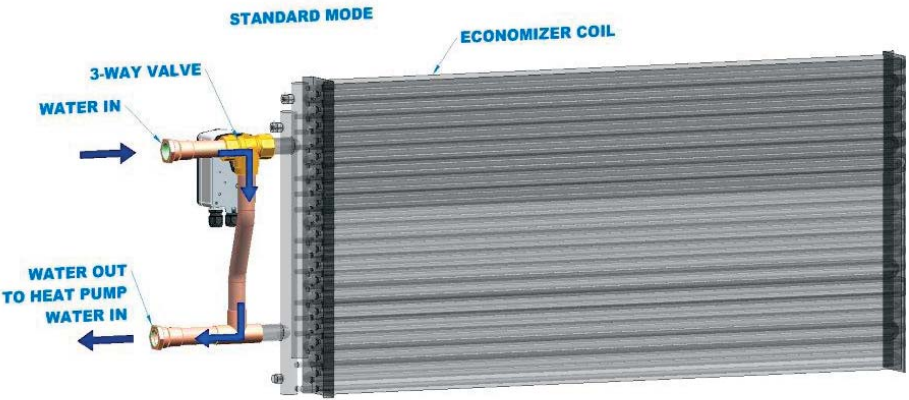
# Application Notes

## Application Notes

Single compressor units with waterside economizers are only available with ECM fan motors and stainless steel drain pans. Dual compressor units with waterside economizers may require a higher static blower package to compensate for the added pressure drop. In either case, careful consideration of the CFM requirements should be taken into account when using waterside economizers.

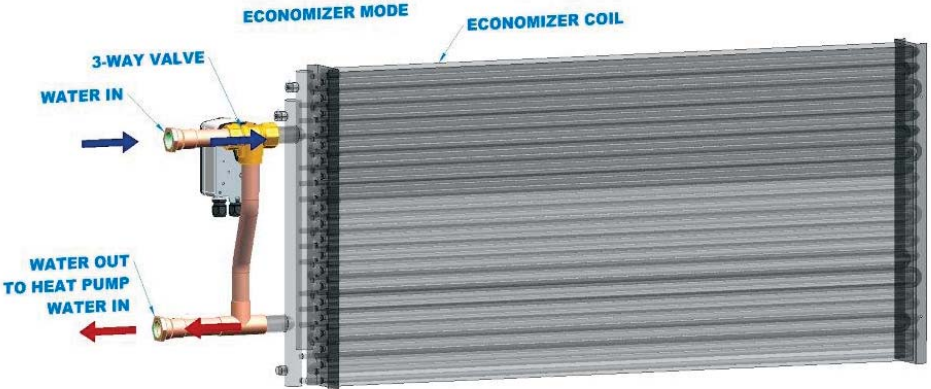
## Standard Mode

In standard operating mode, water flows through the inlet to the 3-way valve, bypasses the economizer coil, and flows directly into the inlet of the coaxial heat exchanger inside the heat pump.



## Economizer mode

In economizer operating mode, water flows through the inlet to the 3-way valve, continues through the economizer coil, and then into the inlet of the heat pump. The tee port on the 3-way valve is closed off in economizer mode.



## Sequence of Operations

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### Thermostat Mode

An additional thermostat control will be factory provided on water source heat pumps equipped with waterside economizer that will be controlled through standard thermostat signals. A temperature sensor is factory installed on the inlet water connection to the economizer. The economizer thermostat will be set in the factory to enable economizer operation when the incoming water temperature falls below 45°F. If the temperature is above this setpoint, normal mechanical cooling is enabled. Please refer to the schematic provided for more information on thermostat mode.

### DDC Control Mode (Aurora with UPC)

Water source heat pumps equipped with waterside economizer option that require communication with the building management system (BMS) will need the UPC option as well. A factory installed sensor will be installed with the UPC controls that will read the incoming water temperature. Based on the setpoint, the UPC will determine whether the unit shall operate in standard cooling mode or in economizer mode. Factory default is 45°F and can be adjusted through the BMS or Aurora Touch Unit (ATU). Please consult UPC Application Guide for specific details of control sequence of operations.

## Performance Data

### Versatec Base Waterside Performance Data

| Model      | Waterside |      |         | Airside |                    | Cooling Capacity |                 |        |
|------------|-----------|------|---------|---------|--------------------|------------------|-----------------|--------|
|            | GPM       | psig | ft. hd. | CFM     | Delta P (in. w.g.) | Total Btu/hr     | Sensible Btu/hr |        |
| Vertical   | 024       | 6    | 0.8     | 1.8     | 800                | 0.23             | 24,477          | 19,478 |
|            | 030       | 8    | 1.3     | 3.1     | 1,000              | 0.33             | 29,537          | 23,697 |
|            | 036       | 9    | 1.9     | 4.4     | 1,150              | 0.25             | 38,181          | 29,441 |
|            | 042       | 11   | 1.8     | 4.2     | 1,400              | 0.26             | 44,771          | 34,789 |
|            | 048       | 12   | 2.1     | 5.0     | 1,600              | 0.32             | 48,651          | 38,472 |
|            | 060       | 15   | 3.5     | 8.1     | 1,900              | 0.30             | 62,414          | 47,714 |
|            | 070       | 18   | 4.1     | 9.5     | 2,100              | 0.28             | 71,672          | 53,971 |
| Horizontal | 024       | 6    | 1.0     | 2.3     | 800                | 0.18             | 25,896          | 20,300 |
|            | 030       | 8    | 1.7     | 3.9     | 1,000              | 0.27             | 33,317          | 25,548 |
|            | 036       | 9    | 1.4     | 3.2     | 1,150              | 0.21             | 38,117          | 29,445 |
|            | 042       | 11   | 2.1     | 4.9     | 1,400              | 0.24             | 48,236          | 36,462 |
|            | 048       | 12   | 2.5     | 5.8     | 1,600              | 0.30             | 53,222          | 40,616 |
|            | 060       | 15   | 2.6     | 6.0     | 1,900              | 0.26             | 65,411          | 49,783 |
|            | 070       | 18   | 3.2     | 7.4     | 2,100              | 0.25             | 75,252          | 56,014 |

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### Versatec Ultra Waterside Performance Data

| Model      | Waterside |      |         | Airside |                    | Cooling Capacity |                 |        |
|------------|-----------|------|---------|---------|--------------------|------------------|-----------------|--------|
|            | GPM       | psig | ft. hd. | CFM     | Delta P (in. w.g.) | Total Btu/hr     | Sensible Btu/hr |        |
| Vertical   | 024       | 6    | 1.2     | 2.7     | 800                | 0.14             | 28,403          | 21,486 |
|            | 030       | 8    | 2.0     | 4.6     | 1,000              | 0.20             | 36,362          | 27,050 |
|            | 036       | 9    | 1.5     | 3.6     | 1,150              | 0.19             | 39,581          | 29,909 |
|            | 042       | 11   | 2.5     | 5.7     | 1,400              | 0.18             | 52,063          | 38,020 |
|            | 048       | 12   | 2.9     | 6.7     | 1,600              | 0.22             | 57,559          | 42,459 |
|            | 060       | 15   | 3.6     | 8.3     | 1,900              | 0.23             | 69,670          | 50,951 |
|            | 070       | 18   | 3.5     | 8.2     | 2,100              | 0.23             | 78,293          | 57,550 |
| Horizontal | 024       | 6    | 0.6     | 1.4     | 800                | 0.12             | 26,898          | 20,831 |
|            | 030       | 8    | 1.1     | 2.6     | 1,000              | 0.17             | 33,549          | 25,885 |
|            | 036       | 9    | 1.5     | 3.4     | 1,150              | 0.18             | 39,840          | 30,264 |
|            | 042       | 11   | 1.8     | 4.2     | 1,400              | 0.16             | 50,365          | 37,359 |
|            | 048       | 12   | 2.1     | 5.0     | 1,600              | 0.20             | 55,962          | 41,858 |
|            | 060       | 15   | 2.7     | 6.4     | 1,900              | 0.21             | 69,193          | 51,654 |
|            | 070       | 18   | 3.4     | 7.8     | 2,100              | 0.21             | 78,773          | 57,755 |

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## Performance Data cont.

### Envision2 Compact Waterside Performance Data

|            | Model   | Waterside |      |         | Airside |                    | Cooling Capacity |                 |
|------------|---------|-----------|------|---------|---------|--------------------|------------------|-----------------|
|            |         | GPM       | psig | ft. hd. | CFM     | Delta P (in. w.g.) | Total Btu/hr     | Sensible Btu/hr |
| Vertical   | 024-026 | 8         | 1.2  | 2.87    | 800     | 0.11               | 31,404           | 22,593          |
|            | 030     | 8         | 1.2  | 2.87    | 900     | 0.13               | 33,289           | 24,518          |
|            | 036-038 | 9         | 1.3  | 2.94    | 1,200   | 0.14               | 41,764           | 31,793          |
|            | 042     | 11        | 1.6  | 3.67    | 1,300   | 0.13               | 48,857           | 35,999          |
|            | 048-049 | 12        | 1.9  | 4.32    | 1,500   | 0.16               | 54,625           | 40,782          |
|            | 060-064 | 15        | 2.5  | 5.79    | 1,800   | 0.18               | 67,153           | 49,607          |
|            | 070-072 | 18        | 3.5  | 8.18    | 2,000   | 0.21               | 76,538           | 55,758          |
| Horizontal | 024-026 | 8         | 1.2  | 2.71    | 800     | 0.10               | 31,533           | 22,751          |
|            | 030     | 8         | 1.2  | 2.7     | 900     | 0.12               | 33,413           | 24,766          |
|            | 036-038 | 9         | 1.2  | 2.86    | 1,200   | 0.13               | 41,862           | 31,615          |
|            | 042     | 11        | 1.5  | 3.51    | 1,300   | 0.12               | 49,404           | 36,229          |
|            | 048-049 | 12        | 1.8  | 4.13    | 1,500   | 0.15               | 55,437           | 41,177          |
|            | 060-064 | 15        | 2.9  | 6.6     | 1,800   | 0.16               | 70,507           | 51,010          |
|            | 070-072 | 18        | 3.3  | 7.73    | 2,000   | 0.19               | 76,998           | 55,954          |

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### Envision XL and XXL Waterside Performance Data

|            | Model | Waterside |      |         | Airside |                    | Cooling Capacity |                 |
|------------|-------|-----------|------|---------|---------|--------------------|------------------|-----------------|
|            |       | GPM       | psig | ft. hd. | CFM     | Delta P (in. w.g.) | Total Btu/hr     | Sensible Btu/hr |
| Horizontal | 080   | 22        | 1.0  | 2.3     | 2,600   | 0.15               | 91,509           | 68,872          |
|            | 095   | 24        | 1.2  | 2.7     | 2,800   | 0.16               | 100,274          | 74,831          |
|            | 120   | 28        | 1.6  | 3.6     | 3,600   | 0.24               | 123,397          | 93,349          |
| Vertical   | 080   | 22        | 1.9  | 4.3     | 2,600   | 0.16               | 96,506           | 71,324          |
|            | 095   | 24        | 2.5  | 5.8     | 2,800   | 0.15               | 113,644          | 80,924          |
|            | 120   | 28        | 2.2  | 5.1     | 3,600   | 0.18               | 129,742          | 97,238          |
|            | 160   | 35        | 1.8  | 4.1     | 5000    | 0.13               | 191,896          | 140,078         |
|            | 180   | 45        | 2.8  | 6.5     | 5,600   | 0.15               | 226,916          | 161,648         |
|            | 240   | 60        | 4.6  | 10.5    | 7,600   | 0.25               | 287,542          | 208,758         |
|            | 300   | 75        | 6.9  | 15.9    | 9,500   | 0.36               | 337,654          | 249,294         |

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## Correction Factors

| Entering Fluid Temperature Deg °F | Total Btu/hr | Sensible Btu/hr |
|-----------------------------------|--------------|-----------------|
| 45                                | 1.000        | 1.000           |
| 50                                | 0.819        | 0.899           |
| 55                                | 0.641        | 0.799           |
| 60                                | 0.478        | 0.657           |
| 65                                | 0.360        | 0.494           |
| 70                                | 0.241        | 0.330           |

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## Water Pressure

Waterside economizer coils are designed to handle a maximum fluid side working pressure of 500 psig. Pressure drop values published in the waterside economizer performance tables only account for the economizer coil. The heat pump pressure drop published in the specification catalogs shall be added to this pressure drop. Pressure drop is calculated with rated flow as stated in the table at 45°F entering fluid temperature.

## Air Pressure

Published air side pressure drop only accounts for the economizer coil and shall be added to the heat pump pressure drop. Pressure drop is calculated with a wet coil at 80°F/67°F (db/wb) return air temperature. Please verify the required CFM can be delivered to the space with the extra resistance of the economizer coil along with the design external static pressure.

## Condensate

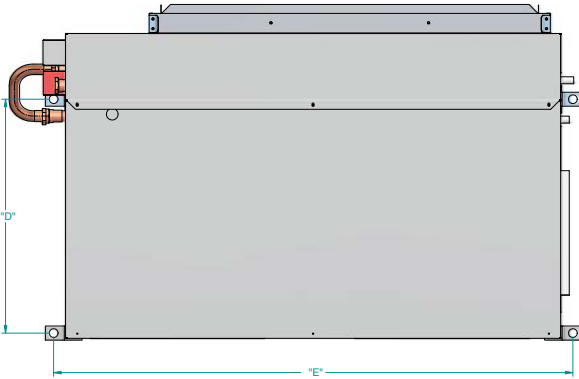
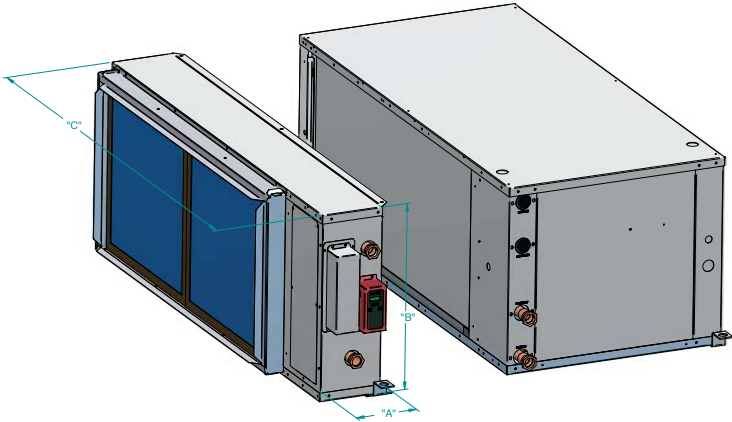
All horizontal heat pumps must be externally trapped and vented according to mechanical code requirements. The condensate drains should be tied together as illustrated below. Most vertical units are internally trapped on the heat pump and will need externally trapped at the waterside economizer drain.





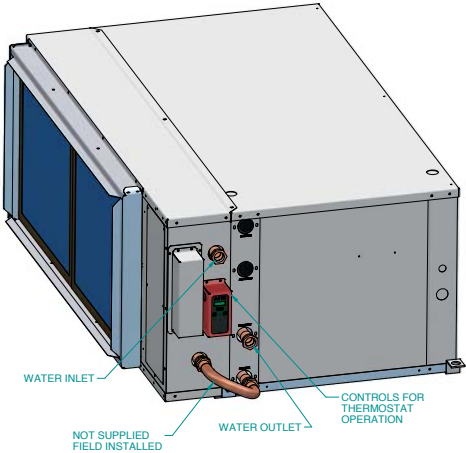
# Dimensional Data cont.

## Single Compressor Horizontal

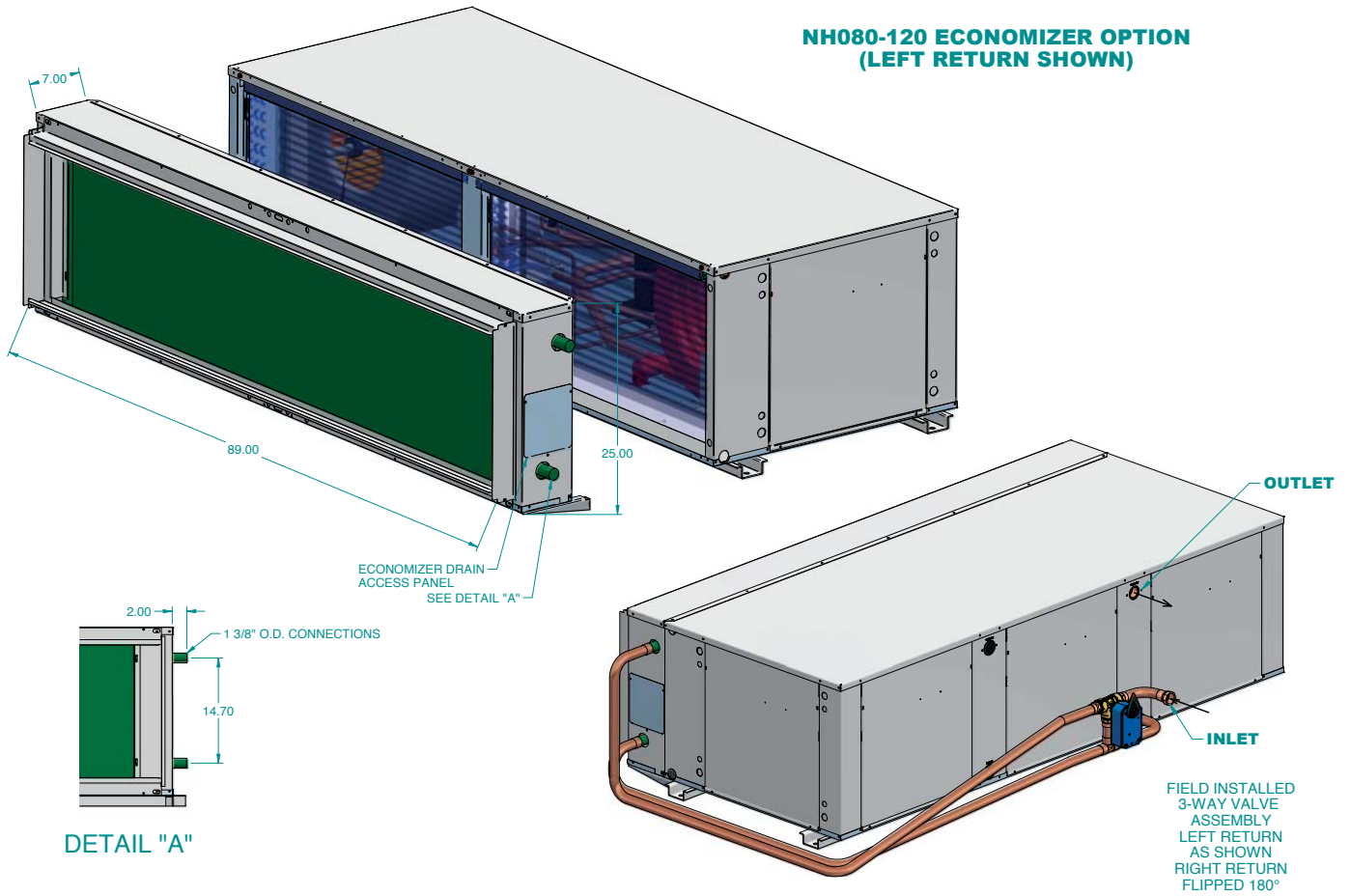


| MODEL SERIES | MODEL SERIES | MODEL SERIES | "A" | "B"  | "C" | "D"  | "E"  | FILTER RACK WIDTH |
|--------------|--------------|--------------|-----|------|-----|------|------|-------------------|
| UBH024-030   |              |              | 7.2 | 17.2 | 42  | 22.7 | 44.6 | 2.2               |
| UBH036       | USH024-030   |              | 7.2 | 19.2 | 42  | 22.7 | 44.6 | 2.2               |
| UBH042-048   | USH036       | NBH024-030   | 7.2 | 19.2 | 45  | 22.7 | 47.6 | 2.2               |
| UBH060       | USH042-048   | NBH036-038   | 7.2 | 21.2 | 48  | 25   | 50.6 | 2.2               |
| UBH070       | USH060       | NBH042-049   | 7.2 | 21.2 | 53  | 25   | 55.6 | 2.2               |
|              | USH070       | NBH060-064   | 7.2 | 21.2 | 61  | 25   | 63.6 | 2.2               |
|              |              | NBH070-072   | 7.2 | 21.2 | 68  | 25   | 70.6 | 2.2               |

All dimensions in inches.

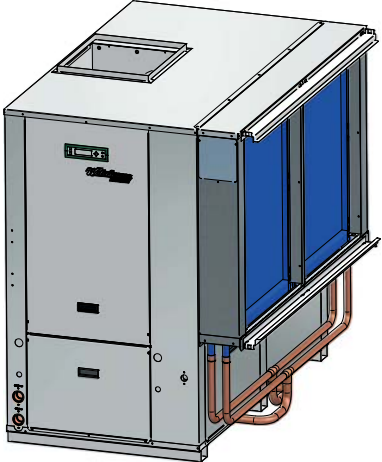
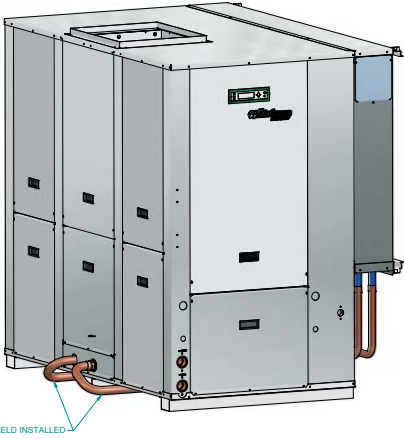
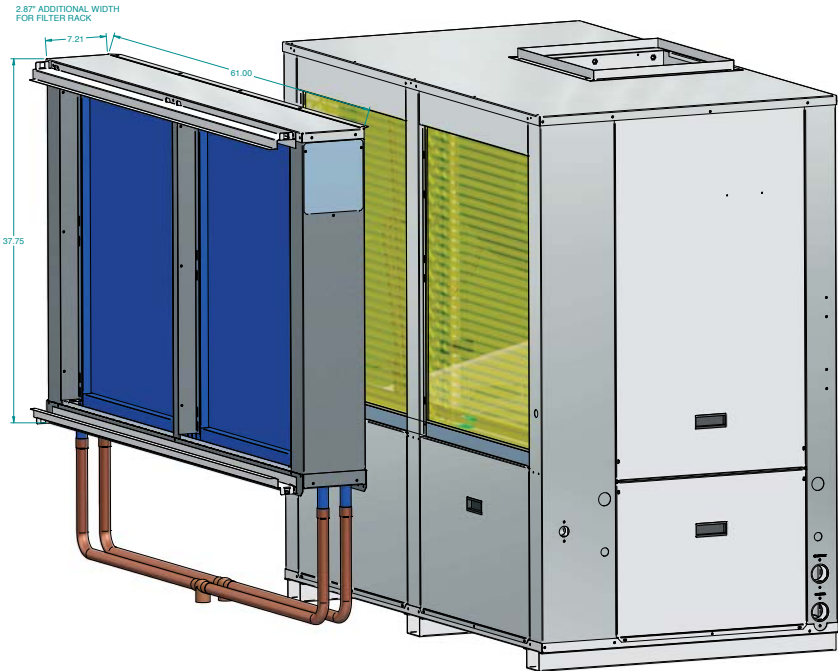


## Dimensional Data cont.



# Dimensional Data cont.

**NV080-120 ECONOMIZER OPTION  
(RIGHT RETURN SHOWN)**

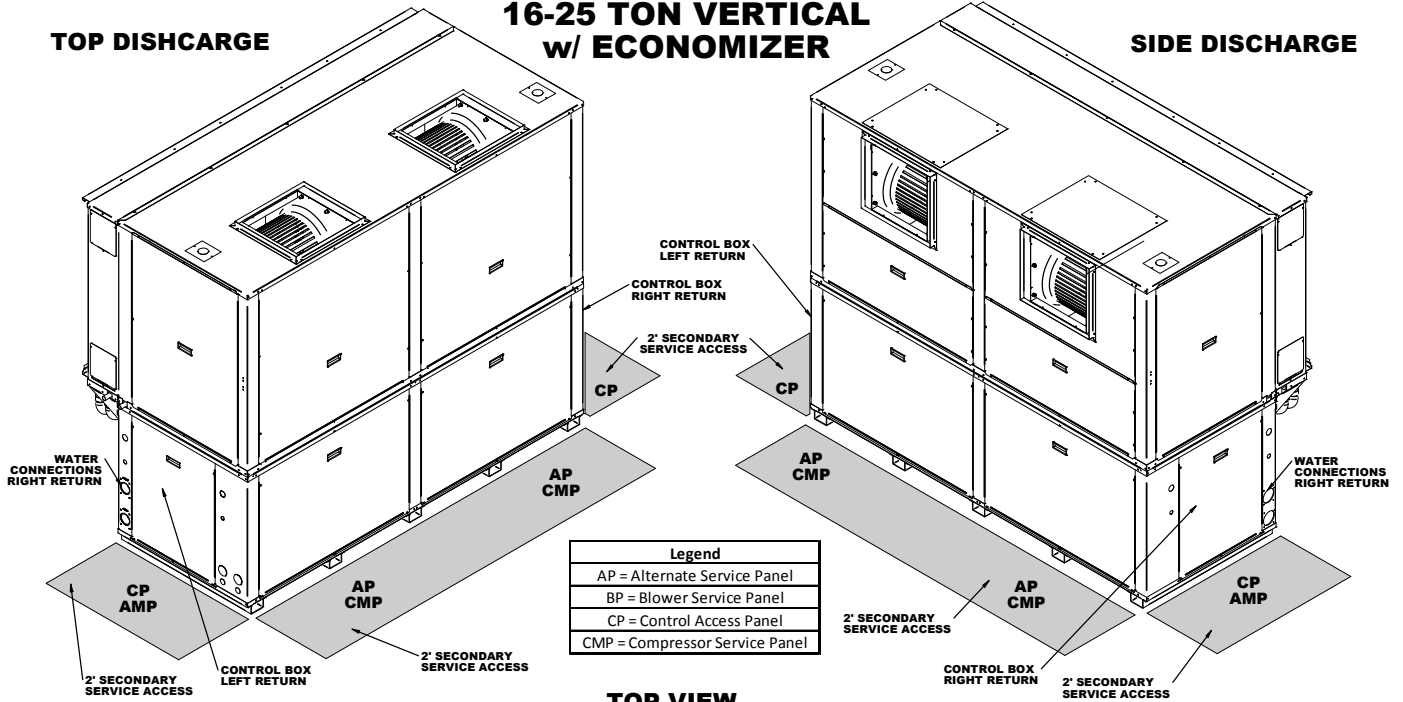


# Dimensional Data cont.

## 16-25 TON VERTICAL w/ ECONOMIZER

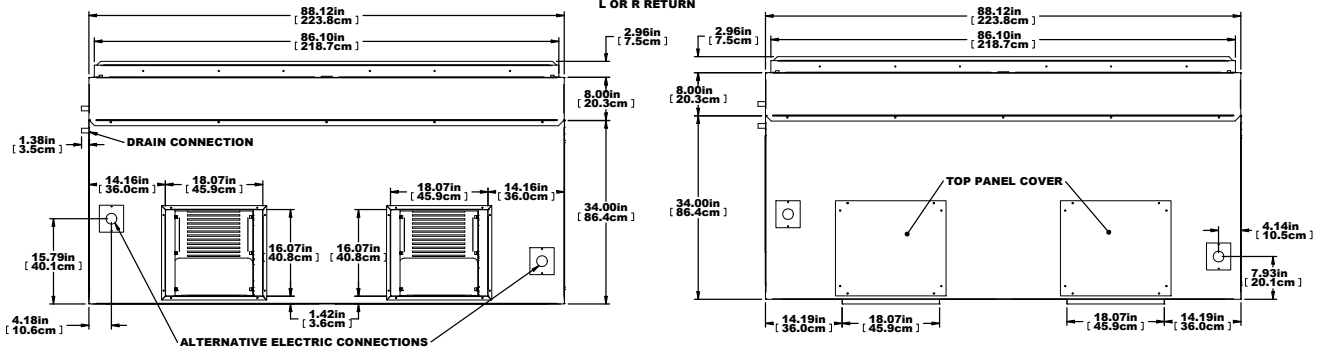
**TOP DISCHARGE**

**SIDE DISCHARGE**

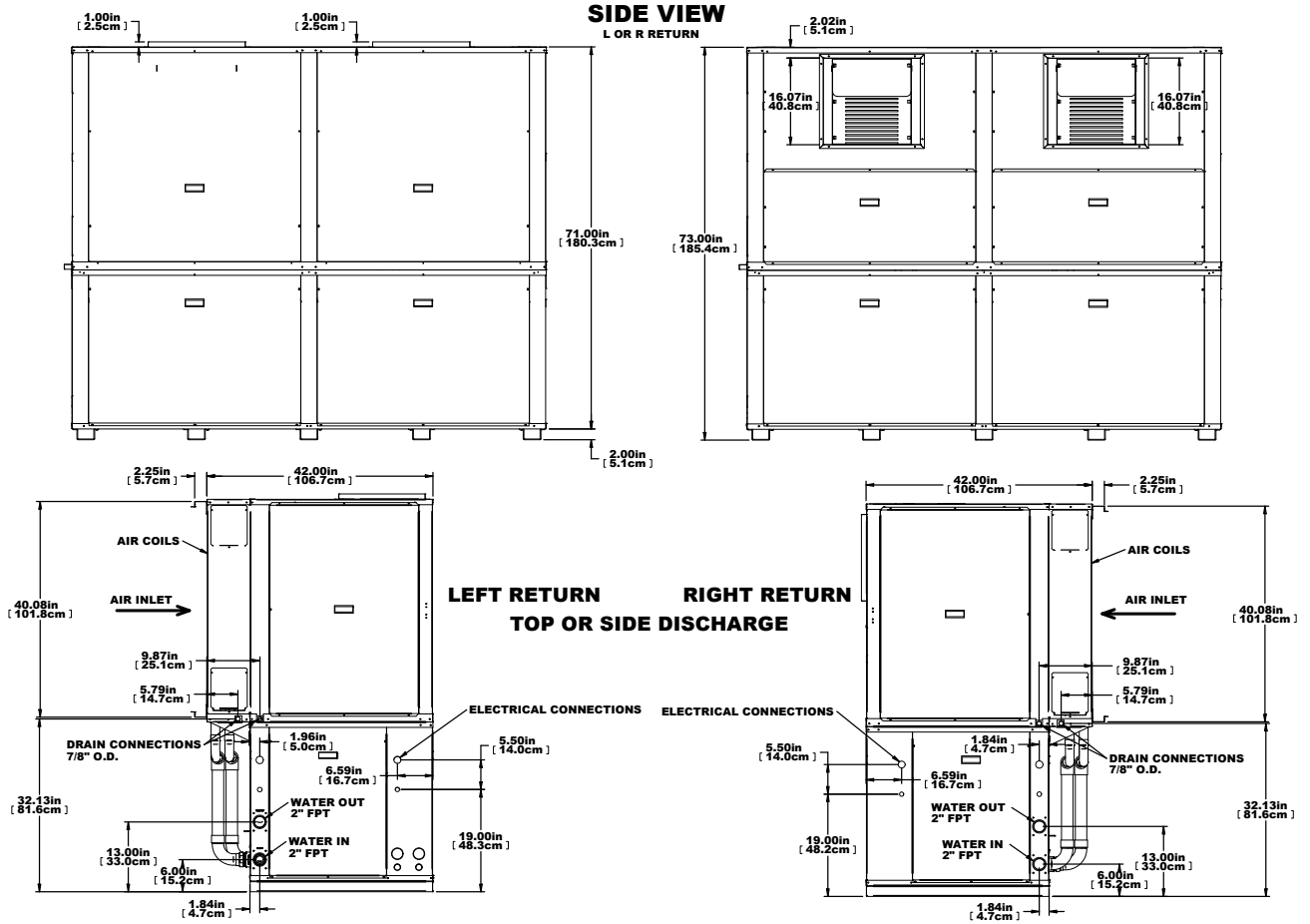


| Legend |                          |
|--------|--------------------------|
| AP     | Alternate Service Panel  |
| BP     | Blower Service Panel     |
| CP     | Control Access Panel     |
| CMP    | Compressor Service Panel |

### TOP VIEW

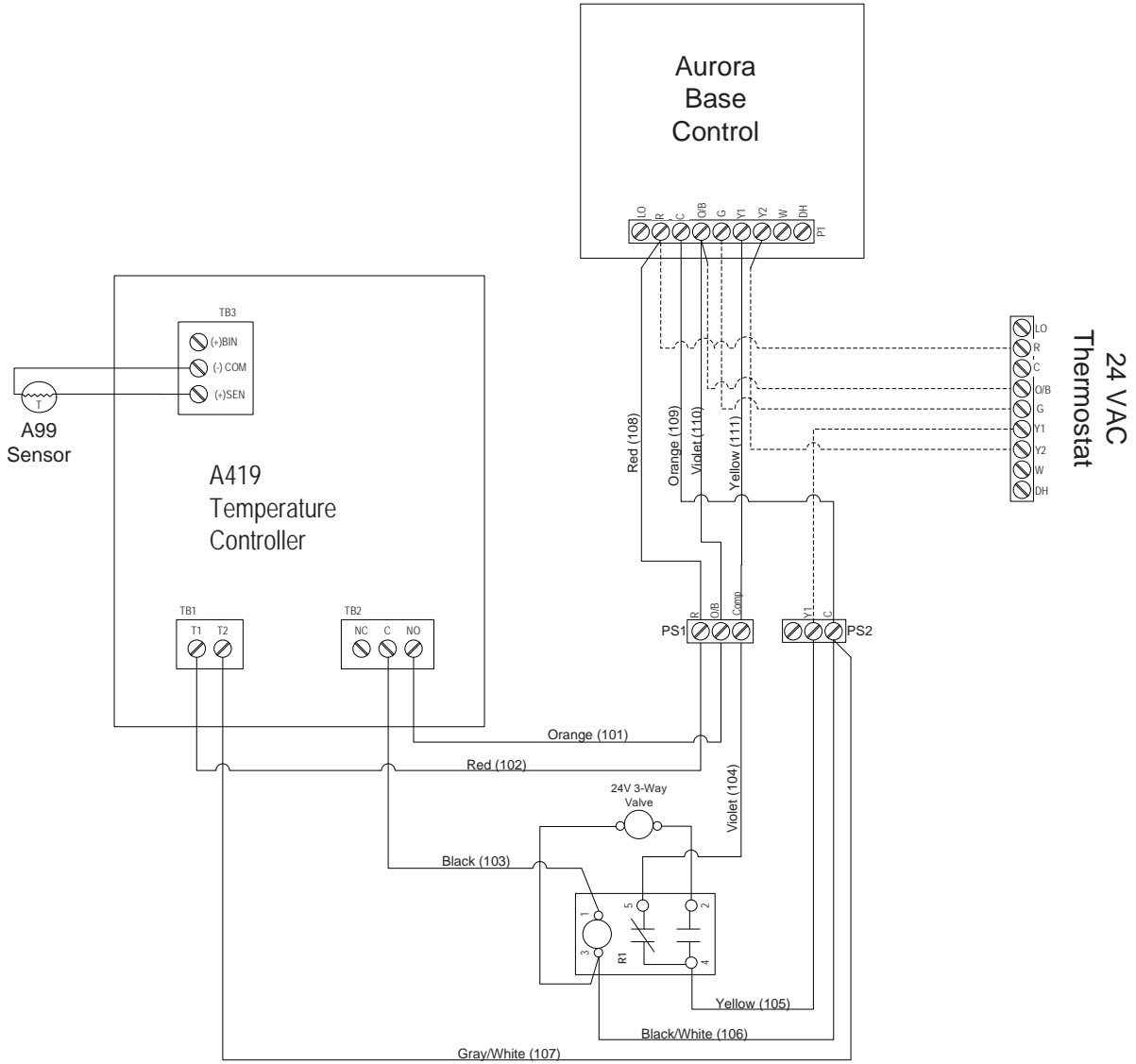


# Dimensional Data cont.



# Dimensional Data cont.

## 24 VAC Thermostat Mode



### Legend

|  |                             |  |                               |
|--|-----------------------------|--|-------------------------------|
|  | Factory Low Voltage Wiring  |  | Thermistor                    |
|  | Factory Line Voltage Wiring |  | Relay Coil                    |
|  | Field Low Voltage Wiring    |  | Switch - Condensate Overflow  |
|  | Field Line Voltage Wiring   |  | Switch - High pressure        |
|  | Optional Block              |  | Switch - Low pressure         |
|  | DC Voltage PCB Traces       |  | Polarized connector           |
|  | Field Zone Sensor Wiring    |  | Light Emitting Diode - Green  |
|  | Internal Junction           |  | Light Emitting Diode - Yellow |
|  | Quick Connect Terminal      |  | Light Emitting Diode - Red    |
|  | Field Wiring Lug            |  |                               |
|  | Ground                      |  |                               |
|  | Relay Contacts - N.O., N.C. |  |                               |
|  | Capacitor                   |  |                               |
|  | Fuse                        |  |                               |

TB1 - Terminal Block 1  
 TB2 - Terminal Block 2  
 TB3 - Terminal Block 3  
 NO - Normally Open  
 NC - Normally Closed  
 R1 - Relay  
 PS1 - Power strip 1  
 PS2 - Power strip 2



## Notes

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## Revision Guide

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| <b>Pages:</b> | <b>Description:</b>                  | <b>Date:</b> | <b>By:</b> |
|---------------|--------------------------------------|--------------|------------|
| 14-15         | Updated Dimensional Data (16-25 ton) | 17 Feb 2017  | MA         |
| All           | First Published                      | April 2015   | MA         |



Product: **Waterside Economizer**  
Document: Specification Catalog and Design Guide



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