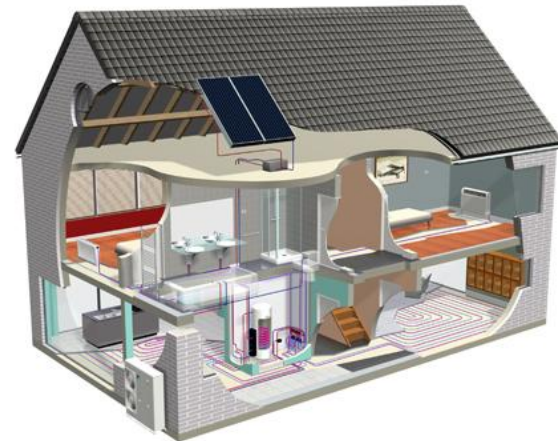


Lance Dyer  
Daikin AC Americas, Inc.  
Residential Solutions Sales Specialist



# Air-To-Water Heat Pump Hydronic System with Inverter Driven Compressor

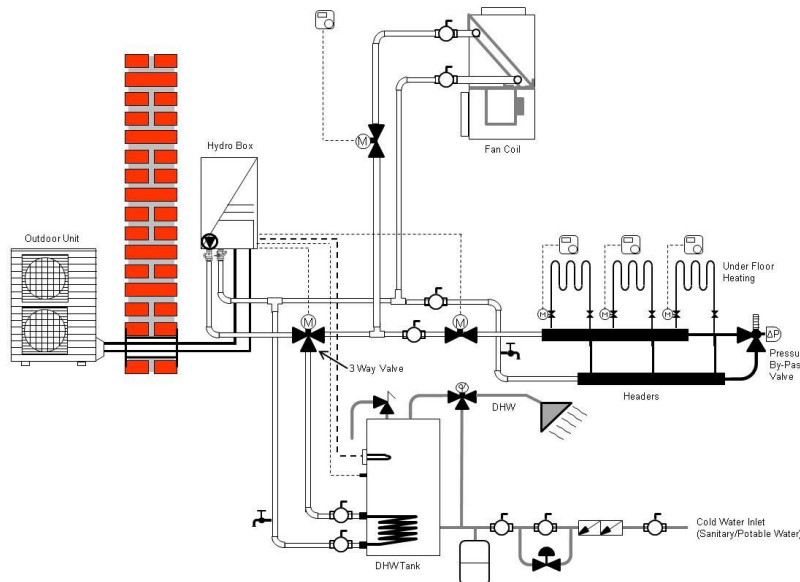
An Eco Friendly Solution for Low Energy  
Homes



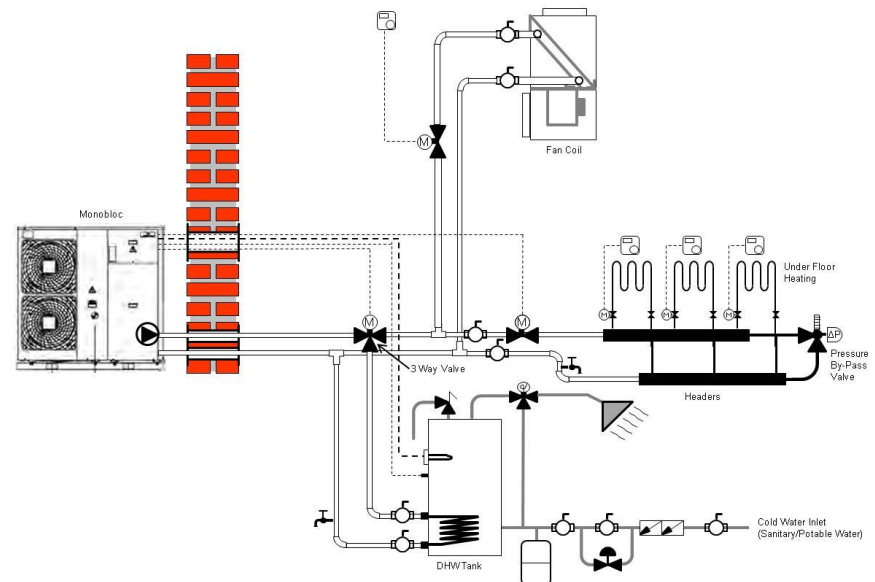
# Air-to-Water Heat Pump – What is it?

1. An Electrically Driven Total Comfort air-to-water heat pump system that utilizes an outdoor R-410A heat pump system
2. Most efficient work with an Inverter controlled compressor (variable speed), to extract renewable heat from the outdoor air
3. The system transfers this heat through refrigerant piping to a refrigerant-to-water brazed plate heat exchanger in the hydrobox (indoor unit on split system and incorporated in the outdoor unit on the Self Contained System).

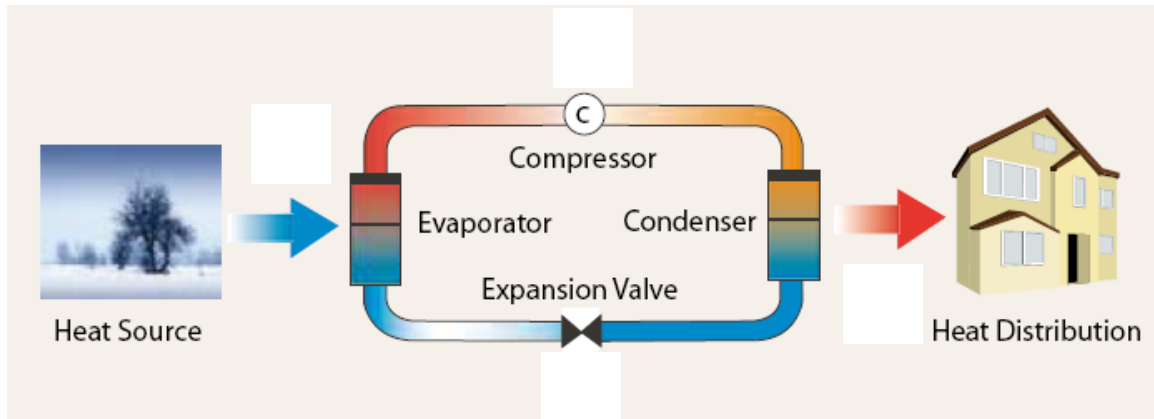
**Split System**



**Self Contained System**



# Air-to-Water Heat Pump



The air/water heat pump is an interesting alternative for classic gas or fuel oil heating that offer unique benefits:

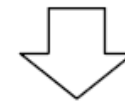
- Uses renewable energy sources (extracts heat from outside air)
- Delivers considerable savings in energy costs
- Delivers a significant contribution in the fight against CO<sub>2</sub> emissions
- Provide heating, cooling and domestic hot water

# Heat Pump Concept



## Example

The electrical (power) input to serve a 10kW electric resistance heat can produce at best case 34,130Btu/hr of Heat (based on COP of 1).



**A 3-ton Air-to-Water Heat Pump produces 35,300 Btu/h of heat with the equivalent electrical input of 3.17 kW will achieve a 3.26 COP. This is 3 times as efficient or uses a 1/3 of the power as electric resistance heat**

Not creating heat energy, only move heat from the outside to the inside.

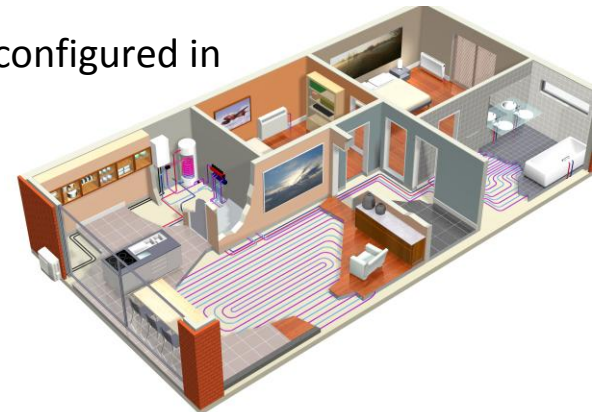
Localized CO<sub>2</sub> emissions = 0

# Why Hydronic Heating and Chilled Water Cooling?

Hydronic heating and chilled water cooling systems use water transported through piping to condition the air temperature inside a residence and heat DHW. A heat pump can accomplish all three functions. With hundreds of possible system configurations, the proper design is capable of meeting the exact comfort needs of its owner. Some systems using Air-to-Water Heat Pumps may be as simple as a heating only application connected to a loop of flexible plastic tubing that warms the floor. Others may use Air-to-Water Heat Pumps connected to an assortment of heat emitters like low temperatures radiators, fan coil units, or radiant in floor. Those same applications can also provide a residence with domestic hot water and chilled water for cooling.

# Whole House Comfort System

- Revolutionary INVERTER driven Air-to-Water Heat Pump Hot Water System aimed at providing a solution primarily for Heating.
- Air-to-Water Heat Pump offers the customer many advantages including:
  - Extremely Efficient Operation (versus Fossil Fuel & Resistance Heat Systems)
  - Significant Reduction of CO2 emissions
  - Possibility to integrate DHW and Cooling
- Heat Pumps are internationally recognized as “Renewable Energy” technology
- Air-to-Water Heat Pump System is extremely flexible and can be configured in many different ways, here are the different options:
  - A) Space Heating Only
  - B) Space Heating & DHW Production
  - C) Space Heating & DHW Production (With Solar)
  - D) Space Heating & Space Cooling
  - E) Space Heating, Space Cooling & DHW Production
  - F) Space Heating, Space Cooling & DHW Production (With Solar)





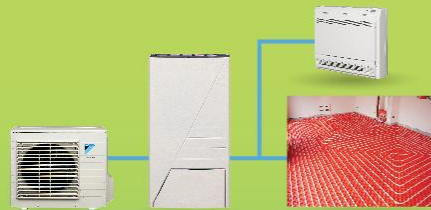
# HIGH EFFICIENCY

## HEATING, COOLING AND DOMESTIC HOT WATER SYSTEM

### HEATING AND COOLING (Or Heating Only)

### DOMESTIC HOT WATER (Optional)

SPLIT  
TYPE



ERLQ\_BA with EKHB\_030



18k  
Btu/hr  
1000 sq. ft



24k  
Btu/hr  
1300 sq. ft



30k  
Btu/hr  
1500 sq. ft



ERLQ\_BA with EKHB\_054



36k  
Btu/hr  
1800 sq. ft



48k  
Btu/hr  
2300 sq. ft



54k  
Btu/hr  
3000 sq. ft

EBLQ\_BA or EDLQ\_BA



MONO  
BLOC



50g  
1-3  
Person

80g  
2-5  
Person

Larger  
Tank  
via  
optional kit



Radiant Floor



Fan Coil Units

Fan Coil units and radiant floor, may be used in combination or independently

# Key Technology

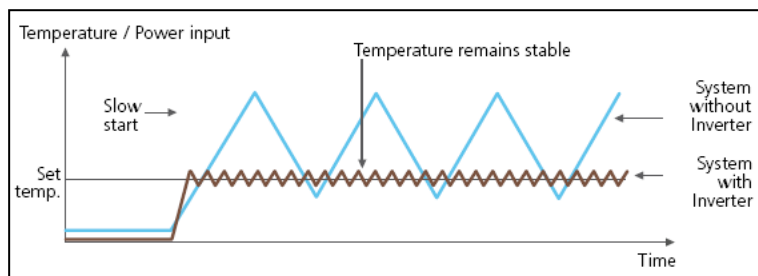
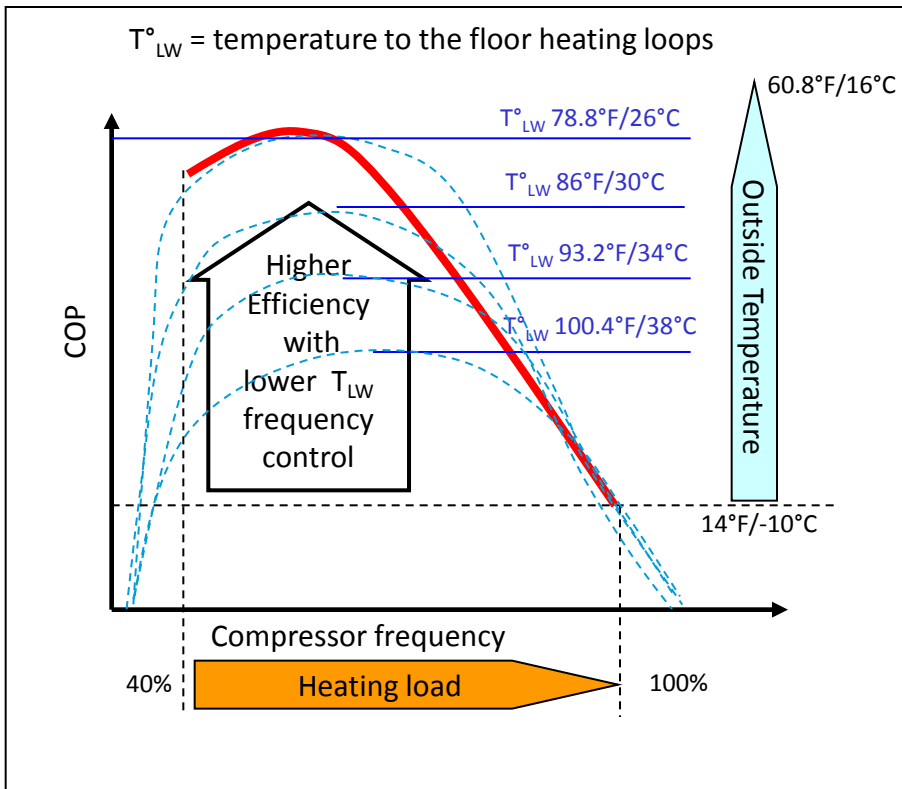
## Inverter Compressor



Frequency controlled compressor (variable speed)

Inverter control in combination with outdoor reset control results in excellent efficiencies (COP's).

- Maximum efficiency by controlling the compressor rpm, for adapting output and requirements.
- Maximum comfort under all conditions, including stable room temperatures
- Soft start-up
- Increased operating life, due to continuous partial-load operations



# Key Technology

## Benefits of an Inverter

### Great Heating Performance

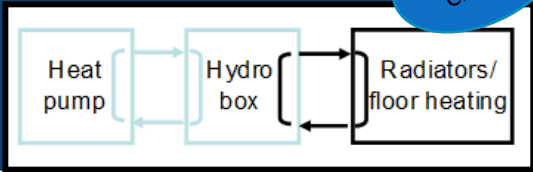
- Better control of evaporator temperature
- Outdoor unit fan/s speed is increased to achieve greater heat transfer
  - Generates higher discharge gas temperature and higher capacity at lower outdoor temperatures
  - Allows the heat pump to maintain 50% of its total capacity down to 5 F outdoor temperature

# How can it be applied?

Location Customizable

## Heat Pump Only

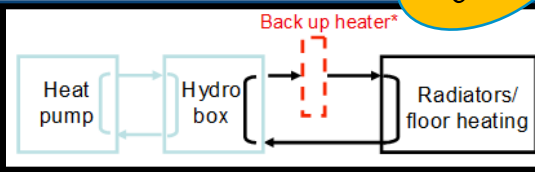
Mild Climate



100% Heat pump coverage : selection of bigger capacity and higher investment cost heat pump

## H/P + Electric B/U

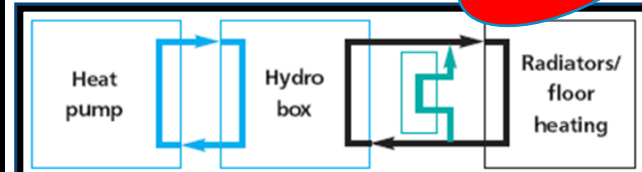
Cold Climate



Best balance between investment cost and running cost, results in lowest Lifecycle Cost

## Dual Fuel

Ultra- Cold Climate



Utilization of Heat Pump then switching over to alternative heat source like boiler for ultra cold climate heating days

Ultimate Flexibility

New Construction

Concealed Units or Duct Free exposed

Cooling

Solar

Renovation / Replacement

Self Contained or Split System

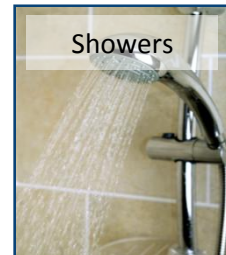
Space Heating

Zoning or Single Zone

Partial house or Whole House

Domestic Hot Water

Home Comfort



# Selection Conditions for Air-to-Water Heat pump System

Typical conditions for the heating LWT are:

86 to 95°F (at design conditions) for floor heating

86 to 113°F (at design conditions) for fan coil units and

104 to 122°F (at design conditions) for low temperature radiators

Typical conditions for cooling LWT are:

41 to 71°F (at design conditions) for fan coil unit

# A Great Solution for LEED, Low Energy & Net Zero Energy Homes

The Air-to-Water Heat Pump portfolio offers many attributes that make it appealing to the “green” movement with LEED, Low Energy and even Net Zero Energy applications.

Scope	Feature / Attribute
Environment	<ol style="list-style-type: none"><li>1. All Equipment contains materials that are fully <b>recyclable</b>.</li><li>2. Inherent design and operational features mean effective tie in to <b>Grid-Tied Solar PV</b> (Low start up amps, operating amps, no locked rotor amps etc).</li><li>3. DHW Production via Optional <b>Solar Thermal</b> solution and using the Air-to-Water heat pump.</li><li>4. A Heating and DHW solution with <b>NO Localized CO2 emissions</b>.</li></ol>
Efficiency	<ol style="list-style-type: none"><li>1. Enhanced energy savings via <b>Inverter Compressor</b> operation where energy consumption matches the load.</li><li>2. Further savings via the <b>Outdoor Reset Function</b> to control LWT depending on Ambient temperatures.</li><li>3. Operational <b>efficiencies (COP up to 4.5) similar to or better than Geo-Thermal WSHP</b> solutions, without the added cost of well drilling, excavation etc</li></ol>
Application	<ol style="list-style-type: none"><li>1. Excellent <b>flexibility for the architect / designer</b> to apply the Air-to-Water system to suit any home design, scale or performance scope.</li><li>2. Unobtrusive and <b>aesthetically pleasing</b> complete Heating, Cooling and DHW</li><li>3. Full utilization of hydronic circuit, thus small diameter piping, high heat transfer coefficient and comfort of <b>Low Sound Level</b> In-Floor Radiant, Low Velocity Fan Convectors or Radiators.</li></ol>

# LEED Certified

- 3-Ton Air-to-Water Heat Pump + DHW solution installed to 1800sqft New Construction Home in Oregon in 2009.
- Customer has been monitoring energy consumption since then.
- Selected as better alternative to Geo-WSHP due to landscaping restrictions.



LEED Platinum Certified

- Received HERS rating of 62 (thus 5-Star+ Home)
- Low environmental impact
- High efficiency system
- Will be incorporated to solar thermal in future
- Already grid tied solar PV
- Low monthly operating costs
- Radiant Heat utilized for enhanced comfort
- **1<sup>st</sup> year home energy costs average less than \$2 per day**

# Net Zero Certified



- Location California
- **Square Footage** **2023**
- % Energy Star App 100%
- % High Efficiency Lighting 25%
- Insulation Levels Medium
- Glazing U-Value/SGHC 0.6/6.5
- HVAC System **4.5-Ton Air-to-Water H/P**
- PV System Size 7.4 KW
- PV System SF 429
- PV System Cost \$19,917
- **Added Cost Mortgage** **\$107/MO**
- OP Cost Standard House \$283/MO
- CO2 Emissions Saved (lbs/yr) 10,284
- **\$ Saved Per Year After Tax** **\$4,571**

# HERS Certified

- **New Hampshire – Twin Ponds Complex**
- Type
  - Apartment complex with 160 apartments
- Total Area
  - 160,167sq/ft
- Average apartment size
  - 1,000sq/ft
- Insulation Level
  - R-50
- Energy Level
  - Ended up as HERS Certified Index score of 68
- Winter Design Condition
  - 19.8° F
- Heating Load
  - Up to 15,700 Btu/hr per apartment
- Air-to-Water heat pump system selected
  - 160x 3-Ton Air-to-Water Heat Pump System (total is 480-Tons)
  - 160x 50Gallon DHW Tanks
- Heating/Cooling Distribution
  - Fan Coil Unit for both Cooling and Heating



# Conclusions

- Eco-efficient design.
- Utilization of Renewable energy from the Outside Air.
- High Full Load and Excellent Part Load Efficiencies.
- Attractive, “affordable” system price.
- High operating and service reliability.
- Low installation costs.
- Flexible and simple installation.
- Adaptable to Radiant Floor, Fan Coil & Radiator Applications
- No local consumption of fossil fuels.
- 30-98% reduction in total CO<sub>2</sub> emissions.
- Optional year-round comfort with active cooling function.
- Simple match up for Solar Thermal and/or Grid Tied Solar PV.
- Excellent solution for Low Energy / **Net Zero Homes**

Questions ?

Thank You