DAIKIN UNIVERSITY

# Daikin Altherma Product & Applications

## Participant Guide

# Instructor Introduction Product and Application

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Presenter's Name

Presenter's Title

## Instructor Introduction

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## Course Introduction

- Introduce an electric hydronic system that heats and cools the space, and can supply domestic hot water.
- Eco-efficient air-to-water heat pump hydronic system.
- Introduced in Europe in 2006, a unique combination using existing Daikin technology.
  (Over 200,000 systems sold in Europe)
- ALTHERMA, DAIKIN's solution for the hydronic heating market
  (with optional cooling).

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## Course Introduction – Table of Contents

- Daikin AC Introduction
- Background and Overview
- Positioning
- Overview of Hydronic Heating and Cooling
- Key Technologies
- Performance and Specifications
- Applications
- Design and Selection
- Selection Software
- Selection Workshop
- Basic Installation Requirements
- Solar Thermal
- Fan Coil

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# Introduction to Daikin



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A History of Integrity, Quality, Growth,
and Cutting Edge Technology

*Please silence cell phones now.*



## Learning Objectives

- Basic understanding of Daikin's history and VRV® technology
- Understand Daikin Industries' position in the global marketplace
- Understand where to go for sales and technical support
- Know what other resources are available to you and how to use them to your advantage
- Understand Daikin's commitment to the environment and the industry

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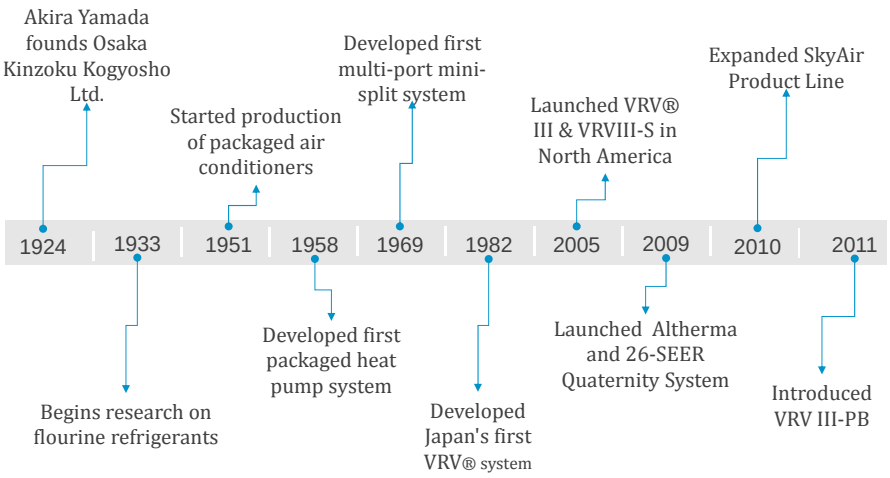
## History (1924 - Present)

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## What is VRV?

- Variable Refrigerant Volume is the patented technology that varies the flow of refrigerant to the individually controlled indoor fan coils
- Achieved through a continuously connected piping system
- Advances the comfort and energy efficiency of a building during its heating and cooling cycles

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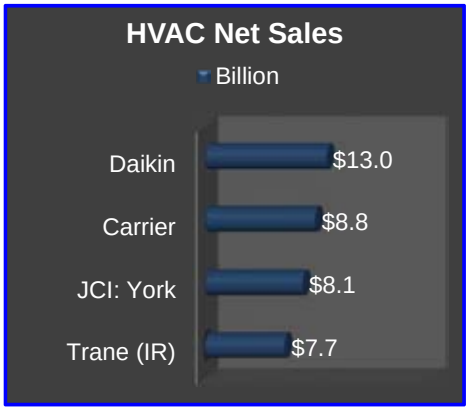
# Daikin's Global Position

- Daikin is the #1 HVAC/R Manufacturer in the world!
- Net sales in HVAC
  - 2010 - $10.8 Billion
  - 2011 - $13.0 Billion
- We lead the way in:
  - Energy efficiency
  - Individualized comfort
  - Quality




Carrier, Daikin, JCI: York, & Ingersoll Rand Investor Relations Publications
Source: Daikin Estimation, SEC Financial Data for 2011

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# Global Business Ranking


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## Global 100 Most Sustainable Companies

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- Solid, reliable products
- Profitable for investors
- Progressive environmental policy
- Sound business strategy

MOST SUSTAINABLE CORPORATIONS GLOBAL 100

**2007 - 2008 - 2009**

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## Daikin Global Sales Revenue

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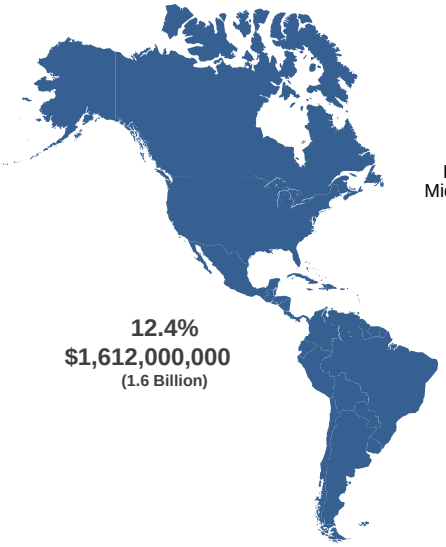
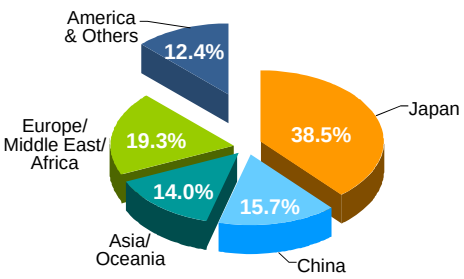


**12.4%**
**$1,612,000,000**
**(1.6 Billion)**

**$13.0 Billion USD**
**World Wide**

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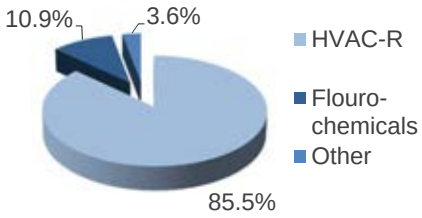
# Daikin's Core Business

- About 85% of Daikin's business is dedicated to HVAC-R.
  - 85.5% HVAC-R
    - Commercial
    - Residential
    - Refrigeration
  - 10.9% Flouro-chemicals
    - Refrigerants
    - Coatings
    - Repellants
  - 3.6% Other Interests
- HVAC-R is Daikin's CORE business!




**Fiscal 2011 - $13.0B in Sales**

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# Acquisitions

| McQuay | AAF | J&E Hall |
|---|---|---|
| • Indoor/outdoor AHUs<br>• Air/water cooled chillers<br>• Fan coils<br>• PTAC units<br>• Water source heat pumps | • Filtration systems<br>• Industrial pollution control<br>• "Clean rooms"<br>• Commercial/industrial HVAC<br>• Nuclear applications<br>• Diesel engine exhaust filtration<br>• Home filtration products | • Commercial/industrial HVAC |

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North America

## DAIKIN AC (AMERICAS) INTRODUCTION

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## Daikin AC (Americas) – Past & Present

- 2004 - Research and Development (R&D) team formed in New York City
  - Tasked with the development of a North American strategy
  - Sales, Service, & Marketing teams were deployed to implement it
- 2005, Daikin AC (Americas), Inc. was established in Carrollton, TX
- Plan of 50% annual growth put into place
- Employs a distributor based system and will never undercut contractor or distributor by selling directly to the end user

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## Daikin AC (Americas) – Our Vision

**Our vision is to be the premier provider of the highest quality air conditioning products, systems, services, and solutions in North America by focusing on outstanding, long-term customer service.**

To accomplish this, we will continue to hire the best people, always conduct our business easily and fairly, and operate with the highest degree of integrity in all business practices.

In order to attract and retain the best people, we are committed to providing the best training and creating an atmosphere of teamwork where we help each other grow.

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## Daikin AC Sales/Service Locations


Daikin AC National Sales Headquarters & Training Center
Carrollton, TX

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## Daikin AC Sales/Service Locations


Daikin AC Western Regional Sales & Training Center
Irvine, CA

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## Daikin AC Sales/Service Locations

Daikin AC Eastern Regional Sales & Training Center
Long Island City in Queens, NY

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## Daikin AC Sales/Service Locations

- Latin America & Southern Zone Office in Miami, FL
  - On-site and local training
  - Equipment and showroom tours
- Daikin-McQuay Sales & Training Center in Marietta, GA
  - On-site and local training
  - Equipment and showroom tours

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## Daikin AC, Inc. Sales Regions


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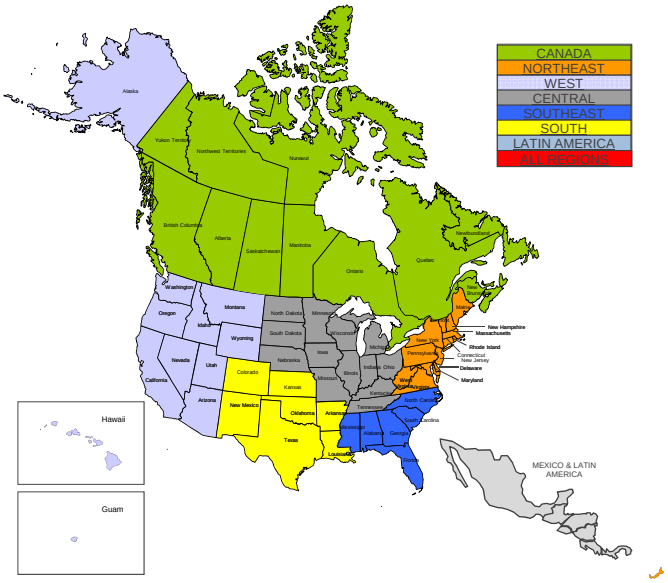
# Daikin AC, Inc. Service Regions




**Director of Service**

| | |
|---|---|
| Tom Pivovar | |

**Call Center**

| | |
|---|---|
| Debi Burgart | AST. Manager |
| Mike Wertzberger | Internal Support |
| Frank Melendez | Internal Support |
| Ricardo Berrios | Internal Support |
| Chris Aldridge | Internal Support |
| Yun Lee | D-Net Specialist |
| Satoshi Okayama | Service Planner |

**Regional Service Manager**

| | |
|---|---|
| James McGory | West/Central Western Canada/Guam |

**Field Service Staff**

| | |
|---|---|
| Kris Dryer | Northeast/Eastern Canada |
| Carl Gratzer | Northeast |
| Leonard Jefferies | Southeast |
| Shawn Quigley | Central |
| Pat Sankolewicz | Central |
| Fred Weddington | Central |
| Ariel Rivero | Mexico/Latin America |
| Kenny Myers | South |
| Bryan Weymouth | West |
| Mark Harte | West |

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# Daikin Support

- **Literature**
  - Brochures
  - Leaflets
  - Submittals
  - Manuals
    - Engineering
    - Service
    - Installation
- **Website**
  - www.Daikinac.com
- **Daikin Representatives and Sales Support Network**


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## Daikin Support

- **Software Tools**
  - VRV Xpress
  - Energy Calc
  - TRL Technical Reference Library
  - Spare Parts Bank
  - Dr. Daikin
- **Training**
  - Sales & Applications by Product Line
  - Installation & Commissioning
  - Service & Troubleshooting
  - General Courses
- **Technical Support**
  - Telephone: 866-4DAIKIN (866.432.4546)
  - Email: techsupport@daikinac.com

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## Daikin's Social Responsibility

- Recover – Recycle – Reclaim – Reuse
- Partnerships with AHRI, ASHRAE and others


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# Environment

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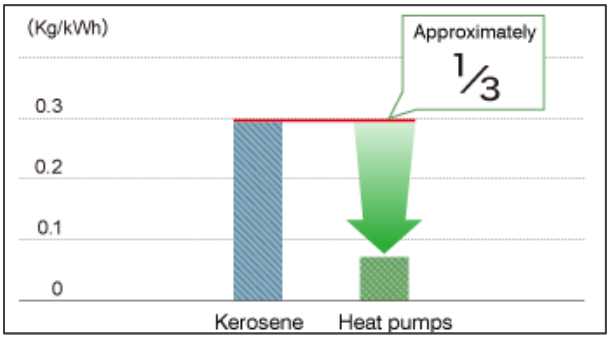
**Reduce $CO_2$ with Heat Pump Systems**

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# Learning Objectives

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- Basic understanding of Daikin's history and VRV® technology
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- Understand where to go for sales and technical support
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# Daikin Altherma Background and Introduction



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## Drivers to a Changing Heating Market

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- The Heating Market is Changing
  - **Energy prices** : ever rising prices of fossil fuels due to increasing demand and reduced availability
  - **Ecological concern** : efforts to reduce emmissions of green house gases and energy consumption
  - **Changing legislations, incentives** : to support the drive towards major changes in energy consumption habits for the purpose of achieving ecological targets in an effort to slow down, stop or even reverse climate change.

 

## Daikin Altherma System Introduction

- Innovative solution
- Integrated unit for space heating, space cooling and domestic hot water with solar thermal option
- Uses a heat pump to heat water for space heating and domestic hot water
- Uses the reverse cycle of the heat pump to chill water for space cooling
- Renewable energy has a key role to play in reducing CO2 emissions and, in particular, the installation of a Altherma system is an effective way of reducing a building's carbon footprint, therefore helping the environment.

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## What is Daikin Altherma?

- Daikin Altherma is an Electrically Driven Total Comfort air-to-water heat pump system that utilizes an outdoor R-410A heat pump system
- It works with an Inverter controlled compressor, to extract heat from the outdoor air
- 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 Mono Bloc System) Low Temp System

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*Did you know that …*

**Altherma is available in Split & MonoBloc configurations**

## What are some of Benefits

**What are some of Benefits that DAIKIN ALTHERMA Offers?**

- Complete renewable solution for home heating and hot water
- Deliver considerable savings in energy
- Significant contribution in the fight against CO2 emissions
- Cost effective on installations
- Low energy consumption
- Safe, easy to maintain and comfortable all year round
- No Flues, fuel lines or fuel tanks
- Providing all your heating and hot water needs throughout the year

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## DAIKIN ALTHERMA Offers

**The Altherma system:**

- Can be set up to operate in one or more multiple modes space heating, space cooling, and water heating
- Can be configured by the installer to meet varying needs using combinations of equipment having different operational parameters and with different control schemes.
- The system's design and installation are field adjusted and engineered dependent on the actual building, climate zone, and conditioning functions necessary for the occupant's needs.



 

## DAIKIN ALTHERMA Offers

- With inverter-driven technology the system compressor which converts free energy from the air and upgrades it to higher temperatures suitable for heating.
  The inverter control regulates the system so that heat output modulates to match the exact capacity required, meaning the load will only consume the exact energy needed at any given time.

- Can be configured by the installer to meet varying needs using combinations of equipment having different operational parameters and with different control schemes.

- The system's design and installation are field adjusted and engineered dependent on the actual building, climate zone, and conditioning functions necessary for the occupant's needs.



 

## With DAIKIN ALTHERMA product, DAIKIN has entered the true HEATING market

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**In 2006 DAIKIN entered the European-heating market using an air to water heatpump**
**In 2009, Daikin AC launched this technology in the U.S**

- Savings on running costs by high COP compared with Gas/Oil boilers
- Friendly for the environment
- Differentiation with cooling function against boilers

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### Product differention

1. **Savings on running costs**
   -40% compared to fuel boilers
   -25% compared to gas boilers
2. **Environmently friendly**
   60 % savings on $CO_2$-emissions
3. **Easy installation**
   No need for chimney
   No need for fuel storage tank
   No need for connection to gas supply
   No worries about CO

### Water heating market

**Heat source market:**

**2009**

Low temp : **30°C to 55°C**
**86°F to 131°F**

Floor heating

Fan Coil Unit

**DAIKIN original strategy:**

Enter the LOW temperature heating market by development of an HFC-based H/P (410A)

## Daikin Altherma - THE 3 IN 1 GUARANTEE FOR ABSOLUTE COMFORT

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Daikin Altherma™ is a unigue system that **heats**, produces **domestic hot water** and can even **cool** spaces. Altherma™ offers maximum year round comfort.

**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 $CO_2$ emissions
- Provide heating, cooling and domestic hot water

 

## What Type Of Saving On My Operation Cost With Daikin Altherma vs. Traditional Heating System?

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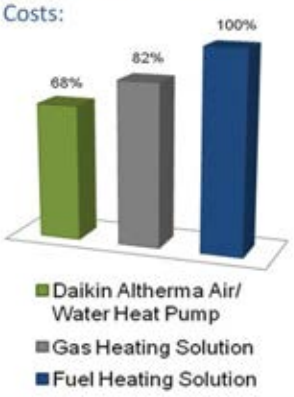
Altherma system works more efficiently and saves more energy than a traditional heating system that using fossil fuel.

Daikin Altherma generates at least 3 to 5 kW of additional heat per 1kW of electricity used and 66 to 80% additional heat.

The Daikin Altherma heat pump boiler works more efficiently and saves more energy than a traditional heating systems using fossil fuel. Typical Operating Costs:




OPERATING COSTS: Conditions: Required annual heating energy: 20,000 kWh. Source: Energy prices based on EUROSTAT statistics [first semester 2007]

# Daikin Altherma Model breakdown

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| Split Type Low Temperature | | Model Number | Heating Capacity Btu/h | Cooling Capacity Btu/h | Power Supply (V/Ph/Hz) |
|---|---|---|---|---|---|
|   |   | ERLQ018BAVJU | 19,600 | 24,500 | 208-230/1/60 |
| | | ERLQ024BAVJU | 23,300 | 27,800 | 208-230/1/60 |
| | | ERLQ030BAVJU | 28,700 | 28,500 | 208-230/1/60 |
| | | EKHBH030BA3VJU | 30,000 | | 208-230/1/60 |
| | | EKHBH030BA6VJU | 30,000 | | 208-230/1/60 |
| | | EKHBX030BA3VJU | 30,000 | | 208-230/1/60 |
| | | EKHBX030BA6VJU | 30,000 | | 208-230/1/60 |
|   |   | ERLQ036BAVJU | 38,200 | 47,600 | 208-230/1/60 |
| | | ERLQ048BAVJU | 47,800 | 59,100 | 208-230/1/60 |
| | | ERLQ054BAVJU | 54,600 | 60,600 | 208-230/1/60 |
| | | EKHBH054BA3VJU | 54,000 | - | 208-230/1/60 |
| | | EKHBH054BA6VJU | 54,000 | - | 208-230/1/60 |
| | | EKHBX054BA3VJU | 54,000 | - | 208-230/1/60 |
| | | EKHBX054BA6VJU | 54,000 | - | 208-230/1/60 |

| MonoBloc Low Temperature | | Model Number | Heating Capacity Btu/h | Cooling Capacity Btu/h | Power Supply (V/Ph/Hz) |
|---|---|---|---|---|---|
|   | Heating Only | EDLQ036BA6VJU | 38,200 | - | 208-230/1/60 |
| | | EDLQ048BA6VJU | 47,800 | - | 208-230/1/60 |
| | | EDLQ054BA6VJU | 54,600 | - | 208-230/1/60 |
| | Heat Pump | EBLQ036BA6VJU | 38,200 | 47,600 | 208-230/1/60 |
| | | EBLQ048BA6VJU | 47,800 | 59,100 | 208-230/1/60 |
| | | EBLQ054BA6VJU | 54,600 | 60,600 | 208-230/1/60 |

| | Model Number | Tank Volume |
|---|---|---|
| Optional Domestic Hot Water Tank | EKHWS050BA3VJU | 50 Gallon (Actual 52.8 Gallon) |
| | EKHWS080BA3VJU | 80 Gallon (Actual 79.2 Gallon) |
| 3rd Party Tank Connection Kit | DACA-DHW-KIT-1 | 40G, 50G, 80G, 119G |

1. A wide line up of product available to meet varying applications & house sizes.
2. Daikin Altherma is available from 18kBtu/hr to 54k/Btu/hr nominal Heating Capacity
3. 6 different capacity sizes available and supported with Heating Only & Heat Pump Hydroboxes.
4. 3kW and 6kW back-up heater options

*Did you know that …*

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# Nomenclature Outdoor Unit

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E R L Q 054 BA VJU

- E — European Model
- R — Outdoor Unit
- L — Heat Pump
- Q — Refrigerant R-410A
- 054 — Nominal Heating Capacity
  - 054 = 54,000 BTUH
  - 048 = 48,000 BTUH
  - 036 = 36,000 BTUH
  - 030 = 30,000 BTUH
  - 024 = 24,000 BTUH
  - 018 = 18,000 BTUH
- BA — Series (Minor Change)
- VJU — Single Phase, 208/230V-60 HZ

 

## Nomenclature Hydrobox

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| EK | HB | X | 054 | BA | 6 | VJU |
|---|---|---|---|---|---|---|

- VJU: Single Phase, 208/230V, 60 Hz
- 6: Backup Heater Capacity 3 or 6 kW
- BA: Series
- 054: Nominal Capacity 054 = 54,000 BTUH, 030 = 30,000 BTUH
- X: X = Heat Pump, H = Heating Only
- HB: Hydro Box
- EK: European Kit

 

# Nomenclature Outdoor Unit Monobloc

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| E | D | L | Q | 054 | BA | 6 | VJU |
|---|---|---|---|---|---|---|---|

- VJU: Single Phase, 208/230V, 60 HZ
- 6: Backup Heater Capacity (6kW)
- BA: Series (Minor Change)
- 054: Nominal Heating Capacity 054 = 54,000 BTUH; 036 = 36,000 BTUH, 048 = 48,000 BTUH
- Q: Refrigerant R-410A
- L: Heat Pump
- D: Outdoor Unit (MonoBloc); D = Heat Only; B = Heat Pump
- E: European Model

## Nomenclature DHW Tank and DHW Kit

EK HWS 050 BA 3 VJU

- VJU: Single Phase, 208/230V, 60 HZ
- 3: Booster Heater Capacity 3 kW
- BA: Series
- 050: Storage Capacity in Gallons (50 & 80 Gallons)
- HWS: Hot Water Stainless Steel Tank
- EK: European Kit

DACA-DHW-KIT-1

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## Nomenclature Solar Kit

EK — European Kit

SOL — Solar Kit

HW — Domestic Hot Water

BA — Series

VJU — Single Phase, 208/230V 60 HZ

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## Nomenclature Room Thermostat

EK RT W A

Series

W = Wired

Room Thermostat

European Kit


Thermostat (powered by 3 alkaline batteries AA.LR6 1.5V, Battery life approximately 2 yr)

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# Nomenclature Fan Coil Unit

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**Model Nomenclature**

| E | FW | T | 024 | A | E | VL | U | -00 |
|---|---|---|---|---|---|---|---|---|

- E = Alfhermia Equipment
- FW = Hydronic Fan Coil Unit
- T = Ducted (Upflow, Horizontal L & R)
- Nominal Capacity (xBtu/hr)
  - 024 = 24,000 Btu/hr
  - 036 = 36,000 Btu/hr
  - 048 = 48,000 Btu/hr
  - 060 = 60,000 Btu/hr
- A = Model Series
- E = Motor Configuration
  - E = ECM Fan Motor
  - P = PSC Fan Motor
- VL = 120V / 1 / 60hz
- U = UL Certified
- -00 = Factory Installed Electric Heat
  - 00 = No Electric Heat
  - 05 = 5kW Electric Heat
  - 10 = 10kW Electric Heat
  - 15 = 15kW Electric Heat
  - 20 = 20kW Electric Heat
  - 25 = 25kW Electric Heat

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# Daikin Altherma Solution Positioning in the Market Place



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## Contents





 

# Market Drivers – Home Energy Consumption

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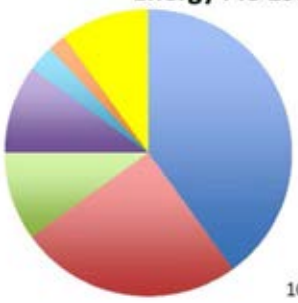
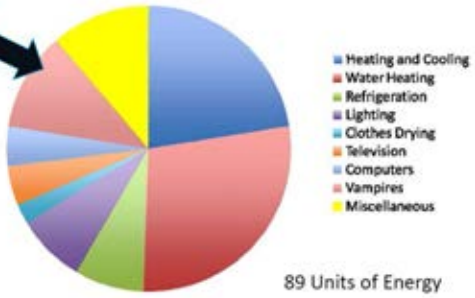
**Energy Pie 1990**




100 Units of Energy

- Overall Energy Use in the home has reduced since 1990 levels.
- Influence of improved efficiency standards for Heating & Cooling as well electronic devices is clear to see.

**Energy Pie 2010**




89 Units of Energy

- Water Heating ratio though has "increased" from 1990 to 2010 (15% > more than 25%)
- Improving efficiency of Water Heating especially is likely the next major energy saving movement.

Source: Affiliated International Management, LLC

## Market Drivers – Fuel Source, Environment

1. Now is the time to rethink the way we heat and cool our homes and provide domestic hot water.
2. Central Air systems as we know them today are about to change dramatically.

**But Why?? (we have been doing this for 100yrs after all)….**

a) Fossil fuel sources are becoming increasingly restricted. Everyone is concerned about reducing their energy bills. And the more eco-conscious among us also want to reduce our impact on the environment by using renewable energy sources.
b) Daikin's Air source heat pumps are a very comfortable solution for cooling needs and provide a very powerful alternative to traditional heating solutions.
c) Daikin systems can eliminate the need for a fossil fuel heating system and are highly efficient, with 1kW of electricity consumption generating 3kW to 5kW of renewable heat throughout the year.
d) Daikin's efficient heating and cooling solutions make maximum use of the renewable energy all around us, converting free heat from the air and the sun to deliver completely reliable and controllable heating and hot water for homes, even when temperatures outside are below zero.



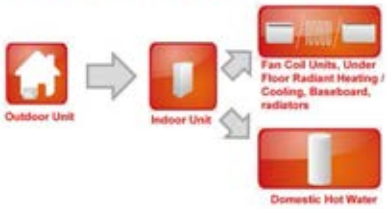
 

# The evolution of Heat Pump technology

- Daikin's Heat Pump range of solutions deliver:
- Savings on running costs
- Reduction in CO2 emissions
- Flexible and simple installation
- Low noise units
- Eco-efficient design
- Safe, easy maintenance
- High operating and service reliability
- Solutions for new homes and for retrofit
- Optional year-round comfort with active cooling function.

**AIR to WATER HEAT PUMP – For Heating, DHW and Cooling**

An air to water heat pump captures (free) heat present in the outside air to be discharged as heat via a hydronic (water) circuit. Along with providing the means to cool rooms in summer time, an air to water heat pump can also produce domestic hot water, for total 3 in 1 comfort.




Customized comfort, all wrapped up
Installation for a single zone to a whole house

Taking advantage of Daikin's state of the art Air to Water HP systems can deliver a very satisfying "total" solution to your customers.

Enjoy the flexibility of configuring the system to exactly match the customers needs, desires and ultimate comfort expectations



## Why use a Heat Pump?


- Heat pumps are considered the most energy efficient, electrically operated heating and cooling system on the market today. Daikin Altherma air-to-water heat pump delivers between 3 to 5 kWh of usable heat for every 1 kWh of electricity it uses.

  To measure how efficient a system is we compare the amount of power needed to run it and the energy it outputs.
  This ratio is expressed as the Coefficient of Performance or COP. A traditional electric heater has a COP of around 1: every 1kW of power used produces only 1kW of heat, a gas boiler has a COP of less than 1

- Typically draws approximately 1/3 to 1/4 of the electricity of a standard resistance heater for the same amount of heating, reducing utility bills. This typical efficiency (300% to 400%) compares to 70-95% for a fossil fuel-powered boiler
  (fuel oil and gas).



# Why use a Heat Pump?

- As an all electric system, no flammable or potentially asphyxiating fuel is used at the point of heating, reducing the potential danger to users, and removing the need to obtain gas or fuel supplies.
- The convenience of a single monthly utility invoice for your heating, cooling and hot water needs.
- May be used to heat water for space heating and domestic hot water (DHW) and can be used to chill water for space cooling.
- The same system may be used for air conditioning in summer, heating system in winter as well as heating DHW.
- Daikin Altherma with inverter technology to run a variable speed compressor, reduces cycle losses, and with a turn down ratio of 7 to 10 adds comfort by load matching. It also saves electricity and extends the life of the compressor.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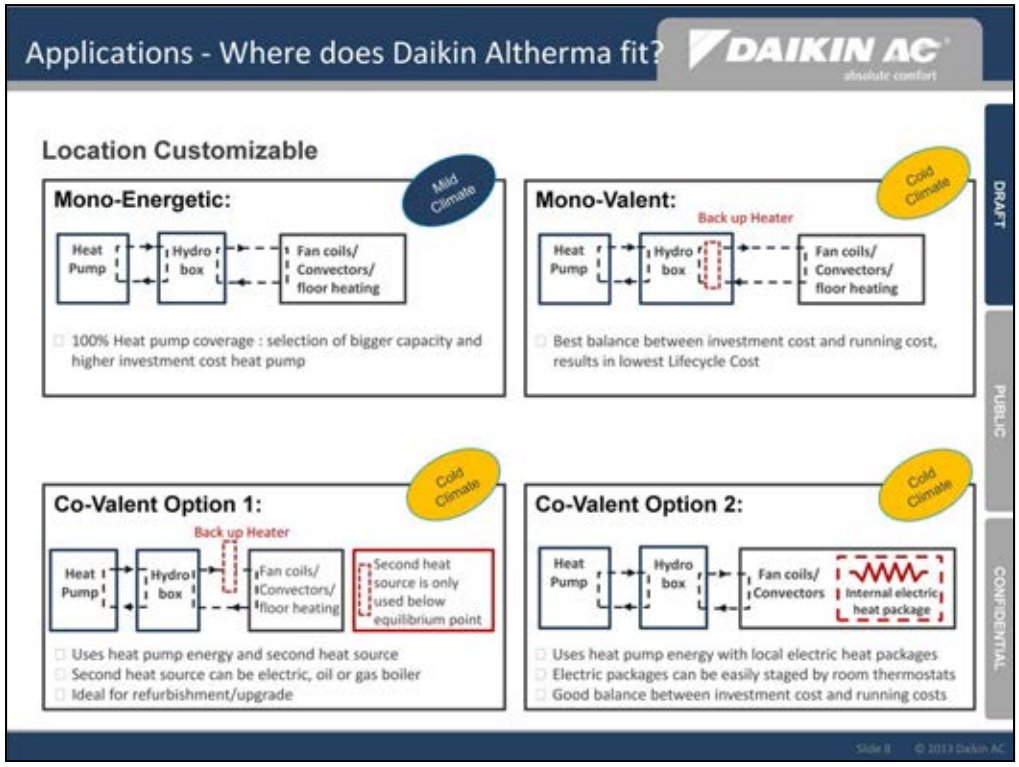
Applications - Where does Daikin Altherma fit?
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Location Customizable
Mono-Energetic:
Mild Climate
Heat Pump
Hydro box
Fan coils/ Convectors/ floor heating
100% Heat pump coverage : selection of bigger capacity and higher investment cost heat pump
Mono-Valent:
Cold Climate
Back up Heater
Heat Pump
Hydro box
Fan coils/ Convectors/ floor heating
Best balance between investment cost and running cost, results in lowest Lifecycle Cost
Co-Valent Option 1:
Cold Climate
Back up Heater
Heat Pump
Hydro box
Fan coils/ Convectors/ floor heating
Second heat source is only used below equilibrium point
Uses heat pump energy and second heat source
Second heat source can be electric, oil or gas boiler
Ideal for refurbishment/upgrade
Co-Valent Option 2:
Cold Climate
Heat Pump
Hydro box
Fan coils/ Convectors
Internal electric heat package
Uses heat pump energy with local electric heat packages
Electric packages can be easily staged by room thermostats
Good balance between investment cost and running costs
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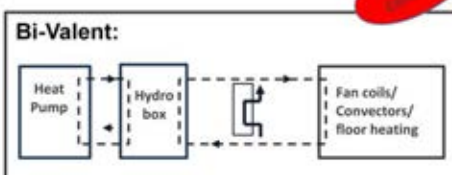
## Applications - Where does Daikin Altherma fit?

**Bi-Valent:**




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

Ideal for Refurbishment/Upgrade

**Space Heating with an Auxiliary Boiler**

1. Space heating application by either the Daikin Altherma Hydro-box or by an Auxiliary boiler connected in the system.
2. An auxiliary contact decides whether the Hydro-box or the boiler will operate.
3. The auxiliary contact can be an outdoor temperature thermostat, an electricity tariff contact, a manually operated contact etc.
4. Domestic Hot Water in such an application is always produced by the System Tank connected to the Hydro-box, including when the boiler is in operation for space heating.



## Applications - Where does Daikin Altherma fit?

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**Ultimate Flexibility**

- New Construction
- Concealed Units or Duct Free exposed
- Cooling
- Solar
- Renovation / Replacement
- Mono-Bloc or Split System
- Space Heating
- Zoning or Single Zone
- Partial house or Whole House
- Domestic Hot Water

**Home Comfort**


 

# What are the key attributes of Daikin Altherma?

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**ENVIRONMENT**

1. All Equipment contains materials that are fully recyclable.
2. Daikin Altherma system inherent design and operational features mean effective tie in to Grid-Tied Solar PV (Low start up amps, operating amps, no locked rotor amps).
3. DHW Production with a 3rd Party Solar Thermal solution and using the "Aero Thermal" Daikin Altherma serving as the Auxiliary Solution.
4. An air source Heating and DHW solution with NO Localized Gas or Oil consumption thus reduced CO2 emission, NO Gas venting, NO drilling and NO safety concerns.

**EFFICIENCY**

1. Enhanced energy savings via Inverter Compressor operation where energy consumption matches the load, with further savings via the Outdoor Reset Function to control water temperatures provided in relation to the current Ambient temperatures.
2. Operational efficiencies (COP up to 4.5) similar to or better than Geo-Thermal WSHP solutions, without the added cost of well drilling and land excavation.
3. Reduced utility capital costs with typically only a 50A electrical circuit required for the entire Heating, Cooling and DHW Solution.

**APPLICATION**

1. Excellent flexibility for the architect / designer and developer to apply the Daikin Altherma system to suit any residence design, scale or performance scope.
2. Unobtrusive, space saving and aesthetically pleasing complete Heating, Cooling and DHW solution.
3. Full utilization of hydronic circuit, meaning small diameter piping, high heat transfer coefficient and the excellent comfort of Low Sound Levels from In-Floor Radiant, Low Velocity Fan Convectors or Radiators.

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# What are the key applications for Daikin Altherma?

- Residential Applications
- The Daikin Altherma systems offers complete flexibility for both new construction, complete refurbishment or partial renovation "residential" projects.

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## Partial Renovation

1. Use Daikin Altherma to enhance an existing home with the addition of a dedicated "radiant heat" zone in living / common areas
2. Install dedicated systems just for bedroom / bathrooms to enhance comfort and appearance

## Single Family New Construction or Renovation

1. The ultimate in flexibility, customize your design to suit any application scope.
2. Configure and integrate systems with a multitude of heat emitter options including In-Floor Radiant, Radiators, Fan Coils, Fan Convectors.
3. Enhance efficiency with tie into Solar Thermal (DHW), Solar PV (Energy) and peak load shifting (Smart Grid)

## Multi Family Buildings

1. Full utilization of the Air Source HP for complete 3 in 1 package of Heating, Cooling and DHW.
2. Meet the regular scope of Multi Family buildings with tailored capacity and optimum DHW tank availability but with elimination of all fossil fuel requirements.
3. All tenants get advantage of dedicated system & single invoice!

## What are the key applications for Daikin Altherma?

- Light Commercial Applications
- The Daikin Altherma systems is a compelling option to consider for many light commercial applications where the following requirements may exist: -

1. Defined Heating, Cooling and Domestic Hot Water needs throughout the year.
2. Replacement of older Fossil Fuel Heating Only systems (such as Oil Heat) and limited scope to upgrade to include Cooling (lack of ducts for example).
3. Desire to enhance building / aesthetics with Radiant UFH
4. Limited but regular DHW Consumption is required.
5. Applications where forced air is not desirable (anti allergy etc).




 

# How does Daikin Altherma Compare?
# Air to Air Systems

1. The staple of the U.S. Residential Market.
2. Market and products continue to evolve and remain dominant, but under more challenge from emerging systems like Geo-thermal & Ductless Mini / Multi-Splits.
3. Historically low, the ratio of Heat Pump systems sold is now increasing (> 40% of units sold in CY 2010).
4. Maintains a strong market advantage with huge replacement market of installed base (85%+ of residential mkt).

| Feature / Specification | Note / Comment |
|---|---|
| Multi Tiered line up & options | Most are up sell and not commonly utilized (growing though) |
| Furnace, HP or Dual Fuel | Customer has options but at a premium and relies on contractors |
| Ability for Zone Dampers | Typically, Control and optimization is challenging |

**What advantages to remember about Daikin Altherma?**

1. Altherma can be HP or Dual Fuel.
2. Integrated HP DHW option.
3. Daikin system optimized for Heating so strong performance.
4. Daikin has INV Compressor.
5. Excellent Zoning Scope.

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# How does Daikin Altherma Compare? Reverse Cycle Chiller (RCC) Systems

1. These systems are beginning to emerge in the U.S. and offer the ability to use an Air Source HP tied to a Hydronic Circuit for your Heating and Cooling needs.
2. Typically using R-410A refrigerant and promoting COP & EER values (No SEER or HSPF). Full Load COP and EER values are similar to Daikin Altherma.
3. Its unclear if DHW is properly integrated or supported. No tanks available.

| Typical Features of Reverse Cycle Chillers |
|---|
| Dual 2-Stage Compressor - 50% or 100% only (Rotary) |
| No Pump included (or included in efficiency levels) |
| Auto-Rotation of Compressors |
| Soft Start-up of Compressors |
| Anti Freezing Cycle (for Water Piping outside) |
| Optional 3kW Auxiliary Heater (not included) |
| Onboard System Controller (No field setting configurable) |

**What advantages to remember about Daikin Altherma?**

1. RCC is Equivalent to MonoBloc,
2. Daikin has integrated Pump,
3. Daikin has factory Std Aux Heat
4. Daikin has INV Compressor
5. Daikin has expanded operation range
6. Daikin Std Warranty is longer

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# How does Daikin Altherma Compare?
# Geothermal Water Source Heat Pumps

1. Geothermal systems are heavily leveraged as a strong efficiency and environmentally friendly solution.
2. Growing rapidly in many parts of the country and eligible for federal tax credits until at least 2016.
3. Have a strong technology position with common utilization of ECM Fan Motors and Multi Stage Compressors.

| Specification / Feature | Note / Comment |
|---|---|
| Renewable Energy Technology | Federal Gov't recognize this. In EU mkt, HP also recognized as Renewable Energy product |
| Highest Efficiency Product available for Residential Apps | Payback verification important to offset drilling / excavation costs |
| Integrated DHW function | How much DHW production is capable by the Desuperheater. |

What advantages to remember about Daikin Altherma?

1. Daikin system is designed for Heating, Cooling and DHW modes
2. Daikin has INV Compressor
3. Daikin can deliver equivalent or higher COP/EER values normally
4. Daikin system eliminates need for drilling

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## One comparison with Geothermal w/w heat pump:

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Example house: 36,000 BTU/hr design load at 70ºF inside & 0 ºF outside
Location: Syracuse, NY (6720 heating degree days)
Total estimated heating energy required: 49.7 MMBTU / season
Average cost of electricity: $0.13/kw hr
Distribution system: radiant panels with design load supply temperature = 110ºF

**GEOTHERMAL WATER-TO-WATER HEAT PUMP OPTION**:
Based on simulation using simulation software, a nominal 3 ton water to water heat pump supplying this load from a vertical earth loop has a seasonal COP = 3.28.
Estimated installed cost = $11,800 (earth loop) + $8750 (balance of system) = $20,550 (not including distribution system) Deduct for 30% federal tax credit: ($ -6165)
Net installed cost: $14,385 (not including distribution system)

**AIR-TO-WATER HEAT PUMP OPTION**
Based on simulation software, a nominal 4.5 ton (054) split system air-to-water heat pump supplying this load has a seasonal COP = 2.8.
Estimated installed cost = $10,600 (not including distribution system)

**Annual space heating cost**: AIR-TO-WATER HEAT PUMP (COP ave = 2.8) = $676 / yr
GEOTHERMAL HEAT PUMP (COP ave = 3.28) = $578 / yr
**Difference in annual heating cost: $98 / year**
**Difference in net installed cost: $3,785**
**Simple payback on higher cost of geothermal HP: 3785 / 98 ≈ 38 years**

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## Comparison Summary

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| Feature | Air to Air System | Reverse Cycle Chiller | Geothermal Heat Pump | Combined Heat + DHW | Daikin Altherma |
|---|---|---|---|---|---|
| Integrated Heating, Cooling, DHW solution | | ü DHW is via desuperheater | ü | | ü |
| High year round Efficiency levels | ü If INV or VFD | | ü | | ü |
| Incorporate to Radiant UFH, Fan Coils, Fan Convectors | | ü | | ü | ü |
| Reduced Fossil Fuel Costs and CO2 Emissions | | ü | ü | ü vs. Separate Systems | ü |
| Integration to Solar Thermal or Solar PV for enhanced energy savings | ü Solar PV Only | | | | ü Aux for Solar Thermal |
| Integration to Thermal Storage for Shifting of Peak Energy Consumption | | ü | | ü | ü |
| Suitable technology for LEED, Green, NZE applications | ü | | ü | | ü |

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## Solution benefits for the Architect

- The freedom to design the home the way you intend
  - Not necessary to include duct chase, ceiling voids
  - Full utilization of open market components for design savvy customers (Towel heaters, Designer Radiators etc)
- Core components supplied from a single company
  - Decide internal requirements and Daikin Altherma can be selected and sized to meet requirements.
  - Discrete and Low Sound level units for easy of placement and high customer satisfaction.
- Highly efficient solution
  - Strong tie in to LEED or Net Zero buildings
  - Ability to connect Solar Thermal solution to compliment DHW or tie in to a grid tied Solar PV installation and maximize the "INV" compressor benefits
  - Enhance the architectural and aesthetic appeal of the home without compromising on comfort or efficiency.
- Maintain the integrity of the landscape
  - No need to dig up the yard or surrounding area or risk of the water table



 

## Solution benefits for the Architect

- Low environmental impact
- High efficiency system
- Maximum return on initial investment
- Adapts to solar thermal and solar PV
- Low monthly operating costs
- Domestic water heating
- Radiant heating options

**LEED Platinum Certified**

- Installed in Oregon early 2009.
- Customer has been monitoring energy consumption since then

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# Solution benefits for the Architect

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| MONTH | kWh Used | kWh Sold | NET kWh Used | Energy Use Charge Calc | Actual Cost | Avg kWh/Day | Avg Cost/Day | |
|---|---|---|---|---|---|---|---|---|
| Feb-09 | | | 635 | 250.000 kWh x 5.12400¢<br>385.000 kWh x 6.89900¢ | $12.81<br>$26.56 | 43.1 | $2.32 | partial month:<br>begin 2/13 |
| March | 1058 | 56 | 1002 | 250.000 kWh x 5.12400¢<br>752.000 kWh x 6.89900¢ | $12.81<br>$51.88 | 33.4 | $2.16 | |
| April | 674 | 98 | 576 | 250.000 kWh x 5.12400¢<br>326.000 kWh x 6.89900¢ | $12.81<br>$22.49 | 20.5 | $1.26 | |
| May | 533 | 196 | 337 | 250.000 kWh x 5.12400¢<br>87.000 kWh x 6.89900¢ | $12.81<br>$6.00 | 10.2 | $0.57 | |
| June | 373 | 115 | 258 | 250.000 kWh x 5.12400¢<br>8.000 kWh x 6.89900¢ | $12.81<br>$0.55 | 8.8 | $0.46 | |
| July | 395 | 171 | 224 | 224.000 kWh x 5.12400¢ | $11.48 | 7.4 | $0.38 | |
| August | 413 | 129 | 284 | 250.000 kWh x 5.12400¢<br>34.000 kWh x 6.89900¢ | $12.81<br>$2.35 | 8.8 | $0.47 | |
| Sept | 433 | 117 | 316 | 250.000 kWh x 5.12400¢<br>66.000 kWh x 6.89900¢ | $12.81<br>$4.55 | 10.5 | $0.65 | |
| Oct | 634 | 45 | 589 | 250.000 kWh x 5.12400¢<br>339.000 kWh x 6.89900¢ | $12.81<br>$23.39 | 20.3 | $1.22 | lower apt filled |
| Nov | 1175 | 14 | 1161 | 250.000 kWh x 5.12400¢<br>911.000 kWh x 6.89900¢ | $12.81<br>$62.85 | 35.1 | $2.29 | |
| Dec | 1694 | 11 | 1683 | 250.000 kWh x 5.12400¢<br>1433.000 kWh x 6.89900¢ | $12.81<br>$98.86 | 52.5 | $3.49 | |
| Jan-10 | 1040 | 3 | 1037 | 250.000 kWh x 5.12400¢<br>787.000 kWh x 6.89900¢ | $12.81<br>$54.30 | 38.4 | $2.49 | |
| Feb | 1037 | 42 | 995 | 250.000 kWh x 5.12400¢<br>745.000 kWh x 6.89900¢ | $12.81<br>$51.40 | 31 | $2.01 | |
| March | 963 | 67 | 896 | 250.000 kWh x 5.12400¢<br>646.000 kWh x 6.89900¢ | $12.81<br>$44.57 | 30.8 | $1.98 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Total YTD: | 10422 | 1064 | 9993 | AVG YTD: | $0.00 | 25.05714286 | $1.5536 | |

The entire residence is showing an average cost of $1.55 per day!

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## System benefits for the Dealer / Contractor

- Simplified System Design
  - Easy to use System Selection and Simulation Software
  - Typical System Schematics available
  - Integrated Pump, Expansion Vessel, Flow Switch
  - Just verify Flow and Pressure Drop of Water Circuit
- Labor Saving Installation
  - Point to point "Dealer Handbook"
  - Small Diameter water piping.
  - Use of "Off the shelf" hydronic components.
  - Limited to No on-site brazing or sweat connections
  - Standardized Thermostat, 2-Way, 3-Way Valve connections
- Flexible System Commissioning
  - Optimum field settings provided by manufacturer
  - All field settings easily configured to meet customers needs
- Intelligent Diagnostics
  - On board system controller with simple 2 digit diagnostic codes
  - Easy access to diagnostic support via www.drdaikin.com or through SMS txt.



 

## Comfort benefits to the End User

- General
  - Only one energy supply needed (single invoice).
  - Comfortable heating, cooling & DHW system designed to meet any needs.
  - Long warranty as standard with ability to buy extended warranty fully supported by Daikin
- Compared to gas/oil heating system
  - No risk for gas or oil leaks, no risk for CO2 contamination.
  - Improved installation possibilities (no combustion ventilation, no combustion exhaust gas evacuation, no oil storage).
  - Possibility of cooling
- Compared to direct electrical (resistance) heating systems
  - Efficiency 2 to 4 times higher.
  - More capacity available for the equivalent power input.
- Compared to geothermal heat pumps
  - No expensive drilling or excavation works.
  - Small installation footprint outside.



 

## Daikin Altherma advantages

- 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 $CO_2$ 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



 

## Conclusions

- The residential heating, cooling and domestic hot water markets and requirements are changing;
  - Energy Prices - the ever rising prices of fossil fuels due to increasing demand and reduced availability
  - Ecological Concern - efforts to reduce emission of green house gases and energy consumption
  - Changing Legislations, Incentives - to support the drive towards major changes in energy consumption habits for the purpose of achieving ecological targets in an effort to slow down, stop or even reverse climate change.
- Market changes are driving home owners to seek alternatives to mainstream heating and cooling (i.e. central air conditioning systems with combustioned based ducted furnaces for heating, or combustioned based boiler systems) for their homes.
- Daikin Altherma can be applied with fossil fuel backup and thermal solar (hybrid system) for heating and DHW, forced air with chilled water for cooling, and has less installation limitations than geothermal (no drilling or excavation).
- The versatility of Daikin Altherma makes it a viable alternative by combining an inverter driven compressor heat pump into a hydronic system that heats and cools the space along with the option of supplying domestic hot water with thermal solar option.



 


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# Overview of Hydronic Heating & Cooling Heat Emitters



**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name
Presenter's Title


Hydronic heating and chilled water cooling systems use water transported through piping to condition the air temperature inside a residence and heat DHW. Altherma 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 Daikin Altherma may be as simple as a heating only application connected to a loop of flexible plastic tubing that warms the floor. Others may use Daikin Altherma 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.

## Why Hydronic Heating & Chilled Water Cooling

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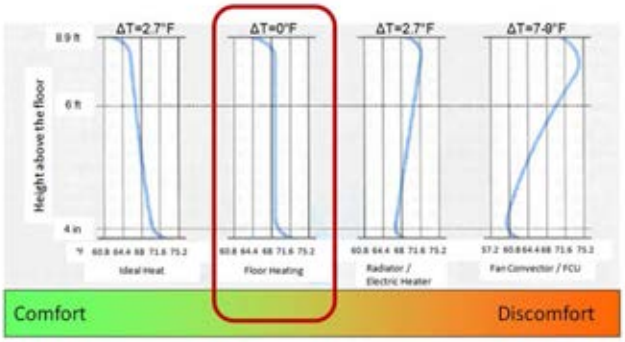
**Superior comfort:**

Hydronic heating has long been respected for its ability to provide excellent thermal comfort.

Room Temperature Profile Comparison:




*Data taken from Daikin House located in Ostend, Belgium*

## Why Hydronic Heating & Chilled Water Cooling

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- **Improved humidity control:**
  Daikin Altherma can produce 41°F chilled water for cooling improving humidity control in humid climates.

**Daikin Fan Coil Unit**

| UNIT MODEL | NOM. CFM | GPM | P.D. (FT. WTR.) | 42° F ENTERING WATER | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 80°F DB/67°F WB ENT. AIR | | | 75°F DB/63°F WB ENT. AIR | | |
| | | | | TOTAL MBH. | SENS. MBH | TEMP. RISE | TOTAL MBH. | SENS. MBH | TEMP. RISE |
| 20VMB | 1600 | 6.5 | 3.8 | 50.3 | 36.3 | 15.5 | 38.4 | 31.8 | 11.8 |
| | | 8.5 | 6.0 | 57.0 | 38.8 | 13.4 | 43.5 | 33.8 | 10.2 |
| | | 10.5 | 8.6 | 61.7 | 40.7 | 11.8 | 47.1 | 35.2 | 9.0 |
| | 2000 | 7.0 | 4.3 | 57.1 | 42.6 | 16.3 | 43.6 | 37.4 | 12.5 |
| | | 10.0 | 7.9 | 67.3 | 46.4 | 13.5 | 51.4 | 40.5 | 10.3 |
| | | 13.0 | 12.5 | 73.6 | 48.8 | 11.3 | 56.2 | 42.4 | 8.6 |

**Sen 69/Lat 31** **Sen 79/Lat 21**

 

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## Unobtrusive installation:

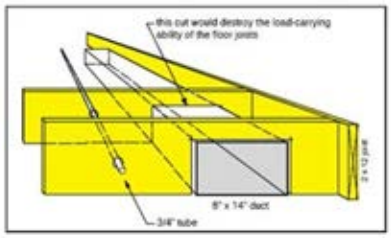
Hydronic heating and chilled water cooling has the ability to be installed without major modifications to the home structure.

Water can absorb over 3400 times more heat as the same volume of air for the same temperature change.

Heat capacity of $H_2O$=62.4 Btu/ft$^3$/°F

Heat capacity of Air=0.018 Btu/ft$^3$/°F

This allows smaller pipes to be routed through the home instead of large ducts (see example)




(Source: Modern Hydronic Heating 2nd Ed., ©Copyright 2004 Delmar Publishing)



## Why Hydronic Heating & Chilled Water Cooling

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**Design Flexibility:**

Hydronic heating offers almost unlimited possibilities to accommodate the comfort needs, usage, aesthetic tastes, and budget constraints of just about any home. Daikin Altherma allows the combination of space heating, space cooling and supply DHW with a single system.

Home Comfort

Under Floor Heating

Low Temperature Radiators

Space Heating or Cooling

Bath


All Sink & Faucet needs

Shower

 

## Why Hydronic Heating & Chilled Water Cooling

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**Zone-ability:**

The Altherma system provides the option of dividing the house into two or more independently-controlled comfort zones. This configuration can reduce energy consumption by allowing for different set-point temperatures in unoccupied areas. It also allows the comfort level of rooms to be adjusted to suit individual tastes.

**Zone-ability**
Daikin Altherma with individually controlled zones

 

## Why Hydronic Heating & Chilled Water Cooling

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- **Clean Operation**: (inside and outside the home): A major complaint from dust and airborne pollutants their systems distribute through the house. Using radiant heat emitters, heat is distributed by natural convection.
- **Quiet Operation**: A properly installed hydronic system can operate with virtually undetectable sound levels in the occupied areas of a home. Low temperature (86°F/30°C to 131°F/55°C) hydronic systems can all but eliminate the expansion noises of piping that are associated with some high temperature hydronic systems.
- **Outdoor heat pump unit is quiet due to inverter driven compressor**; the majority of the time the system is operating on lower capacity (can be less than 45 dBA-sound power) in a part load condition.

 

# Different types of Heat emitters

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| Heat Emitters | Minimum | Maximum |
|---|---|---|
| Low Temperature Radiators | 104°F / 40°C | 104°F / 40°C |
| Fan Coil Units | 86°F / 30°C | 122°F / 50°C |
| Under Floor Heating | 77°F / 25°C | 113°F / 45°C |

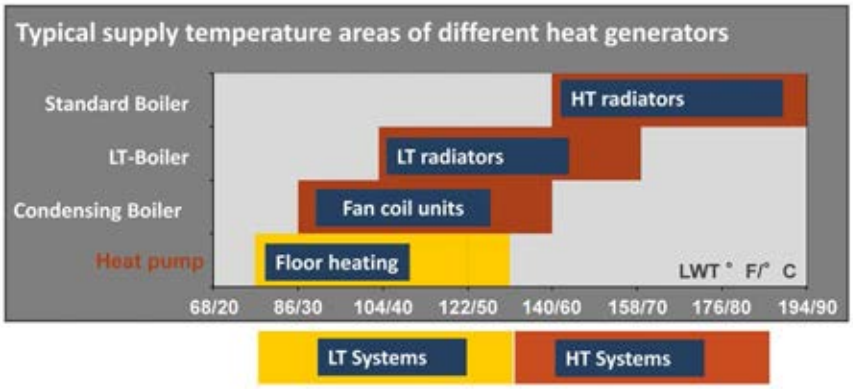
Optimum for Daikin Altherma



## Different types of Heat emitters

The choice of heat emitter is based on the leaving water temperature, consequently on the heat source used.



# Heat transfer

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## Definition

- When an object or fluid is at a different temperature than its surroundings or another object, **transfer of thermal energy** occurs in such a way that the body and the surroundings reach **thermal equilibrium**.

  second law of thermodynamics: heat transfer always occurs from a higher temperature object to a cooler temperature one.

- There are three different types of heat transfer

  1. **Conduction**
  2. **Convection**
  3. **Radiation**


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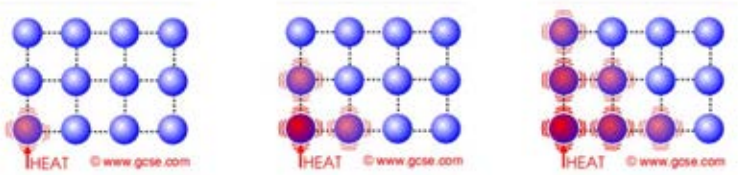
# Heat transfer

## Conduction

- Heat is transferred by conduction when adjacent atoms **vibrate** against one another. The bigger the vibration, the hotter the material.
- For example, a **spoon** in a cup of hot soup becomes warmer because the heat from the soup is conducted along the spoon.
- Conduction is greater in **solids**, where atoms are in constant contact. In **liquids and gases**, the molecules are usually further apart, giving a lower chance of molecules colliding and passing on thermal energy.

Heat emitters for domestic heating, do not rely on conduction to release their heat.

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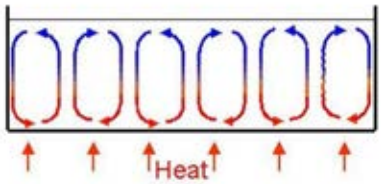
# Heat transfer

## Convection

- Convection is the transfer of heat energy between a solid surface and the nearby **liquid or gas in motion**. As fluid motion goes faster the convective heat transfer increases.
- When a liquid is heated, the molecules at the bottom move with bigger vibrations
  - They take up more space which means that the density goes down
  - Due to the lower density, the fluid rises
  - It gives its energy to the fluid above, and cools down
  - It becomes denser again and falls back to the bottom
  - A convection current is set up




The hotter volume transfers heat towards the cooler volume of that fluid

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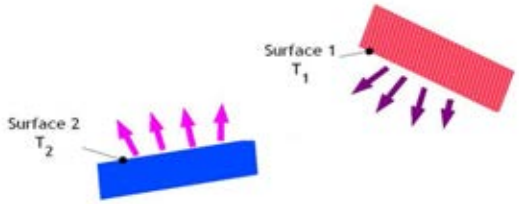
# Heat transfer

## Radiation

- Thermal radiation is the process by which the surface of an object radiates its thermal energy in the form of **electromagnetic waves**. All objects with a temperature above absolute zero radiate energy.
- The frequency of the electromagnetic waves is situated in the infra-red region
- **No medium is necessary** for radiation to occur; radiation works even in and through a perfect vacuum.
- Radiation depends mainly on the surface temperature

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# Heat transfer

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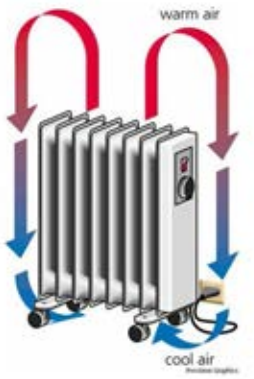
## Heat transfer with radiators

- The odd thing with radiators is that they are actually somewhat misnamed. Most of the heat which comes from them is actually by **convection**. The exact distribution radiation/convection depends on the radiator type.

- Radiators work by heating the air which flows past them. Warm air rises from the radiators and colder air in the room falls.
- This circulation develops a flow of air around the room sending warm air from the radiator and delivering cooler air back to be heated.

**Under floor heating** relies more on radiation: see further on



# Heat transfer

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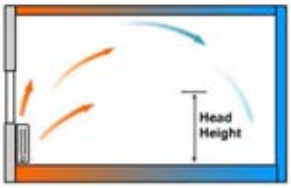
## Properties radiation and convection

- **Convection** has a greater efficiency as it has a more even temperature distribution throughout the room (less cold spots in the room).
- Radiation on the other hand is preferable for human being, as it gives a more sensible heat. The main disadvantage is the risk of cold spots.

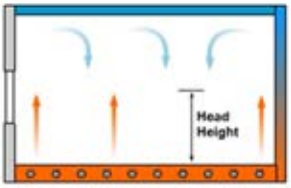
**Radiators:**

The heated surface of a radiator is small, which means that convection is preferred to prevent cold spots within the room




**Under floor heating:**

The heated surface is big, which means that convection is less necessary. Consequently they can rely more on the preferable radiation



# High Temperature Radiators

## Column radiators: cast iron

- These days, two types of cast iron radiators are used:
  1. **Old reconditioned** or reclaimed cast iron radiators
  2. **Reproduction** cast iron radiators.
- These types of radiators are mainly used in public buildings such as older hospitals and schools. Although recently, reproduction cast iron radiators became more fashionable, which reinforced again the use of cast iron radiators in new build houses or for refurbishment.

Old cast iron radiators, mainly used in public places

Weil McLain Co.

New fashionable cast iron radiator, to give an 'old-school' feeling

# High Temperature Radiators

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## Column radiators: cast-iron

- They use **high water temperatures**: 158°F/70°C till 194°F/90°C.
- Column radiators rely more on **radiant heat** compared to other radiators, due to their high surface temperature.
- All of the cast iron radiators are **floor standing**
- Besides the length and the width of the radiator, the **heating capacity** depends also on the depth of the radiator. The depth depends on the number of columns the radiator is made up from.

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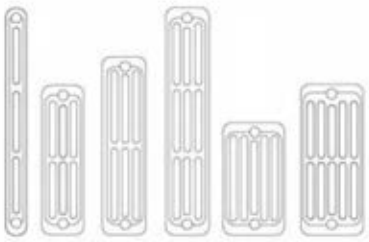


4 columns



6 columns

Weil McLain

# High Temperature Radiators

## Column radiators: cast iron

### Advantages

- **Lasting effect**
  Cast Iron radiators are most well known for their lasting heat effect, thanks to the high thermal mass of iron. The heat generated by cast iron radiators lingers on for a long time after the radiator has been switched off.
- **High heating output**
  Compared to other heat emitters, cast iron radiators provide a high heating output thanks to their maximized surface area.
- **Multiple sizes**
  Cast Iron radiators come in multiple sizes. You can fit them in the smallest corner of your house or you can even fit them in the most unusual place. The customer can choose the amount of columns desired, which determines the radiators heating ability as well as the size.
- **Robust, compared to other heat emitters**



# High Temperature Radiators

## Column radiators: cast iron

### Disadvantages

- **Weight and dimensions**
  Compared to more modern heat emitters, cast iron radiators are large and have a high weight.
- **Not stylish**
  Although the fact there are many new, more fashionable cast iron radiators which give a traditional look, they are not that stylish compared to newer types of heat emitters
- **High water content**
  This will result in an overall increase in the system's water content for central heating. This means you will spend more to heat up all that water.
- **Iron can rust**



# High Temperature Radiators

## Column radiators: stainless steel

- Column radiators made of stainless steel are also tubular steel radiators that look similar to cast iron radiators. In stead of cast iron, they are using **welded sections of tubular steel**.
- These radiators are **floor standing**, and emit most of their heat by **radiation**
- The stainless steel column radiators are developed to overcome some disadvantages of the cast iron column radiators, while maintaining the advantages

Cast iron column radiators

Stainless steel column radiators



# High Temperature Radiators

## Column radiators: stainless steel

### Advantages (compared to cast iron)

- **Lighter**
  Stainless steel column radiators are a lot lighter then cast iron radiators. Consequently they are easier to transport and to handle.
- **Cheaper**
  These radiators are constructed in such a manner that there is only the minimal wastage of raw material and hence they are cost-effective and cheaper than cast iron radiators.
- **Attractiveness**
  Stainless steel column radiators are supplied in a finished color unlike cast iron radiators that are normally supplied in primer in readiness for a finish coat.
- **Stainless steel doesn't rust**



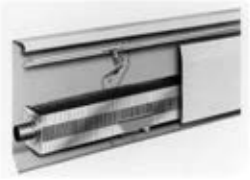
 

# High Temperature Radiators

## Fin – Tube Baseboard Convector

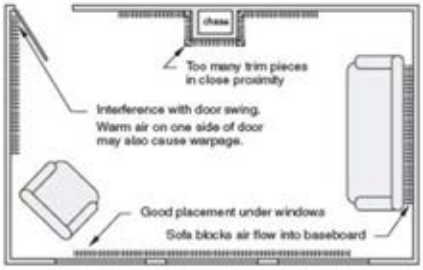
### Advantages

- Low cost per unit of heat output
- Low thermal mass – fast response



### Disadvantages

- Not the most aesthetically pleasing heat emitter
- Easily damaged, especially in commercial applications
- Not well suited for low temperature applications
- Can make expansion noise if not properly installed/controlled

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# High Temperature Radiators

## Convector radiators

- Convector radiators are the **most commonly installed** radiator type.
- The front of the convector radiator is called the **'water plate'.** It consists of two formed **steel** sheets welded together at their perimeter and across the face.
- The upper and lower portions of the water plate act as headers. Several vertical flow channels run between these headers



 

# High Temperature Radiators

## Convector radiators

- A sheet of thin folded steel is welded to the back of the water plate to create **conductor fins** that enhance **convective heat transfer**. Only a small part of the heat transfer will be radiating directly from the water plate (80% conduction, 20% radiation).
- The fact that most of the heat transfers occurs through convection, leads to a greater efficiency and a more even heat distribution throughout the room.
- The fins also enlarge the **heating surface**, which approximately doubles the heating output.



 

# High Temperature Radiators

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## Convector radiators

- The water plate and fin assembly are then framed with **side and top trim panels.**
- There are still convector radiators existing that don't have these side and top panels, but most of the new convector radiators have these installed to make a **more aesthetically pleasing** product for the consumer.

Convector radiators with side and top panels installed are sometimes named as 'Compact radiators'

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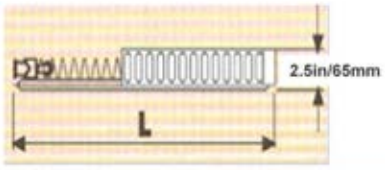
# High Temperature Radiators

## Convector radiators

- To increase heat output without changing face dimensions, manufacturers join two or sometimes three water plates assemblies together into a single assembly
- The simplest convector radiators are single panel
  - The appropriate choice for small radiators where a low heat output is required
  - The appropriate choice for larger radiators where the heat is to be disbursed over a wide area for even heating
  - Their narrow profile allows them to be mounted quite close to the wall, which is occasionally a consideration



# High Temperature Radiators

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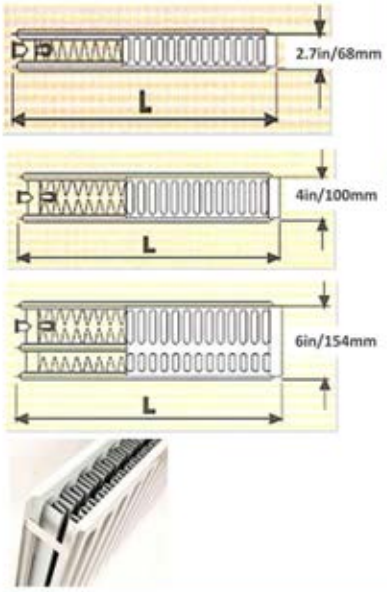
## 3. Convector radiators

- **Double panel** convector radiators give a **heating output** per square meter which is almost twice as high compared to a single panel convector radiator. The extra heat output is almost entirely convective rather than radiant.
- Double panel convector radiators with only one convector row are also available.
- **Triple panel** convector radiators are available too, but are much less commonly used because in most rooms double panel convector radiators give enough heat output for the space they take up.



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# High Temperature Radiators

## Convector radiators

- Convector radiators can be either **'seam top' or 'roll top'.**
- These terms refer to the way in which the steel sheets which form the radiator are joined together along the top edge.
- The **seam top types** are generally slightly cheaper and have a slightly higher heat output than the roll top types, but these differences are almost negligible.
- The **roll top types** offer a round more easily cleaned surface.



 

# High Temperature Radiators

## Convector radiators

### Advantages

- **Heat output**
  For a given physical size of radiator, the convector radiators deliver the highest heat output of the radiators.
- **Fast response**
  Convector radiators have a very low thermal mass relative to its heat output capability. This allows a fast response if there is a heating demand in a cold place.
- **Low water content**
  The internal volume of the water plate is very low relative to a typical cast-iron radiator of similar frontal area. Low water content radiators reduce the system's overall water content therefore saving you money in heating bills.
- **Big variety**
  Convector radiators are available in a wide variety of sizes with varying heat output per square meter.



 

# High Temperature Radiators

## Panel radiators

- Panel radiators are the same as convector radiators, with the only difference that panel radiators **don't have fins** on the back of the water plate.

  Panel radiators rely more on **radiant heat** compared to convector radiators, which leads to less efficiency and potential cold spots within the room.

- The **fins** on the convector radiators approximately **double the heating output**. This means that a single convector radiator will have a very similar heat output for the same size as a double panel radiator, at the **same cost**.
- Panel radiators are not that common, convector radiators are used in stead.

Remark: the naming **'panel radiator'** and **'convector radiator'** are frequently mixed. Most of the time when someone talks about 'panel radiators', they're talking about 'convector radiators.

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# High Temperature Radiators

## Designer radiators

- Designer radiators is a catch all term for the **more expensive radiators.**
- The **variety is almost endless** and includes floor and wall mounted, cast iron and aluminum, stone and marble, stainless steel, tubular, bathroom vanities, stylized towel rails …

  designer radiators come in all shapes and sizes, you're only limited by your imagination

- Radiators are now designed to blend in with your décor or can even stand out and attract attention.
- A very popular designer radiator is the **tubular towel rail**, that provide a more aesthetic solution to heating a bathroom and warming/drying towels
- **Cost** is not the primary consideration leading to the purchase of such kind of radiators.

Designer radiators are a lot more expensive than traditional residential radiators. But then they are not just radiators…

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# High Temperature Radiators

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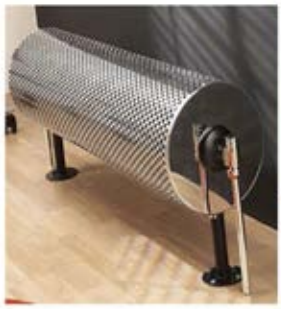
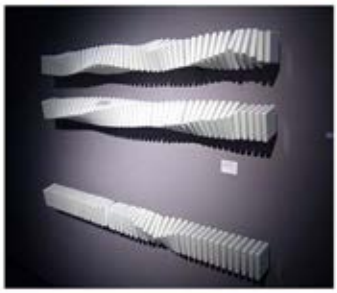
## Designer radiators





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# High Temperature Radiators

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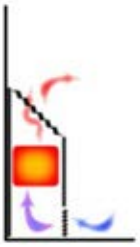
## Low Surface Temperature Radiators

- Low surface temperature radiators are low water content radiators with a **protective external casing** designed to prevent the young and old from burning themselves.
- Most important applications: health care buildings, local authorities, commercial buildings, bedrooms.
- When the system is running at maximum design output, the heating devices should not exceed 109°F / 43°C.



The actual radiator is a **fin covered heat exchanger** inside the casing that releases it's heat via grills at the top of the casing, while allowing cooler air to enter the casing through grills at the bottom.

The rely on air movement through **convection** to distribute heat

Disadvantage: **low heat output**

# Low Temperature Radiators

## All types of HT Radiators can be used as LT Radiators

- The smaller temperature difference between the room and the radiator, means that the heat output per square meter will be less compared to High Temperature Radiators.
  - To achieve the same heat output as with HT Radiators, LT Radiators need to be bigger dimensioned.
- Large sized LT Radiators have **two advantages**:
  - they create better thermal comfort conditions due to small temperature differences in the room
  - less cold spots in the room thanks to the bigger dimensions

Due to their low temperature range (104°F/40°C to 148°F/65°C), LT Radiators can be used in combination with **Heat Pumps**

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# Fan coil units (FCU)

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## Also called: Fan assisted convectors

- These units **actively** draw in cool air, heat it and expel the warm air. To do so, each unit includes a low volume fan which directs cool air over a heat exchanger. The fan will operate until the desired temperature has been reached, which is measured with a thermostat.
- Fan coil units have <u>one big advantage</u>: by forcing air movement, they can **heat up a room very quickly**.
- But they have also <u>one big disadvantage</u>: as they **require electricity** to drive the fan they can be very expensive to run on a long term basis
- This makes Fan coil units are most applicable **as 'back-up' heat emitters**, or in places where other heat emitters can not be used.

Due to their low temperature range (86°F/30°C t0 122°F/50°C), Fan coil units can be used in combination with **Heat Pumps**.

# Under Floor Heating (UFH)

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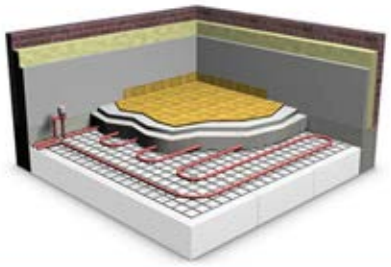
## Principles

- Floor heating systems are a simple concept: a source of heat energy in the tubing beneath the floor, **radiates heat** into the floor covering and hence to the room above.
- Adequate **insulation** is needed beneath the tubing or beneath the heated slab, to optimize the heat output. Most manufacturers recommend a minimum of 1in/25mm of **Extruded Polystyrene (EPS),** but these levels should be higher in the coldest climates.
- Under Floor Heating can be used in combination with
  - **LT Boiler**
  - **Condensing Boiler**
  - **Heat Pump**
  - **Solar Technology**

Water temperature range of water leaving the heating system to the tubing: **77°F/25°C to 113°F/45°C**



# Under Floor Heating (UFH)

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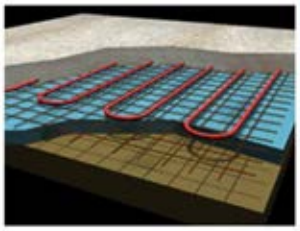
## Two ways of installation

### Wet installations

- The tubing is embedded in a thick concrete slab or in a layer of concrete on top of a sub-floor
- The concrete distributes the heat which gives an excellent heat capacity



### Dry installations

- The tubing runs in an air space under the floor and are fitted into aluminum diffusers to spread the heat across the floor.
- Dry installations need to operate at a higher temperature and demands more energy than wet installations

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# Under Floor Heating (UFH)

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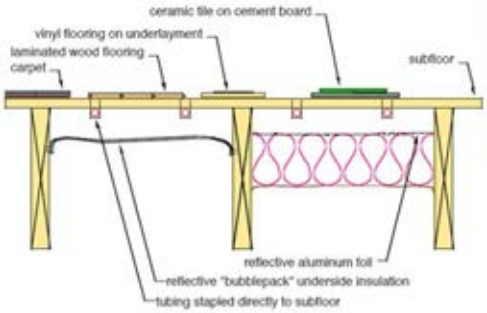
## Plate Less Staple-Up

### Advantages

- Adds **very little weight** to floor
- Doesn't increase floor height
- Relatively **low thermal mass** for fast response
- **Lower installed cost** relative to plated systems




(Source: Modern Hydronic Heating 2nd Ed., ©Copyright 2004 Delmar Publishers)

### Disadvantages

- **Limited heat output** (not more than 150 Btu/hr/ft2)
- Requires **high water temperature** (140°F/60°C – not compatible with LT Altherma
- Poor lateral heat dispersion can cause "striping" of floor (**uneven floor temp.**)
- More thermal resistance between tubes and top of floor surface
- Tubing must run parallel with floor joists



# Under Floor Heating (UFH)

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## 3. Types of Under Floor Heating

There are three main types of radiant floor heating:

1. Radiant Hot water UFH or Radiant **Hydronic UFH**
2. **Radiant Electric UFH**
3. Radiant **Air UFC**

- **Air UFC**: it's possible to use hot air to heat the floor and the home through the heated floor.
- This a rather **inefficient solution** as air cannot hold large amounts of heat.
- Radiant Air UFH systems are seldom installed in residential buildings

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# Under Floor Heating (UFH)

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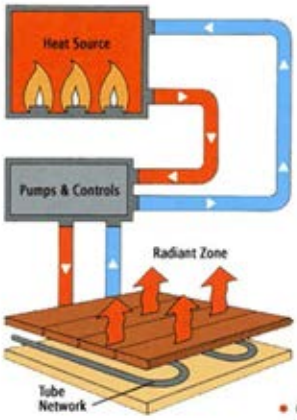
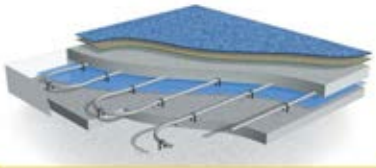
## Types of Under Floor Heating



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- **Hydronic UFH** systems work with **heated water** pumped through tubing positioned **in loops** beneath a finished floor.
- This system needs a water heating system, a set of controls (temperature sensors: outdoors, in the room, in the floor slab …) and circulating pumps.
- Hydronic UFH is by far the **most popular** and competitive radiant heating system

- Cross-linked polyethylene (PEX) tubing is a very common solution today for tubing
- Rubber tubing is also used, though in a much smaller scale
- Copper piping is a solution of the past

 

# Under Floor Heating (UFH)

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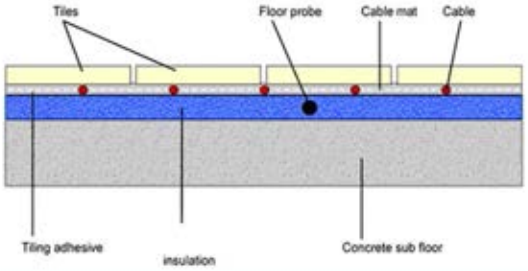
## Types of Under Floor Heating

- **Electric UFH** uses **electric cables** inserted into the floor, or mats of electrically conductive plastic mounted onto the sub-floor.
- Advantage: since electric UFH doesn't involve a water heating system and several complex control elements, its **installation** is usually much **simpler and cheaper** compared to Hydronic UFH
- Disadvantage: the energy bill will be much higher compared to Hydronic UFH, due to the high **electricity prices**

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# Under Floor Heating (UFH)

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## Types of Under Floor Heating

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**When to use Electric UFH and Hydronic UFH**

- Make a comparison based on lower installation cost (Electric UFH) and on lower energy bill (Hydronic UFH)
- **Electric UFH** is a better choice when the goal is to heat small areas like a bathroom or a kitchen (when we don't want to install a wider system all over the house), thanks to the lower installation cost
- **Hydronic UFH** systems is a better choice when the goal is to heat a **large area** or the entire house, thanks to the lower energy bill.

Hydronic UFH system is the most beneficial UFH system, and is by far the most popular one.

# Under Floor Heating (UFH)

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## 4. Advantages Under Floor Heating

**Most important advantage: increased comfort**

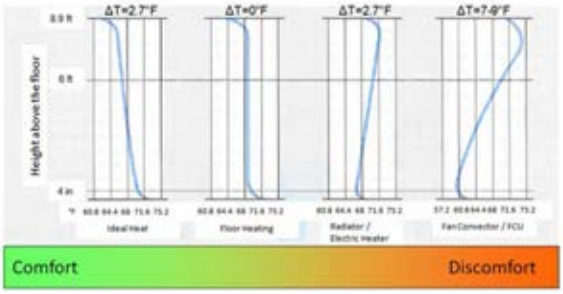
- Comfort: 50/50 mix of **radiation and convection**

  Thanks to the **large heated floor surface**, UFH delivers a greater portion radiation compared to other heat emitters.

  This creates a more comfortable temperature gradient: **warmer at foot level, and cooler at head level.**

**Highest heating comfort** is achieved with UFH

Temperature in a room heated with UFH, can be **3.6°F/2°C lower** than one heated by radiators, to achieve the same level of comfort



# Under Floor Heating (UFH)

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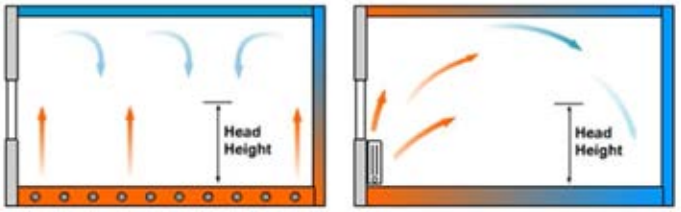
## Advantages Under Floor Heating

- Comfort: large heated floor surface
  - This allows occupants to walk around barefoot even in winter, a very popular feature
  - Compared to radiators, there will be no cold spots in the room. UFH systems result in a more uniform temperature distribution in the room compared to radiators.




A bigger portion of radiation is aloud (which is preferable for human being) thanks to the large heated floor surface.

This is the reason why convection heat is preferable for radiators: to prevent cold spots in the room.

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# Under Floor Heating (UFH)

## Advantages Under Floor Heating

- Comfort: **better hygiene** for asthma sufferers
  - Radiators generate convection currents in the air of the room, which **circulate the dust** along with heat. UFH systems produce no such convection currents.
  - The moisture content of the warmth produced by UFH is also too low for **dust mites**
- Comfort: **quiet operation**
  - Unlike radiators there is no gurgle of water through baseboard radiators or creaking from expansion and contraction
  - Unlike FCU, there is no noise from a fan or airflow through ducts

**Increased comfort** compared to radiators and FCU, is the most important advantage of Under Floor Heating.

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# Under Floor Heating (UFH)

DAIKIN AC absolute comfort

## Advantages Under Floor Heating

- **Energy savings: 15% - 40% compared to radiators**

**lower thermostat settings**

Temperature in a room heated with UFH, can be (36°F /2°C) lower than one heated by radiators, to achieve the same level of comfort. This means that people can keep their thermostats lower and thus realize significant energy savings

**lower boiler temperature**

This is possible thanks to the large heating floor surface. This results in a higher efficiency, and thus energy savings

**less air infiltration**

FCU can significantly increase or decrease air pressure in different parts of the building, which in turn can increase air infiltration rates. This will not happen with UFH and thus leads to energy savings

**solar hot water**

The relatively low water temperature required provides an opportunity to utilize solar hot water

Zoning the system is important, since maintaining different temperatures in different parts of the house allows energy savings and can respond to different needs

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# Under Floor Heating (UFH)

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## Advantages Under Floor Heating

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- **Low service costs**
  UFH systems are practically **maintenance free**, and the piping used has a lifespan of up to **100 years**
- **Aesthetics and Place saving**
  UFH is invisible
- UFH doesn't take up valuable **wall space** which gives a greater freedom as to where furniture can be placed.
- UFH can be used in spaces with **high ceilings**, where the output of radiators would be lost to the higher parts of the room
- UFH can be used with concrete **floors** and all types of wooden floors
- UFH can be used with all types of **floor covering** (stone, tiles, wood, carpets, vinyl, …)
- With UFH you **prevent discoloration** of paintwork, peeling of paper, …
- **Cleaning** of the floors is easier when no radiators are installed, and wet floors dry very quickly

# Under Floor Heating (UFH)

## Disadvantages Under Floor Heating

- **Slow thermal response**
  This leads to lower overall efficiency for spaces occupied for relatively short periods, due to the heat lost during the longer warm-up and cool-down periods.

  The thermal response time depends on the type of flooring. Wooden flooring can take 30 minutes to an hour, whereas concrete flooring can take up to several hours to heat up.

  Better control compared to radiators is needed (working with schedules)

- **Limited heat output for small rooms**
  Limited heat output due to limitation on maximum comfortable floor temperatures. This may be insufficient for small rooms with large heat requirements and large losses (e.g. bathrooms). In this extra radiators/FCU can be used.

- **Heat loss into the ground.**
  There is potential for significant heat loss into the ground. This reduces the overall efficiency of the system.

# Under Floor Heating (UFH)

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## Disadvantages Under Floor Heating

- **Cooling is difficult**

  Most of the commercialized floor heating systems do not offer cooling, while FCU can provide both cooling and heating. Cooling with under floor heating gives an unpleasant feeling and there is a risk of condensation on the cool surface.

- **Higher Installation cost**

  Compared to radiators and FCU, the installation cost of Under Floor Heating will be more expensive

  - When **room-by-room zoning** is needed, a whole set of controls will be necessary
  - Difficult to install UFH in **existing buildings** due to the need to remove and relay floors, or possibly ceilings below for upper-floor applications
  - When a traditional boiler is used, extra accessories are required

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# Daikin Altherma™
# Key Technology Overview

**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name

Presenter's Title

# Condensing Unit Technology Overview

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**Aero Spiral Fan**

The bent fan blade edges control air eddies of the blade edge, drastically reducing operating sound.

**Bell Mouth Guides**

Smooth air inlet bell mouth added to the bell mouth intake to reduce turbulence.

**Super Aero Grille**

Refined ventilation mechanism enables further reduction in required fan power.

**Digitally Commutated Fan Motors**

Efficiency improved in all areas compared to conventional AC motors, especially at low speeds.

**Sine Wave DC Inverter**

Use of the smooth sine wave PWM smoothes motor rotation, further improving operating efficiency and reducing offensive operating sounds.

**Reluctance Digitally Commutated Compressor**

Overheating losses are reduced by pressurizing the area around the motor, boosting energy saving performance in conjunction with other features.

**Applicable to all ERLQ, EBLQ, EDLQ Models**

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# Swing Compressor Technology

- A Daikin Swing Compressor is used in the small capacity (ERLQ018, 024, 030) Altherma outdoor units
- Friction and refrigerant leakage are suppressed
- Improved efficiency increases energy savings
- Compressor life time is increased


| FEATURES | BENEFITS |
|---|---|
| Smooth rotation, little friction | High operation efficiency, energy savings |
| Smooth piston motion | Low vibrations, low sound levels |
| Few parts rubbing each other | High performance, High reliability |

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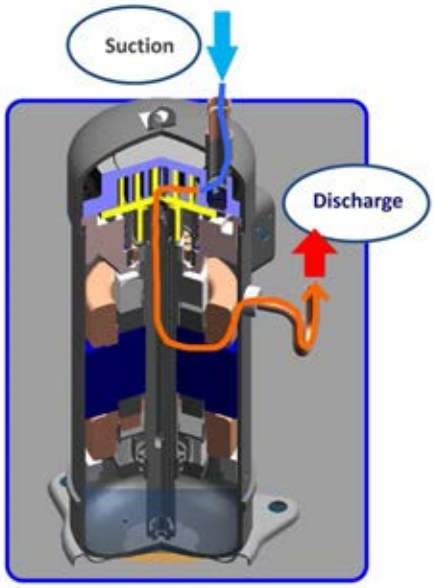
# Scroll Compressor Technology




Inverter Driven Scroll Compressor is used on ERLQ036,048, and 054 as well as all EBLQ and EDLQ models

- Reluctance DC Motor
- Optimized Scroll (R-410A)
- High Pressure Shell
- Stronger Shell material
  - Improved Sealing
- Stable oil temperature
  - Improved efficiency
  - Improved Reliability
- Discharge gas cooled windings prevent heat-shock
- Less heat transfer to suction gas

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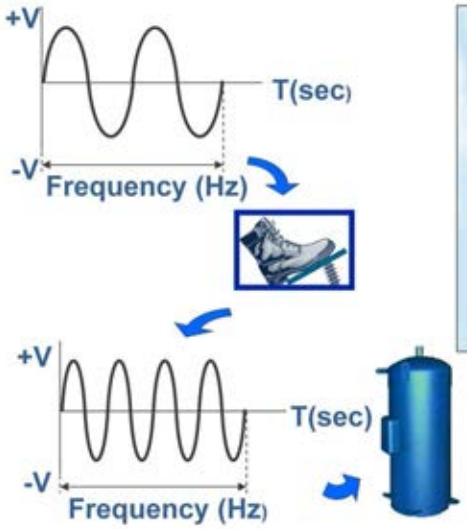
## Why is an Inverter Different?

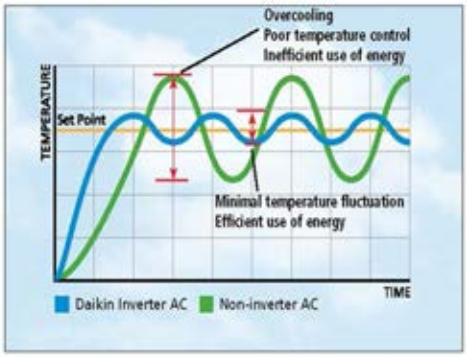
- An inverter is a variable speed drive that changes the electrical frequency being fed to a motor.
- When this technology is applied to a compressor's motor, we can easily vary the air conditioning systems operating capacity.
- Think of the inverter drive controlling a compressor like a throttle pedal controls a cars engine.



# Inverter Technology

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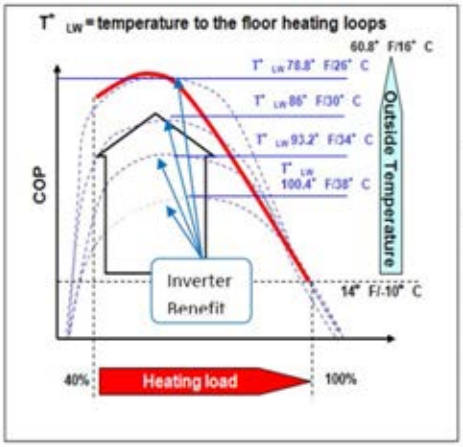
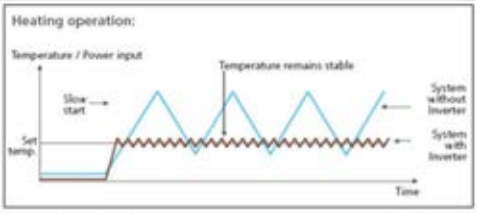
# Inverter technology benefit for Daikin

**Inverter control in combination with weather dependant control results in excellent system efficiencies (COP).**




**Key Technology**

- Variable Speed "Inverter" Compressor
- Climate defined Ambient Balance Point
- Outdoor Reset Function
- R-410A Refrigerant
- Intelligent Control Logic
- Customizable system set-up to meet users requirements

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## Other Inverter Advantages

- Very low startup amperage
- No locked rotor amps
- No stress on windings or compressor frame
- No "light flicker"
- Lubrication of bearings increases before speed increases
- System pressures increase gradually reducing noise and stress on piping
- Quiet compressor startup
- Increased reliability due to 70% to 80% operational time is less the maximum speed (less wear)
- Idea for backup generator and off grid photo voltaic solar applications



 

## Inverter technology benefit for Daikin

- **Great Heating Performance**
  - Allows compressor to increase speed during cold outdoor ambient conditions.
    - Generates higher
      - Head pressure
      - Discharge gas temperatures
      - Discharge air temperatures
  - Attains same heat output as competitive systems with Electric Booster Heat, but doesn't use the extra energy.
  - Improves performance throughout the entire run sequence.

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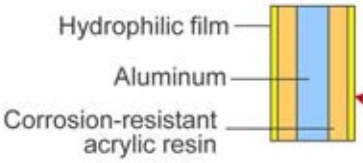
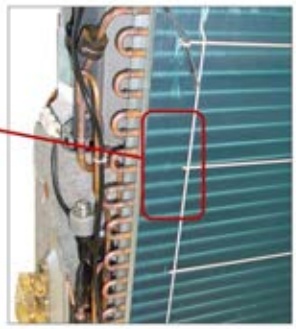
# Corrosion Resistant Coil Fins

| | Corrosion resistance rating | |
|---|---|---|
| | Non-treated | Anticorrosion treated |
| Salt corrosion | 1 | **5 to 6** |
| Acid rain | 1 | **5 to 6** |



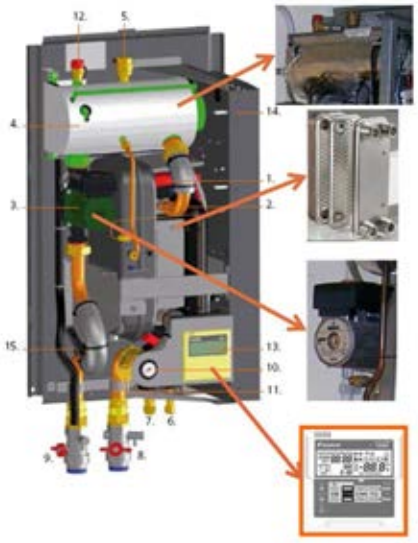
Another example of Daikin's attention to detail is in our coil fin coating.

You will notice that all Daikin outdoor coils are blue in color – this is a special anti-corrosion polyethylene acrylic resin applied to the fins.
It provides 5 to 6 times greater resistance to corrosion than coils with no coating. This is a Daikin exclusive standard feature.



# Hydro-box Technology




**Tank & Back-Up Heater**
Integrated tank & pressure relief valve with electric heat back up.

**Brazed Plate Heat Exchanger (Cupro – Nickel)**
Improved corrosion resistance against chlorine used in city water.

**High Efficiency Pump**
Low sound level, multiple speed, flexible flow and pressure drop characteristics

**Intelligent System Controller**
Full system configuration and control including scheduling, outdoor reset, error code notification, system operation status etc

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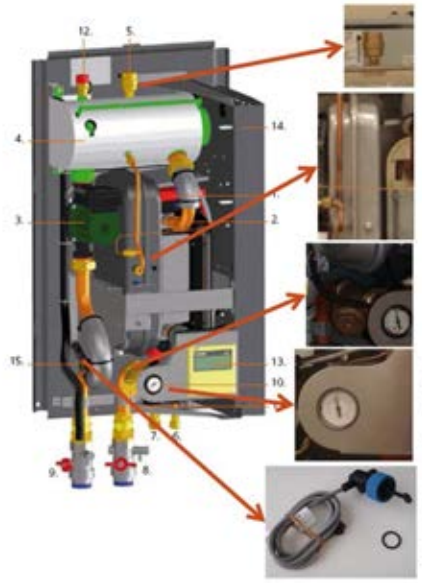
# Hydro-box Technology




**Air Purge Valve**

**Expansion Tank**
2.64gal expansion vessel for optimum pre-pressure adjustment

**Fine Mesh Strainer**
Protect the integrity of the BP Heat Exchanger

**Water Circuit Pressure Gauge**
Quick reference to ensure system pressures are within requirements

**Flow Switch**
Monitoring for flow and disables (protects) system in the event of low flow

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## Hydro-box Technology

**Brazed Plate Heat Exchanger:**

- The compressed plate pack creates a continuous series of channels. The plate and porthole arrangements permit the two heat-transfer media to travel in alternate channels in a counter flow manner.
- The efficiency of these heat exchangers is high due to the turbulent flow patterns of the fluids through the channels.

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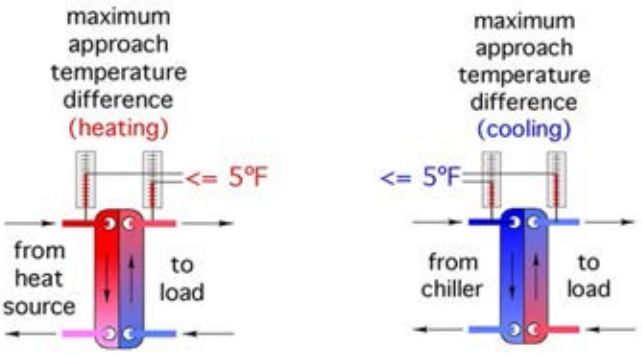
How the brazed heat exchanger operates. The flow pattern of the brazed heat exchanger is similar to any other plate heat exchanger

# Hydro-box Technology




If a heat exchanger is required between heat pump (due to requirement to keep heat pump part of a closed loop), that heat exchanger should be sized for a maximum approach temperature difference of 5 ºF.

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# DHW Tank Technology

- High Efficiency Indirect Design
- Optimized for use with INV type systems
- Stainless Steel (316L)Tank and Heat Exchanger
- Anti-Bacteria Function Heat water to 158°F (70°C) per a define schedule
- Integrated Thermistor for optimum tank temperature measurement & control
- Flexible Control Schedules Priority Setting Mode
- Integrated 3kW Booster Heater with delay function
- Connection to Solar Kit for Solar Thermal
- DHW Tank **CANNOT** work as a standalone device. It MUST be connected to a Hydrobox, which in turn MUST be connected to a Condensing Unit. As such, the "auxiliary" for Solar Thermal in this instance is the entire Daikin Altherma system.



 


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# Daikin Altherma™
# System Performance and Spec



**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name
Presenter's Title


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HIGH EFFICIENCY
DAIKIN
altherma
HEATING, COOLING AND DOMESTIC HOT WATER SYSTEM
HEATING AND COOLING
(Or Heating Only)
DOMESTIC HOT WATER
(Optional)
SPLIT TYPE
ERLQ_BA
EKHBH030BA
EKHBX030BA
ERLQ_BA
EKHBH054BA(A)
EKHBX030B(A)
EKHWS_BA
50g
1-3
Person
80g
2-5
Person
Larger Tank
via optional kit
For reference use only
Equipment selection
should always be
based on detailed
load calculations
12k Btu/hr
1000 sq. ft
24k Btu/hr
1300 sq. ft
30k Btu/hr
1500 sq. ft
36k Btu/hr
1800 sq. ft
48k Btu/hr
2300 sq. ft
54k Btu/hr
3000 sq. ft
MONO BLOC
EDLQ_BA
Radiant Floor
Fan Coil Units
Fan Coil units and radiant floor, may be used in combination or independently
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Slide 2
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## U.S. Certification Overview

- All Daikin Altherma components have been engineered to satisfy the following:
  - **UL-1995** – Safety Standard for Heating & Cooling Equipment.
  - **Int'l Plumbing Code** – All applicable requirements for the product are addressed in the product portfolio.

    Note: Application requirements should be reviewed.

  - **National Std Plumbing Code** – All applicable requirements for the product are addressed in the product portfolio.

    Note: Application requirements should be reviewed.



 

## Testing & Rating - Performance & Efficiency

- Currently no nationally recognized testing and rating standard exists for Daikin Altherma type technology (i.e. Air to Water Heat Pump for Heating, DHW and Cooling).
- The **U.S. DOE have awarded Daikin Altherma a waiver**, BUT the terms of the waiver allow Daikin to "fully" promote the efficiency of the system per EU test procedures.
- The Waiver makes alignment to incentives and rebate programs associated to "products" a challenge, but Daikin have seen good success in using Altherma in applications where the "entire building" envelope is pursuing incentives and rebates.
- In line with the terms of the Waiver Daikin have submitted certified test data to the DOE for their records.



 

## DOE Waiver – why was it issued?

1. Precedence of Carrier and Nordyne waivers for similar integrated systems in 1990's
2. **Inability to adequately test and rate Air to Water Heat Pump systems with existing testing and rating standards,** especially considering the following:
   - **A. AHRI Std 210/240**
     1) Aimed at traditional HVAC systems
     2) Defines Ambient Condition, Indoor Entering Air Conditions, Pipe Lengths, Air Flow Rules
     3) **Does NOT define:**
        - **a. LWT requirements, What kind of Heat Emitter must be used (Under-Floor, Fan Coil, radiator etc) and thus the "Indoor Entering Air Conditions" are an unknown.**
   - B. GAMA RWHR
     1) Aimed at Residential Storage Water Heaters
     2) Defines Indoor Entering Air Conditions, DHW Set-Point Rate, DHW Draw Rates
     3) **Does NOT define:**
        - **a. Ambient Conditions (Altherma heat source is installed outside, HP Water Heater is installed Indoors)**
        - **b. Pipe Lengths (Altherma has a Refrigerant and/or Water Pipe Length to be considered)**



 

# Performance Summary

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## ERLQ018, 024, 030 with EKHB_030

| Small Capacity "Split" Type Outdoor Unit | | | ERLQ018BAVJU | ERLQ024BAVJU | ERLQ030BAVJU |
|---|---|---|---|---|---|
| Nominal capacity | Heating | Btu/hr | 19,620 | 23,340 | 28,760 |
| | Cooling | Btu/hr | 24,570 | 27,840 | 28,560 |
| Nominal input | Heating | kW | 1.35 | 1.66 | 2.21 |
| | Cooling | kW | 2.36 | 2.87 | 3.06 |
| COP | | | 4.25 | 4.12 | 3.81 |
| EER | | | 10.41 | 9.7 | 9.33 |

Measuring conditions: Heating Ta DB/WB 44.6°F/42.8°F (7/6°C) - LWC 95°F (35°C) (DT=9°F (5°C)
- Cooling Ta 95°F (35°C) - LWE 64.4°F (18°C) (DT=9°F (5°C)
* Booster heater operation from 95°F (35°C) onwards
(1) These conditions are based on under floor heating/cooling application

The U.S. Department of Energy (DOE) has issued Daikin with Waivers (Case number: CAC-024, as published from page no. 34,731 in the DOE Federal Register on June 18th, 2010, and Case number CAC-028 as published from page no. 11,438 in the DOE Federal Register on March 2nd, 2011) and assigned an "Alternate Test Procedure" detailing testing requirements to establish full load COP and EER values and provision for calculating the Seasonal Performance Factor (SPF).

**Note 1:** Full Load COP and EER values have been established per testing and rating in accordance to European Standard EN 14511, Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling.
**Note 2:** The Seasonal Performance Factor (SPF) of Heating operation and DHW is rated in accordance to European Standard EN 15316, Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies. As this standard is a calculation method, the SPF characteristics are automatically calculated based on individual equipment selections made with the "Daikin Altherma Simulator" selection software. For further details on this selection software, please contact your local Daikin sales office.



 

# Performance Summary

## ERLQ036, 048, 054 with EKHB_054

| SPLIT TYPE OUTDOOR UNIT 036/048/054 | | | ERLQ036BAVJU | ERLQ048BAVJU | ERLQ054BAVJU |
|---|---|---|---|---|---|
| Nominal capacity | Heating | Btu/hr | 38,200 | 47,800 | 54,600 |
| | Cooling | Btu/hr | 47,600 | 59,100 | 60,600 |
| Nominal input | Heating | kW | 2.46 | 3.17 | 3.83 |
| | Cooling | kW | 3.79 | 5.78 | 6.77 |
| COP | | | 4.55 | 4.42 | 4.18 |
| EER | | | 12.4 | 10.2 | 8.9 |

Measuring conditions: Heating Ta DB/WB 44.6°F/42.8°F (7/6°C) - LWC 95°F (35°C) (DT=9°F (5°C) - Cooling Ta 95°F (35°C) - LWE 64.4°F (18°C) (DT=9°F (5°C)
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# Performance Summary

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## EDLQ036, 048, 054 and EBLQ036, 048, 054

| MONOBLOC OUTDOOR UNIT 036/048/054 | | | HEATING ONLY | | | REVERSIBLE (HEAT PUMP) | | |
|---|---|---|---|---|---|---|---|---|
| | | | EDLQ036BA6V | EDLQ048BA6V | EDLQ054BA6V | EBLQ036BA6V | EBLQ048BA6V | EBLQ054BA6V |
| Nominal capacity | Heating | Btu/hr | 38,200 | 47,700 | 54,600 | 38,200 | 47,700 | 54,600 |
| | Cooling | Btu/hr | - | - | - | 43,800 | 54,500 | 57,000 |
| Nominal input | Heating | kW | 2.53 | 3.33 | 3.93 | 2.53 | 3.33 | 3.93 |
| | Cooling | kW | - | - | - | 3.91 | 5.79 | 6.43 |
| COP | | | 4.32 | 4.2 | 4.07 | 4.32 | 4.2 | 4.07 |
| EER | | | - | - | - | 11.21 | 9.42 | 8.88 |

Measuring conditions: Heating Ta DB/WB 44.6°F/42.8°F (7/6°C) - LWC 95°F (35°C) (DT=9°F (5°C)
- Cooling Ta 95°F (35°C) - LWE 64.4°F (18°C) (DT=9°F (5°C)
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# Performance Comparison

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Altherma is optimized for Heating but uses the same high efficiency INVERTER technology as regular Daikin split systems

Cooling

Heating

| Description | Model Numbers | EER | COP | SEER | HSPF |
|---|---|---|---|---|---|
| High SEER Heat Pump | FTXS09HVJURXS09DAVJU | 11.0 | 2.74 | 16.0 | 8.8 |
| High SEER Heat Pump | FTXS12HVJURXS12DAVJU | 9.3 | 3.37 | 16.0 | 8.8 |
| High SEER Heat Pump | FTXS15HVJURXS15DVJU | 12.2 | 3.36 | 17.0 | 10.1 |
| High SEER Heat Pump | FTXS18HVJURXS18DVJU | 11.3 | 3.17 | 16.3 | 9.1 |
| High SEER Heat Pump | FTXS24HVJURXS24DVJU | 9.3 | 2.72 | 15.0 | 9.2 |
| Quaternity Heat Pump | FTXG09HVJURXG09HVJU | 15.8 | 4.51 | 26.1 | 11 |
| Quaternity Heat Pump | FTXG12HVJURXG12HVJU | 14 | 4.04 | 24.2 | 10.55 |
| Quaternity Heat Pump | FTXG15HVJURXG15HVJU | 12.9 | 3.99 | 21 | 10 |
| 2 Zone Multi Heat Pump | Non Ducted2MXS18GVJU | 12.6 | 3.4 | 19.5 | 9.2 |
| 2 Zone Multi Heat Pump | Ducted2MXS18GVJU | 9.0 | 2.9 | 13 | 7.7 |
| 2 Zone Multi Heat Pump | Mixed2MXS18GVJU | 10.8 | 3.15 | 16.3 | 8.5 |
| 3 Zone Multi Heat Pump | Non Ducted3MXS24JVJU | 12.5 | 3.2 | 16.6 | 9.0 |
| 3 Zone Multi Heat Pump | Ducted3MXS24JVJU | 9.7 | 2.7 | 13 | 7.7 |
| 3 Zone Multi Heat Pump | Mixed3MXS24JVJU | 11.1 | 2.95 | 14.8 | 8.35 |
| 4 Zone Multi Heat Pump | Non Ducted4MXS32GVJU | 10.3 | 3.4 | 17.2 | 9.3 |
| 4 Zone Multi Heat Pump | Ducted4MXS32GVJU | 8.4 | 3.0 | 13.3 | 7.9 |
| 4 Zone Multi Heat Pump | Mixed4MXS32GVJU | 9.35 | 3.2 | 15.25 | |
| Split Altherma LT | ERLQ036BAVJU | 12.17 | | | |
| Split Altherma LT | ERLQ048BAVJU | 9.95 | 4.24 | N/A | N/A |
| Split Altherma LT | ERLQ054BAVJU | 8.73 | 4.03 | N/A | N/A |
| MonoBloc Altherma LT | EBLQ036BA6VJU | 11.71 | 4.32 | N/A | N/A |
| MonoBloc Altherma LT | EBLQ048BA6VJU | 9.42 | 4.2 | N/A | N/A |
| MonoBloc Altherma LT | EBLQ054BA6VJU | 8.89 | 4.07 | N/A | N/A |
| MonoBloc Altherma LT | EDLQ036BA6VJU | | 4.32 | N/A | |
| MonoBloc Altherma LT | EDLQ048BA6VJU | | 4.2 | N/A | N/A |
| MonoBloc Altherma LT | EDLQ054BA6VJU | | 4.07 | N/A | N/A |

Where a HSPF rating is available a COP of 4.0 or greater results in a HSPF of 10.0 or greater

Altherma Cooling full load COP ranges from 8.7 – 12+ which is equivalent to SEER 16 – 18 on regular split systems.

Altherma Heating full load COP exceeds maintains Daikin's excellent COP performance

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# Performance Comparison

Certificate of Product Ratings

3-Ton 2-Stage Geo-WSHP

**Equivalent Performance to Geo-WSHP**

- 036 Altherma with a cooling EER of 12.17 to GLHP (ground loop heat pump) cooling of 14.9 EER. (Rated Conditions)
- Altherma heating COP 4.34 to GLHP heating of 3.30 COP (Rated Conditions)
- New Haven, CT heating hours 4,148; cooling hours 1,309 (2009 weather data)

| **WLHP** (Water-Loop Heat Pumps) | **Full Load** |
|---|---|
| Cooling Capacity(Btuh) | 34500 |
| Cooling EER Rating(Btuh/watt) | 13.50 |
| Cooling Fluid Flow Rate(gpm) | 9.50 |
| Heating Capacity(Btuh) | 45200 |
| Heating COP(watt/watt) | 4.40 |
| Heating Fluid Flow Rate(gpm) | 9.50 |
| **GWHP**(Ground-Water Heat Pumps) | |
| Cooling Capacity(Btuh) | 38700 |
| Cooling EER Rating(Btuh/watt) | 20.70 |
| Cooling Fluid Flow Rate(gpm) | 9.50 |
| Heating Capacity(Btuh) | 37500 |
| Heating COP(watt/watt) | 4.00 |
| Heating Fluid Flow Rate(gpm) | 9.50 |
| **GLHP** (Ground-Loop Heat Pumps) | |
| Cooling Capacity(Btuh) | 35300 |
| Cooling EER Rating(Btuh/watt) | 14.90 |
| Cooling Fluid Flow Rate(gpm) | 9.50 |
| Heating Capacity(Btuh) | 29600 |
| Heating COP(watt/watt) | 3.30 |
| Heating Fluid Flow Rate(gpm) | 9.50 |

| ERLQ036BAVJU | | |
|---|---|---|
| Nominal capacity | Heating | 38,200btu/hr |
| | Cooling | 47,600Btu/hr |
| Nominal input | Heating | 2.46kW |
| | Cooling | 3.79kW |
| COP | | 4.55 |
| EER | | 12.4 |

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## Performance Statement (to meet CA Title 24)

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Daikin Altherma is an **Integrated** Air to Water Heat Pump System designed to **separately deliver** Space Heating, Space Cooling and supplying hot water for an connected DHW indirect tank.

The existing test procedures in the U.S. do not adequately define testing parameters for Air to Water systems and thus the U.S. DOE awarded Daikin Altherma a Waiver (No.s CAC-024, CAC-028) from those test procedures and instead instructed that Daikin use the EU test procedure (EN14511) as an alternate rating method.
The EN14511 testing and rating standard provides metrics to determine the system full load EER and COP. However to meet Title 24 requirements in CA, it is necessary to submit performance values for SEER, HSPF as well as E.F. for the DHW portion of the system (if utilized).

| Operation Mode | Metric | Note | Proposal |
|---|---|---|---|
| HEATING | COP | Full Load Efficiency | Use DOE Certified (EN14511) Values per U.S. DOE Waiver |
| | HSPF | Seasonal Efficiency | Use CEC COP > HSPF Calculation Method (HSPF = 3.2*COP-2.4) |
| COOLING | EER | Full Load Efficiency | Use DOE Certified (EN14511) Values per U.S. DOE Waiver |
| | SEER | Seasonal Efficiency | Use EER at 95F & 82F and utilize std SEER calculation |
| DOMESTIC HOT WATER | Alternative E.F. | Energy Factor (DHW) | Use COP at Nominal Condition with leaving water temp of 131F and base DHW usage on 56.5Gallons per day as worse case CA condition |



## Performance Statement (to meet CA Title 24)

DAIKIN AC absolute comfort

### CEC approved of Daikin Altherma systems

| Description | Model Number | Nominal Capacity (Tons) | Space Heating | | Space Cooling | Water Heating Efficiency |
|---|---|---|---|---|---|---|
| | | | Heating | Combined Hydronic | | |
| | | | HSPF | E.F. | SEER | E.F. |
| Split Altherma LT | ERLQ018BAVJU | 1.5 | 11 | 2.4 | 13 | 2.4 |
| Split Altherma LT | ERLQ024BAVJU | 2 | 11 | 2.4 | 13 | 2.4 |
| Split Altherma LT | ERLQ030BAVJU | 2.5 | 11 | 2.4 | 13 | 2.4 |
| Split Altherma LT | ERLQ036BAVJU | 3 | 11 | 2.4 | 13 | 2.4 |
| Split Altherma LT | ERLQ048BAVJU | 4 | 11 | 2.4 | 13 | 2.4 |
| Split Altherma LT | ERLQ054BAVJU | 4.5 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EBLQ036BA6VJU | 4 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EBLQ048BA6VJU | 5 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EBLQ054BA6VJU | 4.5 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EDLQ036BA6VJU | 3 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EDLQ048BA6VJU | 4 | 11 | 2.4 | 13 | 2.4 |
| Monobloc Altherma LT | EDLQ054BA6VJU | 4.5 | 11 | 2.4 | 13 | 2.4 |



# 3rd Party Verification EPRI White Paper

DAIKIN AC absolute comfort

## TEST DESIGN AND PROCEDURE

EPRI tested an Altherma heat pump with domestic water heating at its Knoxville, Tennessee laboratory for operation and performance in a semi-controlled environment. The system tested has a nominal capacity of 11.2 kW (38.2 kBtu/hr) heating and 13.9 kW (47.4 kBtu/hr) cooling. The unit model numbers are given below:

Outdoor Unit: ERHQ011AAV3V
Hydrobox: EKHBX011AB6V3V
Water Tank: EKHWS200B3V3X

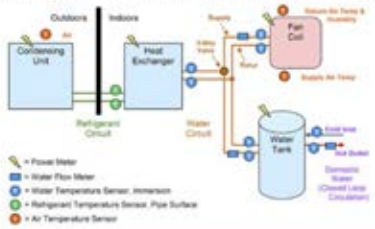
→ **ERLQ036BAVJU**
**EKHBX054BA6VJU**
**EKHWS050BA3VJU**

Testing conditions are loosely based on the AHRI Standard 210/240 "Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment, though the Altherma was not tested in controlled air conditions. It was installed in EPRI's thermals & environmental laboratory where indoor temperature and humidity are somewhat controlled, but outdoor temperature is not.

**Installation**

The Altherma conditioned water loop supplied a nominal 2-ton fan coil unit on one branch and the domestic water heater on a second branch. No radiant heating circuit was included in this setup. The domestic water heating and space conditioning branches were separated by a three way valve controlled by Altherma. A schematic of the Altherma setup is shown in Figure 3-1.

**Full Temperature Probe measurement of installed system for full system analysis**

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# EPRI Report Summary - Heating

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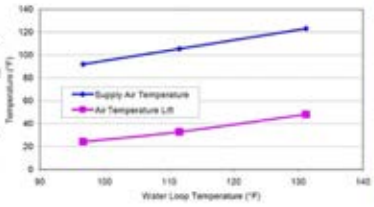
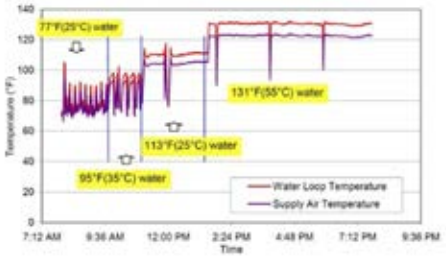
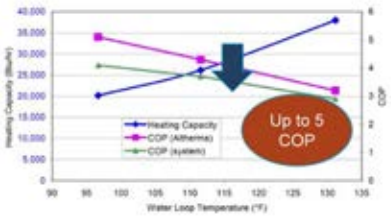
**Heating Mode Test**

In heating mode, hot water is generated by the Altherma hydro-box and is circulated through the heating water loop and heat is supplied to conditioned space through a fan coil air handler. The water loop temperature can be set through the Altherma controller in the range from 77°F (25°C) to 131°F (55°C).

Steady-state tests were run with water loop temperatures of 77, 95, 113, and 131°F (25, 35, 45, and 55°C). Figure 4-1 is a heating profile showing actual water loop temperature at the entrance to the fan coil and supply air temperature. The water loop temperature setting was adjusted throughout the test and the setting is indicated above or below the appropriate part of the graph and highlighted in yellow.

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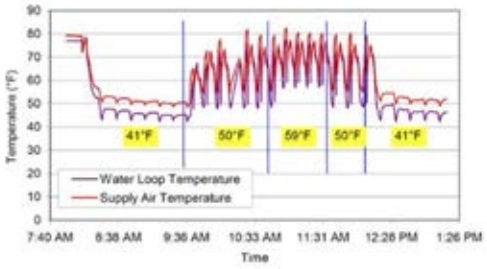
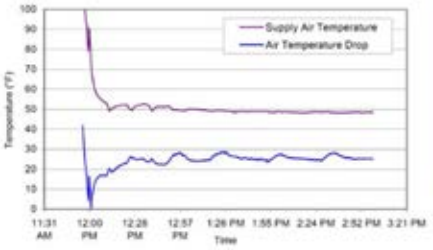
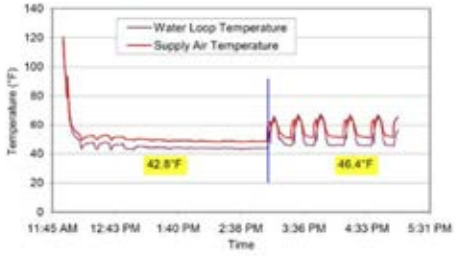
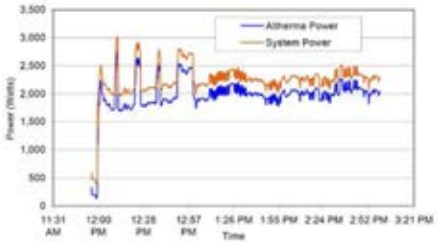
# EPRI Report Summary - Cooling

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# EPRI Report Summary - DHW

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**Altherma Water Heating**

EPRI conducted a series of "draw tests" for the water heating component of the Altherma system between August and October 2009, using procedures loosely based on the U.S. Code of Federal Regulations water heating test protocol.[1] EPRI used differing conditions that are not necessarily held within the prescribed bounds articulated in the federal standard. The draw test provides insight into how a water heater performs when nearly depleted of hot water from a single, continuous water draw event. Hot water is drawn from the water tank at 3.0 (±0.2) gpm until the water outlet temperature decreases by 25°F from the maximum observed water outlet temperature. When the 25°F-decrease is reached, the water heater will be nearly depleted of its hot water supply, and the water draw is terminated. The water heater is then allowed fully reheat undisturbed.

The draw tests were conducted using Altherma's heat pump only mode (i.e. no resistive elements were enabled) and a 120°F water tank temperature setting. Four draw tests were executed, and a summary of each draw test is provided in Table 4-1. The four draw tests are ordered based on average outdoor temperatures during each test, from lowest to highest outdoor temperature.

As shown in Table 4-1, the water drawn out of the tank for each draw test is generally between 47 and 49 gallons. The average power draw during the reheat period was consistent among the four draw tests (1.6kW to 1.8kW), but the maximum power draw varied quite largely (2.9kW to 4.4kW) with no apparent correlation to average outdoor temperature. The overall COP (quotient when "energy out" is divided by "energy in") increases with increasing average outdoor temperature, as should be expected with an outdoor heat pump unit. A graph showing the trend of overall COP verses average outdoor temperature is shown in Figure 4-10.

## EU Test Result based on PrEN255-3

| Scope | Set-Point | |
|---|---|---|
| | 118F | 113F |
| Heat Up COP | 2.46 | 2.69 |
| Standby P.L. / 24hr (heat losse of tank & standby power) | 3.954kW | |
| Tapping COP (large pattern) | 1.55 | 1.68 |
| Equivalent Hot Water (1st Hour Rating) | 93 Gallon | 85 Gallon |

**Based on 45F Ambient Condition**

**Summary of Draw Test results for Altherma Water Heater**

| Test Number | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Test Duration (hours) | 1.9 | 1.7 | 1.5 | 1.5 |
| Indoor Temp. Avg (°F) | 71.9 | 71.2 | 73.0 | 73.0 |
| Indoor Humidity, Avg (%RH) | 45.7 | 45.6 | 44.2 | 47.4 |
| Outdoor Temp During Reheat, Avg (°F) | 68.5 | 73.2 | 78.2 | 80.8 |
| Outdoor Humidity During Reheat, Avg (%RH) | 88.1 | 76.1 | 60.7 | 56.9 |
| Water Draw Flow Rate, Avg (gpm) | 2.7 | 3.0 | 3.0 | 3.0 |
| Water Draw Inlet Temp, Weighted Avg (°F) | 54.6 | 58.2 | 58.8 | 59.0 |
| Water Draw Outlet Temp, Weighted Avg (°F) | 119.3 | 119.4 | 119.6 | 120.1 |
| Water Draw Volume (gal) | 48.9 | 49.3 | 47.9 | 46.7 |
| Water Draw Energy (ton-h) | 2.2 | 2.1 | 2.0 | 2.0 |
| Electric Power Reheat, Avg (kW) | 1.7 | 1.7 | 1.8 | 1.6 |
| Electric Power Reheat, Max (kW) | 4.4 | 2.9 | 4.3 | 3.0 |
| Electric Energy Reheat (kWh) | 3.0 | 2.6 | 2.4 | 2.2 |
| Overall COP (Btu/Btu) | 2.6 | 2.8 | 3.0 | 3.2 |

**DHW Draw (Tapping) test result ranged from 2.6 – 3.2 COP**
**As a comparison, the recently launched Heat Pump water heaters achieve between 2.0-2.5 EF (COP)**

# Specification Summary

DAIKIN AC
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| Small Capacity "Split" Type Outdoor Unit | | | | ERLQ018BAVJU | ERLQ024BAVJU | ERLQ030BAVJU |
|---|---|---|---|---|---|---|
| Fan | Motor | Model | | | Brushless DC Motor | |
| | | Output | W | 53 | 53 | 53 |
| Operation range (Ambient Temperature) | | Heating | °F (°C) | | -4 - 77 (-20 - 25) | |
| | | Cooling | °F (°C) | | 50 - 110 (10 - 43) | |
| | | Domestic water | °F (°C) | | -4 - 110 (-20 - 43)* | |
| Sound power level | | Heating | dBA | 61 | 61 | 62 |
| | | Cooling | dBA | 63 | 63 | 63 |
| Sound pressure level | | Heating | dBA | 48 | 48 | 49 |
| | | Cooling | dBA | 48 | 48 | 50 |
| Air Flow Rate (nominal at 230V) (cfm) | | Heating | m3/min | N/A | N/A | N/A |
| | | Cooling | m3/min | N/A | N/A | N/A |
| Piping connections | Liquid (OD) | Type | | | Flare Connection | |
| | | Diameter (OD) | in. | 1/4 | 1/4 | 1/4 |
| | Gas | Type | in. | | Flare Connection | |
| | | Diameter (OD) | in. | 5/8 | 5/8 | 5/8 |
| | Drain | Type | in. | | Socket | |
| | | Diameter (OD) | in. | 7/10 | 7/10 | 7/10 |
| | Piping Length | Minimum | ft. | 10 | 10 | 10 |
| | | Maximum | ft. | 98 | 98 | 98 |
| | | Chargeless | ft. | 33 | 33 | 33 |
| | Installation Height Difference | Maximum | ft. | 66 | 66 | 66 |
| Refrigerant charge | Charge | R-410A | lbs. | 3.75 | 3.75 | 3.75 |
| | Additional | | oz/ft | 0.21 | 0.21 | 0.21 |
| Power supply | | | | | 208-230V/1Ph/60Hz | |
| Minimum Circuit Amps (MCA) | | | A | 18 | 18 | 18 |
| Maximum Over current Protection (MOP) | | | A | 20 | 20 | 20 |
| Dimensions (Net) | | HxWxD | in. | | 28-9/10 x 32-1/2 x 11-8/10 | |
| Weight | | Net | lbs. | 123 | 123 | 123 |
| | | Gross | lbs. | 134 | 134 | 134 |

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# Specification Summary

| HYDROBOX 030 | | | | EKHBH030BA3VJU | EKHBX030BA3VJU | EKHBH030B6VJU | EKHBX030B6VJU |
|---|---|---|---|---|---|---|---|
| Function | | | | Heating only | Reversible | Heating only | Reversible |
| Leaving water temperature range | | Heating | °F (°C) | (59) 77 - 131* ((15) 25 - 55) | | (59) 77 - 131* ((15) 25 - 55) | |
| | | Cooling | °F (°C) | - | 41 - 71.6 (122) (5 - 22 (50)) | - | 41 - 71.6 (122) (5 - 22 (50)) |
| Drain valve | | | | Yes | | | |
| Material | | | | Epoxy polyester painted galvanized steel | | | |
| Color | | | | Neutral white (RAL 9010) | | | |
| Dimensions (Net) | | HxWxD | in. | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 |
| Weight | | Net | lbs. | 101 | | 101 | |
| | | Gross | lbs. | 130 | | 130 | |
| Factory mounted back-up heater | | Capacity | kW | 3 | 3 | 6 | 6 |
| | | Capacity Steps | | 1 | 1 | 2 | 2 |
| | | Max Over current Protection (MOP) | | 20 A | 20 A | 30 A | 30 A |
| | | Minimum Circuit Amps (MCA) | | 14.3 A | 14.3 A | 28.6 A | 28.6 A |
| | | Power supply | | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz |
| When connected to all outdoor units | Main components | Expansion vessel | Volume | gal. | 2.64 | | 2.64 | |
| | | | Max. water pressure | PSI | 43.5 | | 43.5 | |
| | | | Pre Pressure | PSI | 14.5 | | 14.5 | |
| | Water circuit | Piping connections diameter | | in. | 1" Male BSP | | 1" Male BSP | |
| | | Piping | | in. | 1" | | 1" | |
| | | Safety valve | | PSI | 43.5 | | 43.5 | |
| | | Total water volume | | gal. | 5.5 | | 5.5 | |
| | Refrigerant circuit | Gas side diameter | | in. | ø 5/8 | | ø 5/8 | |
| | | Liquid side diameter | | in. | ø 1/4 | | ø 1/4 | |
| | Operation range | Waterside | Heating | °F (°C) | (59) 77 - 131* ((15) 25 - 55) | | (59) 77 - 131* ((15) 25 - 55) | |
| | | | Cooling | °F (°C) | - | 41 - 71.6 (122) (5 - 22 (50)) | - | 41 - 71.6 (122) (5 - 22 (50)) |

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# Specification Summary

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| | | HYDROBOX 030 | | | | EKHBH030BA3VJU | EKHBX030BA3VJU | EKHBH030B6VJU | EKHBX030B6VJU |
|---|---|---|---|---|---|---|---|---|---|
| | | Function | | | | Heating only | Reversible | Heating only | Reversible |
| When connected to ERLQ018 | Main components | Pump | Nominal ESP Unit | Heating | PSI | 7.1 | | 7.1 | |
| | | | | Cooling | PSI | - | 7.4 | - | 7.4 |
| | | Water side Heat exchanger | Water volume | | gal. | 0.18 | | 0.18 | |
| | | | Water flow rate Min./Max | | GPM | 3.17/11.09 | | 3.17/11.09 | |
| | | | Water flow rate Nom. | Heating | GPM | 4.35 | | 4.35 | |
| | | | | Cooling | GPM | - | 3.88 | - | 3.88 |
| When connected to ERLQ024 | Main components | Pump | Nominal ESP Unit | Heating | PSI | 6.5 | | 6.5 | |
| | | | | Cooling | PSI | - | 8.5 | - | 8.5 |
| | | Water side Heat exchanger | Water volume | | gal. | 0.18 | | 0.18 | |
| | | | Water flow rate Min./Max | | GPM | 3.17/11.09 | | 3.17/11.09 | |
| | | | Water flow rate Nom. | Heating | GPM | 5.18 | | 5.18 | |
| | | | | Cooling | GPM | - | 4.44 | - | 4.44 |
| When connected to ERLQ030 | Main components | Pump | Nominal ESP Unit | Heating | PSI | 5.5 | | 5.5 | |
| | | | | Cooling | PSI | - | 7.00 | - | 7.00 |
| | | Water side Heat exchanger | Water volume | | gal. | 0.18 | | 0.18 | |
| | | | Water flow rate Min./Max | | GPM | 3.17/11.09 | | 3.17/11.09 | |
| | | | Water flow rate Nom. | Heating | GPM | 6.37 | | 6.37 | |
| | | | | Cooling | GPM | - | 4.60 | - | 4.60 |

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# Specification Summary

DAIKIN AC
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| SPLIT TYPE OUTDOOR UNIT 036/048/054 | | | | ERLQ036BAVJU | ERLQ048BAVJU | ERLQ054BAVJU |
|---|---|---|---|---|---|---|
| Fan | Motor | Model | | Brushless DC motor | | |
| | | Output | W | 70 | | |
| Operation range | | Heating | °F (°C) | -4 - 95 (-20 - 35) | | |
| | | Cooling | °F (°C) | 50 - 114.8 (10 - 46) | | |
| | | Domestic water | °F (°C) | -4 - 109.4 (-20 - 43) | | |
| Sound power level | | Heating | dBA | 64 | 64 | 66 |
| | | Cooling | dBA | 64 | 66 | 69 |
| Sound pressure level | | Heating | dBA | 49 | 51 | 53 |
| | | Cooling | dBA | 50 | 52 | 54 |
| Air Flow Rate (nominal at 230V) (cfm) | | Heating | cfm | 3178 | 3178 | 3178 |
| | | Cooling | cfm | 3390 | 3531 | 3425 |
| Piping connections | Liquid (OD) | Type | | Flare connection | | |
| | | Diameter (OD) | in. | ø 3/8 | ø 3/8 | ø 3/8 |
| | Gas | Type | | Flare connection | | |
| | | Diameter (OD) | in. | ø 5/8 | ø 5/8 | ø 5/8 |
| | Drain | Type | | Hole | | |
| | | Diameter (OD) | in. | ø 1-1/32 | ø 1-1/32 | ø 1-1/32 |
| | Piping Length | Minimum | ft. | 16.4 | 16.4 | 16.4 |
| | | Maximum | ft. | 246 | 246 | 246 |
| | | Equivalent | ft. | 312 | 312 | 312 |
| | | Chargeless | ft. | 98.4 | 98.4 | 98.4 |
| | Installation Height Difference | Maximum | ft. | 98.4 | 98.4 | 98.4 |
| Refrigerant charge | Charge | R-410A | lbs. | 8.15 | | |
| | Additional | | oz/ft | Refer to chart in installation instructions | | |
| Power supply | | | | 208-230V/1Ph/60HZ | | |
| Maximum Overcurrent Protection (MOP) | | | A | 30 | | |
| Dimensions (Net) | | HxWxD | in. | 46 1/6 x 35 7/16 x 12 5/8 | | |
| Weight | | Net | lbs. | 227 | 227 | 227 |
| | | Gross | lbs. | 251.3 | 251.3 | 251.3 |

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# Specification Summary

DAIKIN AC
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| HYDROBOX 054 | | | | | EKHBH054BA3VJU | EKHBX054BA3VJU | EKHBH054B6VJU | EKHBX054B6VJU |
|---|---|---|---|---|---|---|---|---|
| Function | | | | | Heating only | Reversible | Heating only | Reversible |
| Leaving water temperature range | | Heating | °F (°C) | | (59) 77 - 131* | ((15) 25 - 55) | (59) 77 - 131* | ((15) 25 - 55) |
| | | Cooling | °F (°C) | | - | 41 - 71.6 (5 - 22) | - | 41 - 71.6 (5 - 22) |
| Drain valve | | | | | Yes | | | |
| Material | | | | | Epoxy polyester painted galvanized steel | | | |
| Color | | | | | Neutral white (RAL 9010) | | | |
| Dimensions (Net) | | HxWxD | in. | | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 | 36 5/16 x 19 3/4 x 14 7/32 |
| Weight | | Net | lbs. | | 123 | | 123 | |
| | | Gross | lbs. | | 152 | | 152 | |
| Factory mounted heater | | Capacity | kW | | 3 | 3 | 6 | 6 |
| | | Capacity Steps | | | 1 | 1 | 2 | 2 |
| | | Max Over current Protection (MOP) | | | 20 A | 20 A | 30 A | 30 A |
| | | Minimum Circuit Amps (MCA) | | | 14.3 A | 14.3 A | 28.6 A | 28.6 A |
| | | Power supply | | | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz | 208-230V/1Ph/60Hz |
| When connected to all outdoor units | Main components | Expansion vessel | Volume | gal. | 2.64 | | 2.64 | |
| | | | Max. water pressure | PSI | 43.5 | | 43.5 | |
| | | | Pre Pressure | PSI | 14.5 | | 14.5 | |
| | Water circuit | Piping connections diameter | | in. | 1 1/4 Male BSP | | 1 1/4 Male BSP | |
| | | Piping | | in. | 1 1/4 | | 1 1/4 | |
| | | Safety valve | | PSI | 43.5 | | 43.5 | |
| | | Total water volume | | gal. | 1.45 | | 1.45 | |
| | Refrigerant circuit | Gas side diameter | | in. | ø 5/8 | | ø 5/8 | |
| | | Liquid side diameter | | in. | ø 3/8 | | ø 3/8 | |
| | Operation range | Waterside | Heating | °F (°C) | 59 - 131 (15 - 55) | | 59 - 131 (15 - 55) | |
| | | | Cooling | °F (°C) | - | 41 - 71.6 (5 - 22) | - | 41 - 71.6 (5 - 22) |

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# Specification Summary

| | | HYDROBOX 054 | | | EKHBH054BA3VJU | EKHBX054BA3VJU | EKHBH054B6VJU | EKHBX054B6VJU |
|---|---|---|---|---|---|---|---|---|
| | | Function | | | Heating only | Reversible | Heating only | Reversible |
| When connected to ERLQ036 | Main components | Pump | Nominal ESP Unit Heating | PSI | 7.6 | | 7.6 | |
| | | | Nominal ESP Unit Cooling | PSI | - | 8.1 | - | 8.1 |
| | | Water side Heat exchanger | Water volume | gal. | 0.26 | | 0.26 | |
| | | | Water flow rate Min./Max | GPM | 4.23/15.32 | | 4.23/15.32 | |
| | | | Water flow rate Nom. Heating | GPM | 8.48 | | 8.48 | |
| | | | Water flow rate Nom. Cooling | GPM | - | 7.58 | - | 7.58 |
| When connected to ERLQ048 | Main components | Pump | Nominal ESP Unit Heating | PSI | 6.3 | | 6.3 | |
| | | | Nominal ESP Unit Cooling | PSI | - | 7.1 | - | 7.1 |
| | | Water side Heat exchanger | Water volume | gal. | 0.26 | | 0.26 | |
| | | | Water flow rate Min./Max | GPM | 4.23/15.32 | | 4.23/15.32 | |
| | | | Water flow rate Nom. Heating | GPM | 10.59 | | 10.59 | |
| | | | Water flow rate Nom. Cooling | GPM | - | 9.46 | - | 9.46 |
| When connected to ERLQ054 | Main components | Pump | Nominal ESP Unit Heating | PSI | 5.08 | | 5.08 | |
| | | | Nominal ESP Unit Cooling | PSI | - | 6.79 | - | 6.79 |
| | | Water side Heat exchanger | Water volume | gal. | 0.26 | | 0.26 | |
| | | | Water flow rate Min./Max | GPM | 4.23/15.32 | | 4.23/15.32 | |
| | | | Water flow rate Nom. Heating | GPM | 12.13 | | 12.13 | |
| | | | Water flow rate Nom. Cooling | GPM | - | 9.93 | - | 9.93 |



 

# Specification Summary

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| MONOBLOC OUTDOOR UNIT 036/048/054 | | | HEATING ONLY | | | REVERSIBLE (HEAT PUMP) | | |
|---|---|---|---|---|---|---|---|---|
| SINGLE PHASE | With bottom plate heater | | EDLQ036BA6VJ | EDLQ048BA6VJ | EDLQ054BA6VJ | EBLQ036BA6VJ | EBLQ048BA6VJ | EBLQ054BA6VJ |
| Operation range | Heating | °F (°C) | 5 - 95 [1] (-15 - 35) | | | 5 - 95 [1] (-15 - 35) | | |
| | Cooling | °F (°C) | - | | | 50 - 114.8 (10 - 46) | | |
| | Domestic water | °F (°C) | 5 - 95 [1][2] (-15 - 35) | | | 5 - 95 [1][2] (-15 - 35) | | |
| Sound power level | Heating | dBA | 64 | 64 | 66 | 64 | 64 | 66 |
| | Cooling | dBA | - | - | - | 65 | 66 | 69 |
| Sound pressure level | Heating | dBA | 51 | 51 | 52 | 51 | 51 | 52 |
| | Cooling | dBA | - | - | - | 50 | 52 | 54 |
| Refrigerant charge (R-410A) | Charge | lbs. | 6.5 | | | 6.5 | | |
| | Additional | lbs. | Not Required | | | Not Required | | |
| Power supply | | | 208-230V/1Ph/60Hz | | | 208-230V/1Ph/60Hz | | |
| Minimum Circuit Amps (MCA) | | A | | | | | | |
| Maximum Over current Protection (MOP) | | A | 30 | | | 30 | | |
| Dimensions (Net) | HxWxD | in. | 55 27/32 x 56 1/2 x 15 1/32 | | | 55 27/32 x 56 1/2 x 15 1/32 | | |
| Weight | Net | lbs. | 397 | | | 397 | | |
| | Gross | lbs. | 441 | | | 441 | | |

Measuring conditions: Heating Ta DB/WB 44.6°F/42.8°F (7/6°C) - LWC 95°F (35°C) - Cooling Ta 95°F (35°C) - LWE 64.4°F (18°C)
(1) E(D/B)L* models can reach -4°F (-20°C) but without capacity guarantee
(2) Booster heater operation from 95°F (35°C) onwards
(3) For further information pertaining to the hydronic specs of the Monobloc system, refer to the engineering data book

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# Specification Summary

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| MONOBLOC OUTDOOR UNIT 036/048/054 | | | HEATING ONLY | | | REVERSIBLE (HEAT PUMP) | | |
|---|---|---|---|---|---|---|---|---|
| SINGLE PHASE | With bottom plate heater | | EDLQ036BA6VJU | EDLQ048BA6VJU | EDLQ054BA6VJU | EBLQ036BA6VJU | EBLQ048BA6VJU | EBLQ054BA6VJU |
| Leaving water temperature range | Heating | °F (°C) | 59 - 131 (15 - 55) | | | 59 - 131 (15 - 55) | | |
| | Cooling | °F (°C) | N/A | | | 41 - 71.6 (5 - 22) | | |
| Expansion vessel | Volume | gal. | 2.64 | | | 2.64 | | |
| | Max. water pressure | PSI | 43.5 | | | 43.5 | | |
| | Pre Pressure | PSI | 14.5 | | | 14.5 | | |
| Water Piping connections diameter | | in. | 1 1/4 Female BSP | | | 1 1/4 Female BSP | | |
| Safety valve | | PSI | < 43.5 | | | < 43.5 | | |
| Total water volume | | gal. | 1.45 | | | 1.45 | | |
| Pump (Nominal ESP) | Heating | PSI | 7.61 | 6.31 | 5.00 | 7.61 | 6.31 | 5.00 |
| | Cooling | PSI | N/A | N/A | N/A | 8.11 | 7.12 | 6.79 |
| Water side Heat exchanger | Water volume | gal. | 0.27 | | | 0.27 | | |
| | Water flow rate Min./Max | GPM | 4.23 / 15.32 | | | 4.23 / 15.32 | | |
| | Water flow rate Nom. | Heating GPM | 8.48 | 10.59 | 12.13 | 8.48 | 10.59 | 12.13 |
| | | Cooling GPM | N/A | N/A | N/A | 9.72 | 12.13 | 12.68 |
| Factory mounted Back Up Heater | Capacity | kW | 6 | | | 6 | | |
| | Capacity Steps | | 2 | | | 2 | | |
| | Max Over current Protection (MOP) | | 28.6 | | | 28.6 | | |
| | Minimum Circuit Amps (MCA) | | 30 | | | 30 | | |
| | Power supply | | 208-230V / 1 / 60Hz | | | 208-230V / 1 / 60Hz | | |

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# Specification Summary

**Note:**
**Factory supplied 3-Way Valve is included**

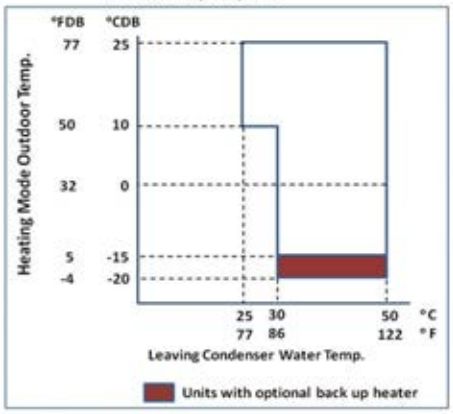
| DOMESTIC HOT WATER TANK | | | EKHWS050BA3VJU | EKHWS080BA3VJU |
|---|---|---|---|---|
| Water volume | | gal. | 52.8 | 79.2 |
| Max. water temperature | | °F (°C) | 185 | |
| Max. water pressure | | PSI | 145 | |
| Insulation (Polyurethane foam) Min. thickness | | in. | 1-5/8 | |
| Height | | in. | 45-3/8 | 63 |
| Diameter | | in. | 22-7/8 | |
| Booster heater | | kW | 3 | |
| Piping connections | Water inlet H/E Diameter | in. | ø 3/4 FBSP | |
| | Water outlet H/E Diameter | in. | ø 3/4 FBSP | |
| | Cold water in Diameter | in. | ø 3/4 FBSP | |
| | Hot water out Diameter | in. | ø 3/4 FBSP | |
| Minimum Circuit Amps (MCA) | | A | 14.3 | |
| Maximum Over current Protection (MOP) | | A | 20 | |
| Power supply | | | 208-230V/1Ph/60Hz | |
| Material inside tank | | | Stainless steel (DIN 1.4521) - 316L | |
| Material outside casing | | | Epoxy-coated mild steel | |
| Color | | | Neutral white | |
| Dimensions (Net) | HxWxD | in. | 45 9/32 x 22 27/32 x 22 27/32 | 63 x 22 27/32 x 22 27/32 |
| Empty weight | | lbs. | 99 | 129.8 |



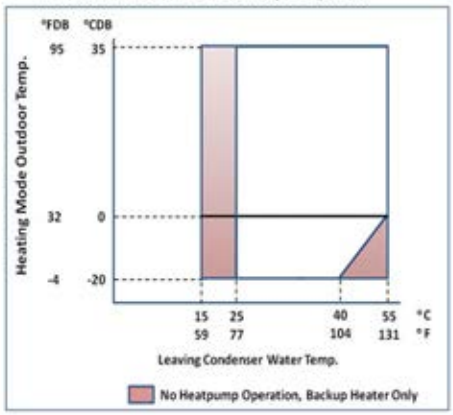
 

# Operation Range – Heating Mode

ERLQ 018,024,030




ERLQ / EDLQ / EBLQ 036, 048, 054

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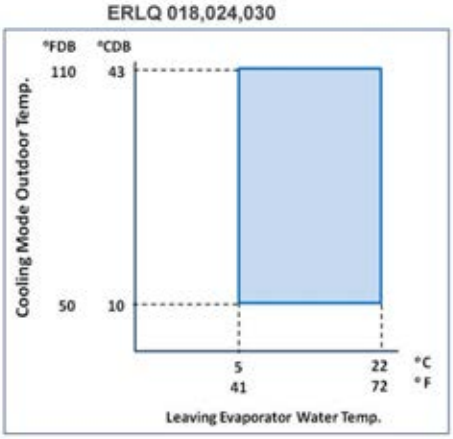
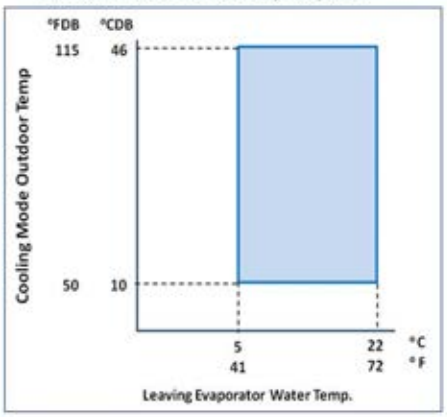
# Operation Range – Cooling Mode

ERLQ 018,024,030




ERLQ / EDLQ / EBLQ 036, 048, 054

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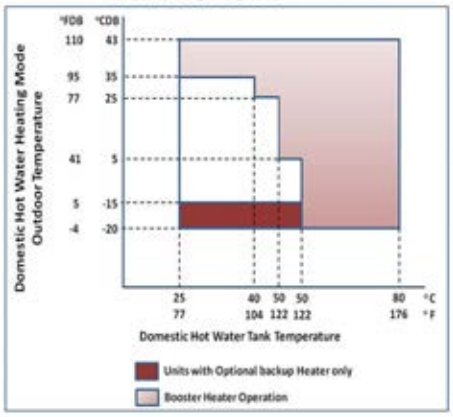
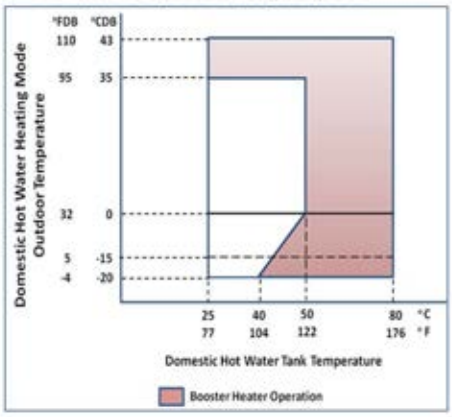
# Operation Range – DHW Mode

ERLQ 018,024,030




ERLQ / EDLQ / EBLQ 036, 048, 054





## Standard Limited Warranty

**Leading Product Warranty**

Daikin offers industry leading comprehensive standard warranties for extra peace of mind with your investment. Extended warranties are also available.


**Notes:**

1. Parts warranty includes Fan Coil and Hydrobox components.
2. Warranty terms are valid from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) twenty-four (24) months from the date of shipment by Daikin AC.

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Thank You
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# Daikin Altherma™ Applications



**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name
Presenter's Title

# Daikin Altherma Split System

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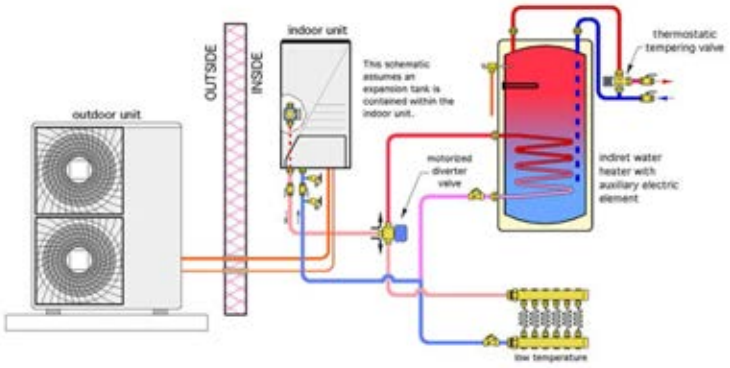
Air-to-Water Heat Pump Systems




Daikin Altherma is an innovative system that **heats,** produces **domestic hot water and can even cool** spaces. Daikin Altherma offers your customers maximum comfort the whole year through.

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# System design Considerations

- Determined Heat Gain/Loss (using Manual J)
- Chosen to dominate the system design, either Heating or Cooling which ever has been
- The heating and cooling load estimates affect every aspect of the system design procedure, system selection and equipment selection procedures

- The load calculation must be as accurate as possible
  - Eliminate Under-sizing of Equipment
  - Eliminate Over-sizing of Equipment



 

# System design Considerations

- **Under Sizing Equipment Causes**
  The obvious problem with undersized equipment is that it will not maintain the desired temperature.

- **Oversized Equipment Causes**
  - short-cycles
  - increases the installed cost
  - increases the operating cost
  - increases the demand on our utilities
  - adds unnecessary stress on equipment

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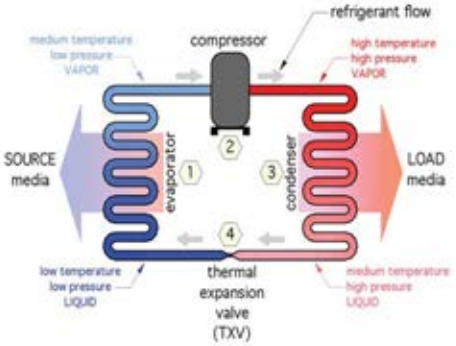
# Basic Heat Pump Operation

Basic heat pump operation




1. Air comes into contact with a liquid refrigerant in the ***evaporator***. The refrigerant absorbs the ambient heat from the air and evaporates.
2. The resulting gas passes to a ***compressor***, which increases the pressure, and therefore the temperature, of the gas.
3. The hot compressed gas now passes to the ***condenser*** where it is passed over a cold surface. This surface absorbs the heat from the gas and uses it to heat. As the gas cools it returns to its liquid state.
4. The liquid travels to an ***expansion valve*** where it resumes normal pressure then returns to the evaporator to be recycled around the system.



# Basic Heat Pump Operation

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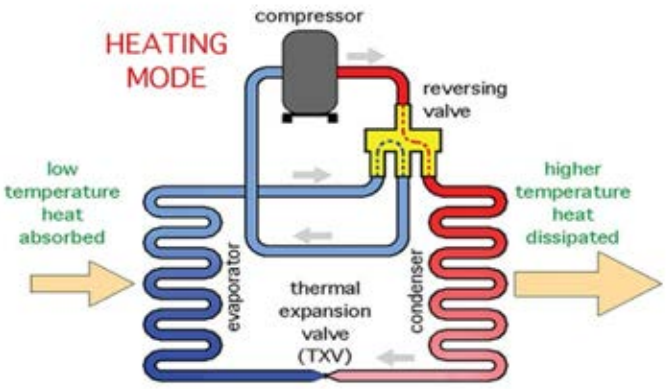
## Basic Heat pump operation (reversible heat pumps)

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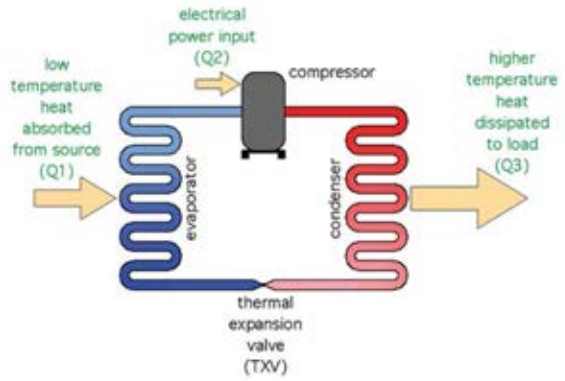
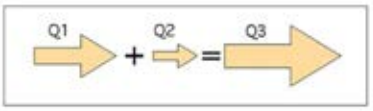
# Basic Heat Pump Operation




$$COP = \frac{Q3}{Q2}$$

$$\text{COP} = \frac{\text{heat output (Btu/hr)}}{\text{electrical input (watt)} \times 3.413}$$

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# Daikin Altherma System Applications

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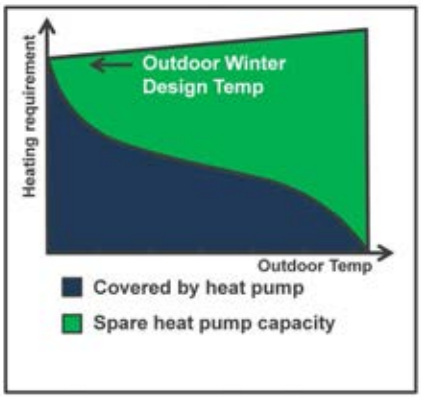
## MONO-VALENT: Ideal for New Construction


- Uses heat pump energy only
- Ideal for new construction (i. e. Net Zero designs, deep energy retrofits)
- 100% heat pump coverage: higher investment cost heat pump

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# Daikin Altherma System Applications

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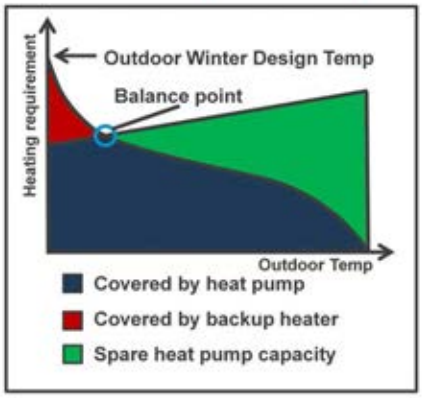
## MONO-ENERGETIC : Ideal for New Construction


- Uses heat pump energy with backup electric heater
- Ideal for new construction
- Best balance between investment cost and running costs

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# Daikin Altherma System Applications

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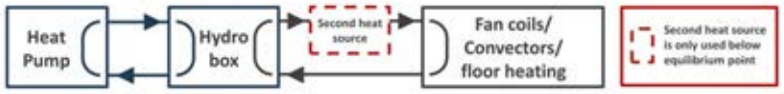
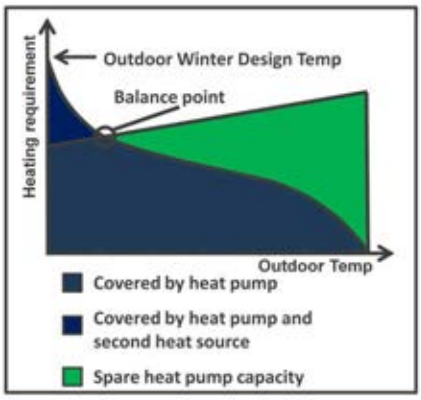
## CO-VALENT Option 1:




- Uses heat pump energy and second heat source
- Second heat source can be electric, oil or gas boiler
- Ideal for refurbishment/upgrade



# Daikin Altherma System Applications

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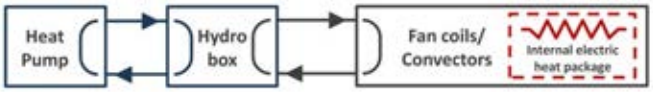
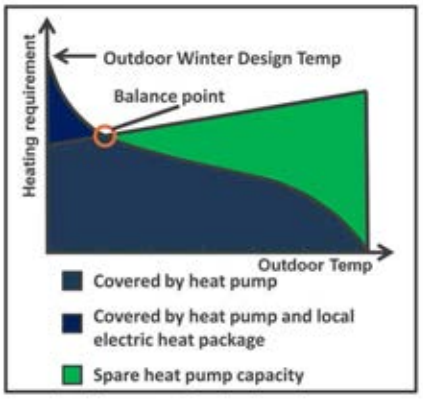
## CO-VALENT Option 2:




- Uses heat pump energy with local electric heat packages
- Electric packages can be easily staged by room thermostats
- Good balance between investment cost and running costs

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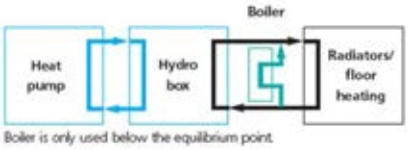
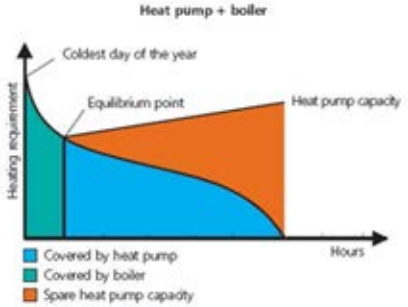
# Daikin Altherma System Applications

## Ideal for Refurbishment/Upgrade

**Bi-Valent**




Boiler is only used below the equilibrium point




**Space Heating with an Auxiliary Boiler**

1. Space heating application by either the Daikin Altherma Hydrobox or by an Auxiliary boiler connected in the system.
2. An auxiliary contact decides whether the Hydrobox or the boiler will operate.
3. The auxiliary contact can be an outdoor temperature thermostat, an electricity tariff contact, a manually operated contact etc.
4. Domestic Hot Water in such an application is always produced by the System Tank connected to the Hydrobox, including when the boiler is in operation for space heating.



## Daikin Altherma Considerations

- Minimum Water Content of the system:
  **2.6 gallons (10 liters) for sizes: 018-030**
  **5.3 gallons (20 liters) for sizes: 036-054**
  are minimum water volume for the systems. This volume excludes the volume of the heat emitters selected.
- Hydronic Circuit Flow is Greater than the Max Flow Through System
  A primary/secondary piping configuration will have to be used by incorporating closely spaced tees or a hydro separator.
  Maximum flow through the hydrobox
  **11 GPM for 018-030 size.**
  **15 GPM for 036-054 size**.
- The Operation Heating supply water temperatures for Altherma
  **Floor heating: 86°to 95°F / 30°to 35°C**
  **Fan Coil Units: 86°to 113°F / 30°to 45°C**
  **Low temperature radiators: 104°to 122°F / 40°to 50°C**

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## System Design and Operation Recommendations

- Accurate calculations of heat losses (transmission and ventilation losses)
- Selection of Daikin Altherma based on heat loss calculation and preferably for low water temperature application (95°F/35°C to 104°F/40°C).
  Use the available Daikin Altherma selection and software tools.
- Selection of heat emitters should be based on design ΔT of 9°F/5°C for optimum efficiency and capacity.
  The actual heat emitter ΔT can be designed between 5°F/3°C to 14°F/8°C.



 

## System Design and Operation Recommendations

- The circulator in the hydrobox section has a three speed motor and is factory set on high speed; remember to match the circulator speed with the required system flow
  (lower circulator speed can be selected at lower flow and head).
  If the system flow exceeds 12 gpm @ approximately 10 feet of head, a primary/secondary hydronic piping system is recommended.

- ***Design hint:***
  *If the heat losses exceed the single total Altherma capacity at design ambient conditions, multiple Altherma system may be used in unison to aid greater DHW consumption or larger heating loads in single zones. For multiple zones it is highly recommended to utilize multiple (separate) systems. Daikin Altherma can also be applied using an auxiliary boiler connected in parallel*
  *(Bi-Valent application)*



 

## Altherma Split Type Overview

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# *Split system* air-to-water heat pump

image courtesy of Daikin

Outdoor unit

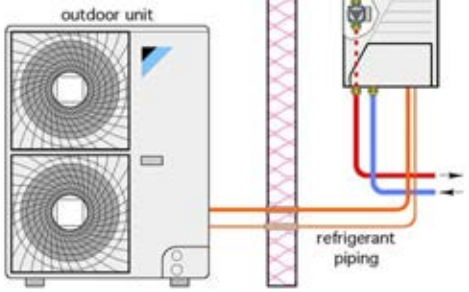
Heating mode:
1. compressor
2. evaporator
3. expansion device

Cooling mode:
1. compressor
2. condenser
3. expansion device

Indoor unit

Heating mode:
1. condenser
2. circulator
3. expansion tank
4. aux element
5. controls

Cooling mode:
1. evaporator
2. circulator
3. expansion tank
4. controls

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# Altherma Monobloc Type Overview

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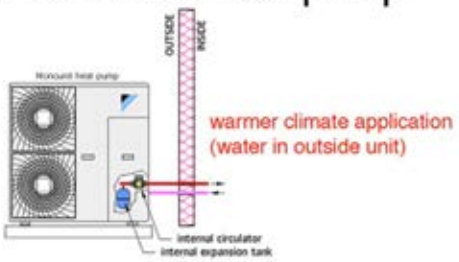
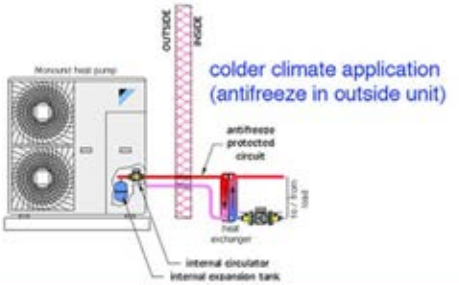
## *Complete unit* air-to-water heat pump

Image courtesy of Daikin

Complete unit

Monobloc

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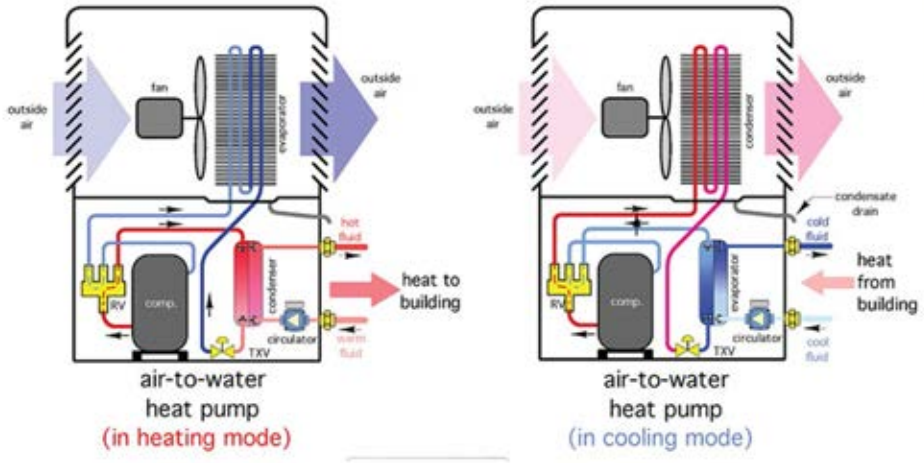
# Internal components





## Heating Performace Overview

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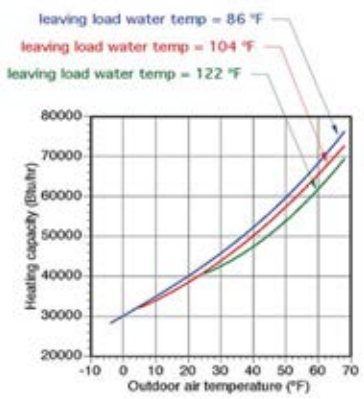
# Heating performance:

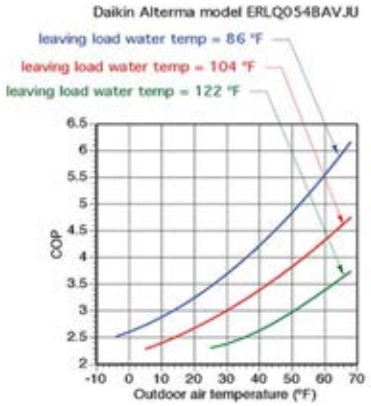
$$COP = \frac{\text{heat output (Btu/hr)}}{\text{electrical input (watt)} \times 3.413}$$

Daikin Alterma model ERLQ054BAVJU




**Heating capacity**
Increases with:
a. warmer outdoor temperature
b. lower load water temperature

Daikin Alterma model ERLQ054BAVJU




**COP**
Increases with:
a. warmer outdoor temperature
b. lower load water temperature

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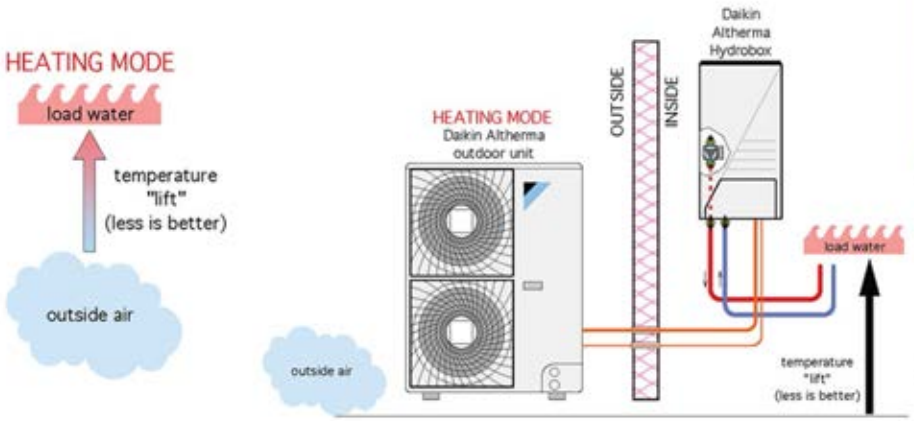
# Heating Performace Overview




**Anything the decrease the "temperature lift" increases both the heating capacity and COP of the heat pump.**

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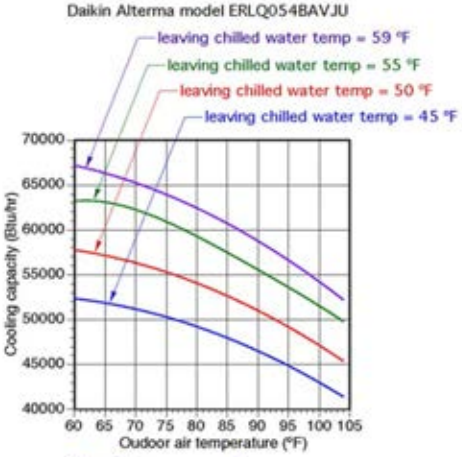
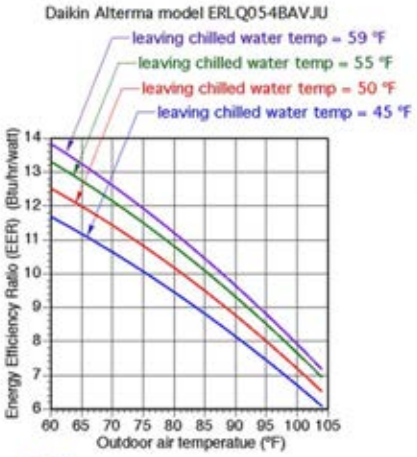
# Cooling Performace Overview




**Cooling capacity**
Increases with:
a. lower outdoor temperature
b. Higher chilled water temperature




**EER**
Increases with:
a. lower outdoor temperature
b. higher chilled water temperature

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# Cooling Performace Overview

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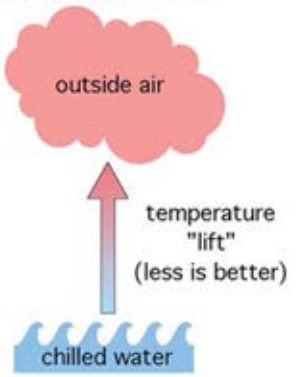
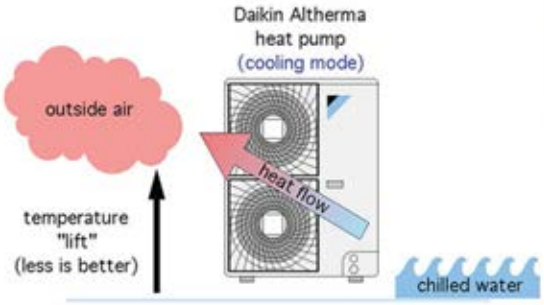
## COOLING MODE




**Anything the decreases the temperature lift' increases both the cooling capacity and EER of the heat pump.**

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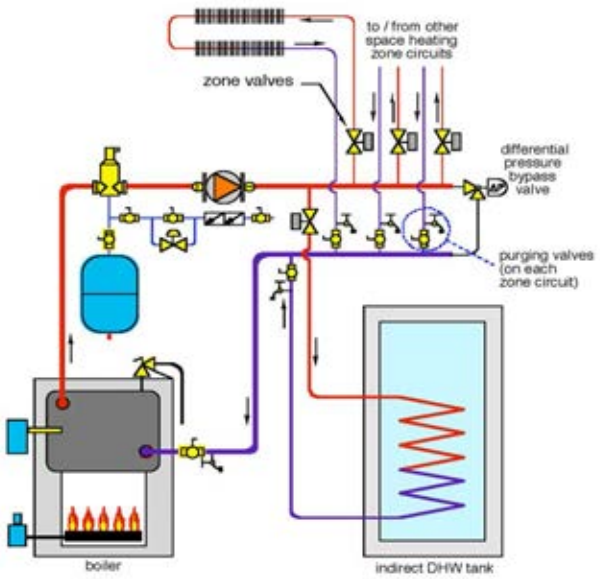
# Conventional Boiler Overview

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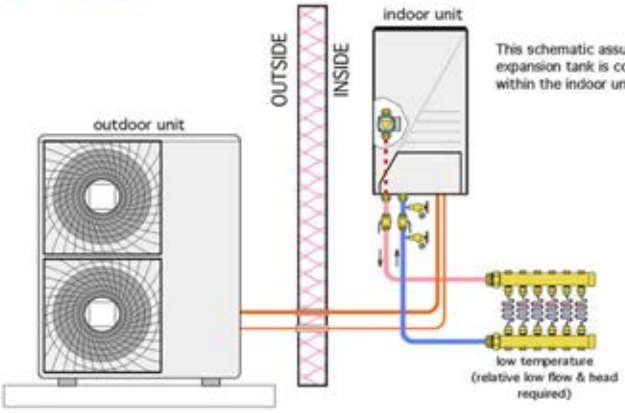
# Application Combination Flexibility

## Heating only application - for small loads




NOTE:

1. Be sure that the "net" pump curve for the internal circulator shows suffıcient flow and head for the distribution system.

2. Be sure the internal expansion tank in the indoor unit has sufficient capacity for the volume of the distribution system.

# Application Combination Flexibility

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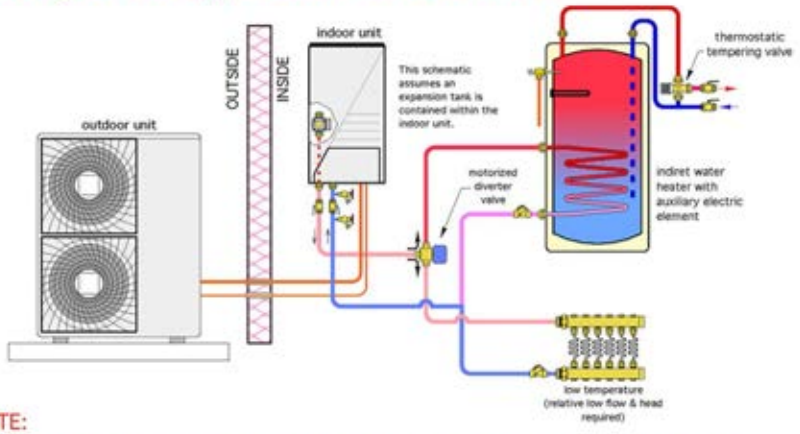
## Heating + DHW application - for small loads




NOTE:

1. Be sure that the "net" pump curve for the internal circulator shows sufficient flow and head for the distribution system.

2. Be sure the internal expansion tank in the indoor unit has sufficient capacity for the volume of the distribution system.

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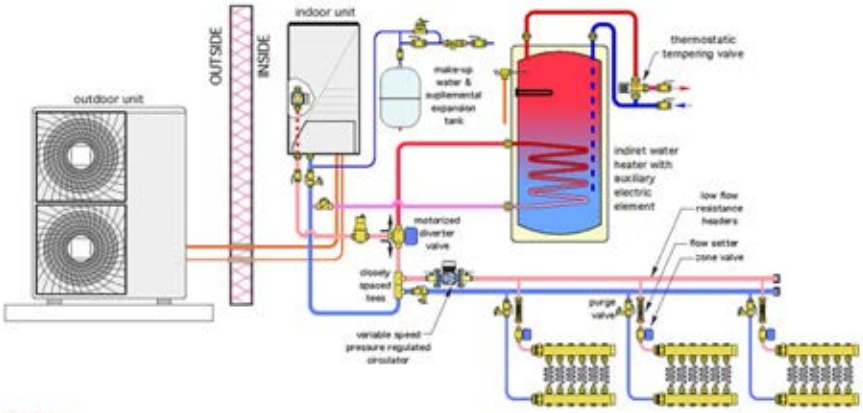
# Application Combination Flexibility

## Heating + DHW application - for LARGER loads




NOTE:

1. Be sure that the "net" pump curve for the internal circulator shows sufficient flow and head for the indirect tank circuit.

2. Size the supplement expansion tank for the volume of the distribution system.

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# Application Combination Flexibility

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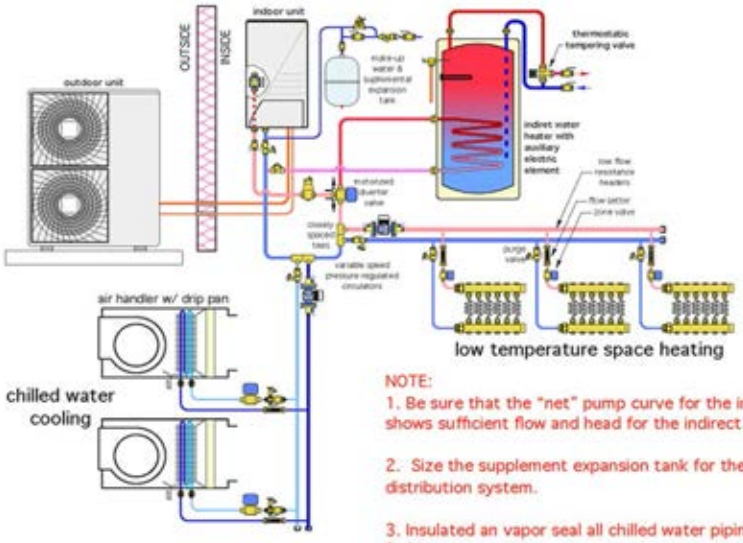
## Heating + Cooling +DHW application - for LARGER loads




NOTE:

1. Be sure that the "net" pump curve for the internal circulator shows sufficient flow and head for the indirect tank circuit.

2. Size the supplement expansion tank for the volume of the distribution system.

3. Insulated an vapor seal all chilled water piping, valves, fittings

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# Application Combination Flexibility

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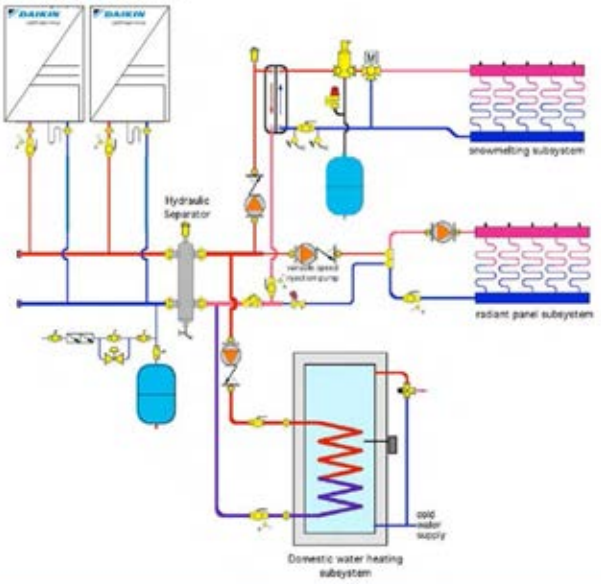
## Multiple Altherma Systems

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## comfort with the lowest energy consumption

- To get the most comfort with the lowest energy consumption with Daikin Altherma, it is very important to observe the following items:
- Define possible schedule timer actions for each day by filling out the form at the end of the operation manual can help minimize energy consumption.
- Make sure the heat pump system works at the lowest possible hot water temperature to heat the home. To optimize this, make sure the weather dependent set point (outdoor reset) is used and configured to match the installation environment (use the available selection and software tool).
- Make sure the DHW is only heated up to the temperature required.
- Make sure the DHW heating by the booster heater located in the DHW tank is started 1 to 2 hours before the expected DHW usage (refer to the DHW heating and booster heating schedule timer programming in the operation manual).



 

# Application Combination Flexibility

**Zone Heating:**

Typical Conditions for under floor heating LWT 86°F to 95°F (30°C to 35°C) at design conditions.

Cooling to Prevent condensation temperature can never be **lower than 64.4°F (18°C)**

**Minimum Water Volume:**

Assure that the total water volume, excluding the internal water volume of the indoor unit is enough

**Min. 2.6 gal for size: 018-030**
**Min. 5.3 gal for size: 036-054**


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# Application Combination Flexibility

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**Zone Heating with Domestic Hot Water**

Equivalent Hot Water Volume usage at a temperature of 104° F, which considered a comfortable domestic hot water temperature


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# Application Combination Flexibility

**Zone Heating / Cooling with Domestic Hot Water**

- Heating: 86 F (30 C) to 113 F (45 C) (Max118 F (48 C) for heating)
  Cooing: 41 F (5 C) to 55 F (13 C)
- Fan Convectors: 104 F(40 C) to 122 F(50 C)

**Zones Heating / Cooling with Domestic Hot Water**

- Entering water temperature (not to exceed 122 F (50 C) for heating and not below 41 F (5 C) for cooling)
- Entering air temperature of coil (typically 68 F (20 C) for heating and 77 F (25 C) for cooling)
- Under Floor heating LWT 86 F (30 C) to 95 F (35 C)




 

# Application Combination Flexibility

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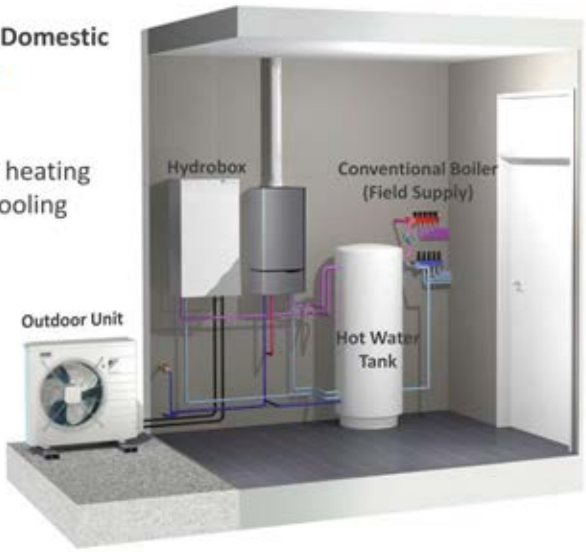
**Bi-Valent Application**

**Zones Heating / Cooling with Domestic Hot Water and Boiler Backup**

- Entering water temperature not to exceed 149°F/65°C for heating and not below 41°F/5°C for cooling

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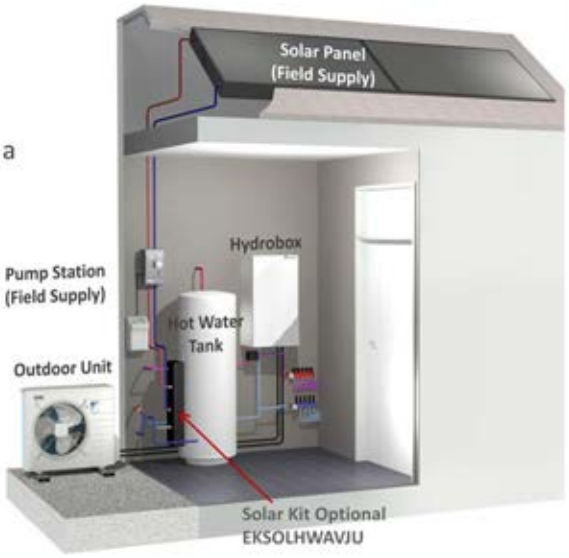
# Application Combination Flexibility

**Solar Kit Option:**

Daikin Altherma when applied with the DHW option, can additionally have a "Solar Kit" included that then connects to a Solar Thermal solution

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# Application Combination Flexibility

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Thermal Tank Storage
(www.tss-ecx.com)




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## Application Combination Flexibility

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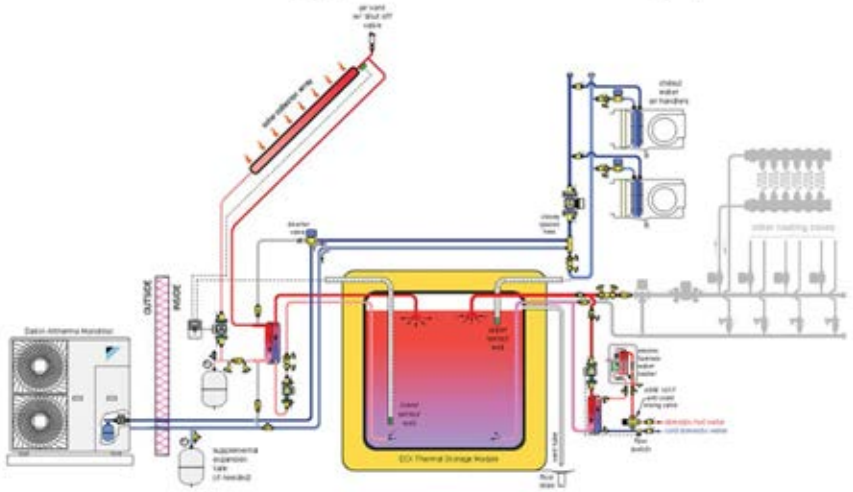
Heat pump + solar input to storage

Direct to load cooling (no chilled water storage)



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## Application Summary

- Air to water heat pumps are available for hydronic heating, chilled water cooling, and domestic water heating.
- Both "self-contained" and "split system" versions are available
- In cold climates "self-contained" systems should use antifreeze to protect against freezing.
- Life cycle cost can be very competitive or lower than ground source heat pumps (depending on climate and load).
- Can be combined with large thermal storage to take advantage of favorable outdoor air temperatures and/or off-peak electrical rates.
- Keep supply water temperature on heating distribution system as low as possible for best performance. Suggest supply water temperature at design load not exceed 120ºF.
- Keep supply water temperature on cooling distribution system as high as possible for best performance. Suggest supply water temperature at design load not be less than 45ºF.


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Thank You
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# Daikin Altherma™
# Hydronic Fan Coil Unit Option



**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name
Presenter's Title

# Hydronic Fan Coil Unit - Overview

- For Hydro-Air or traditional forced air applications, the high efficiency hydronic fan coil unit can be used with Daikin Altherma to meet your comfort needs
- The Hydronic Fan Coil Unit has been engineered to provide an effective solution in combination with the "Low Temperature" characteristic of the system.

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# Hydronic Fan Coil Unit - Features

- High efficiency and comfort are delivered and allow your application to blend into the environment using the traditional ductwork for Heating and Cooling air distribution.
  - Single A-Coil configured for Hydronic Heating and Cooling Operation
  - ECM Fan Motor for improved sound levels and energy savings
  - Flexible Installation with Up-flow, Horizontal L and Horizontal R configuration possible
  - Factory Installed MERV 8 Filter for cleaner indoor air (throwaway type)
  - Minimal Cabinet Dimensions with 1/2" TUF-SKIN Cabinet Insulation
  - Option Electric Heat Integrated Fan Coil Units also available
  - 5yr Parts Warranty

Variable Speed Motor

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# Hydronic Fan Coil Unit - Applications

- With the availability of a customized Hydronic Fan Coil Unit (FCU), your Daikin Altherma solution can be prepackaged and tailored to suit the needs of your customers.
  - **Whole House – Single Zone**
    - Use an Altherma system for Heating, Cooling and DHW and tie in a matched FCU for your heating and cooling emitter.
    - Tie into existing ductwork
  - **Whole house – Multi Zone**
    - Utilize 2 (or more) Daikin Altherma Hydronic FCU's to serve a zoning application scope and further enhance the overall comfort and energy saving experience of your customers.
  - **Multi Family Applications**
    - Enhance the concept of the "3 in 1" Daikin Altherma solution for apartments, condo's etc with a Split System + DHW Tank + Hydro Fan Coil Unit.
    - Minimize your costs with a streamlined solution for quick and easy selection and installation.



 

# Typical System Schematic

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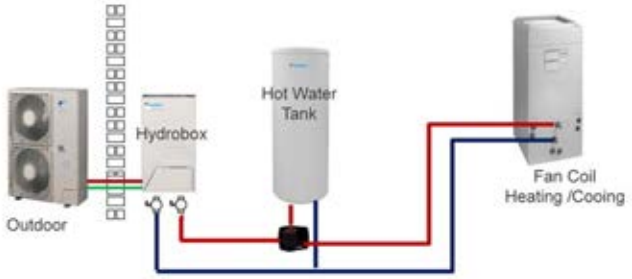
**Key Considerations**

1. What type of Fan Coil is required?
2. What is the best size of Fan Coil for the application?
3. Is the Fan Coil the ONLY source for Heating and Cooling (i.e. No Radiant)
4. Where will the Fan Coil be located?
5. What is the best suited water pipe size (and material) to ensure flow and Pd are within the systems limitations?
6. How will the water piping from the hydrobox be routed to the Fan Coil?

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# Nomenclature

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| E | FW | T | 024 | A | E | VL | U | -00 |
|---|---|---|---|---|---|---|---|---|

- E = Altherma Equipment
- FW = Hydronic Fan Coil Unit
- T = Ducted (Upflow, Horizontal L & R)
- Nominal Capacity (kBtu/hr)
  - 024 = 24,000 Btu/hr
  - 036 = 36,000 Btu/hr
  - 048 = 48,000 Btu/hr
  - 060 = 60,000 Btu/hr
- A = Model Series
- E = Motor Configuration
  - E = ECM Fan Motor
  - P = PSC Fan Motor (future)
- VL = 120V / 1 / 60Hz
  VJ = 208-230V / 1Ph / 60Hz
- U = UL Certified
- -00 = Factory Installed Electric Heat
  - 00 = No Electric Heat
  - 05 = 5kW Electric Heat
  - 10 = 10kW Electric Heat
  - 15 = 15kW Electric Heat
  - 20 = 20kW Electric Heat
  - 25 = 25kW Electric Heat

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# ECM Fan Motor Line

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## 120V Model
## No Electric Heat Options

| Capacity | Daikin Model Number |
|---|---|
| 18MBH | EFWT024AEVLU (600 CFM) |
| 24MBH | EFWT024AEVLU (800 CFM) |
| 30MBH | EFWT036AEVLU (1000 CFM) |
| 36MBH | EFWT036AEVLU (1200 CFM) |
| 48MBH | EFWT048AEVLU (1600 CFM) |
| 60MBH | EFWT060AEVLU (1825 CFM) |

## 208-230V Model
## Various Electric Heat Options (Factory Installed)

| Capacity | Daikin Model Number | Electric Heat |
|---|---|---|
| 18MBH | EFWT024AEVJU (600 CFM) | -00 |
| | | -05 |
| | | -10 |
| 24MBH | EFWT024AEVJU (800 CFM) | -00 |
| | | -05 |
| | | -10 |
| 30MBH | EFWT036AEVJU (1000 CFM) | -00 |
| | | -05 |
| | | -10 |
| | | -15 |
| 36MBH | EFWT036AEVJU (1200 CFM) | -00 |
| | | -05 |
| | | -10 |
| | | -15 |
| 48MBH | EFWT048AEVJU (1600 CFM) | -00 |
| | | -15 |
| | | -20 |
| | | -25 |
| 60MBH | EFWT060AEVJU (1825 CFM) | -00 |
| | | -15 |
| | | -20 |
| | | -25 |

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# ECM Specifications (120V)

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| Capacity | 018 | 024 | 030 | 036 | 048 | 054 |
|---|---|---|---|---|---|---|
| **Model Number (No Electric Heat Options)** | **EFWT024AEVLU*** ** | **EFWT024AEVLU** | **EFWT036AEVLU*** ** | **EFWT036AEVLU** | **EFWT048AEVLU** | **EFWT060AEVLU** |
| **Cooling Performance:** | | | | | | |
| Nominal Capacity (Btu/hr) | 19,100 | 22,600 | 28,600 | 32,000 | 42,700 | 49,600 |
| Nominal Sensible Capacity (Btu/hr) | 14,200 | 17,700 | 22,400 | 25,800 | 34,700 | 39,500 |
| EWT Range (°F) | 40 - 50F | | | | | |
| Nominal Flow Rate (GPM) | 4.5 | 5.0 | 6.0 | 6.0 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 5.5 | 7.7 | 4.8 | 5.5 | 5.4 | 7.9 |
| **Heating Performance:** | | | | | | |
| Nominal Capacity (Btu/hr) | 19,300 | 25,000 | 31,900 | 34,800 | 50,200 | 57,000 |
| EWT Range (°F) | 100 - 125 F | | | | | |
| Nominal Flow Rate (GPM) | 3.0 | 4.5 | 4.5 | 4.5 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 2.5 | 5.5 | 3.0 | 3.0 | 5.4 | 7.9 |
| **Airflow Rate:** | | | | | | |
| Nominal (CFM) | 600 | 800 | 1050 | 1200 | 1600 | 1825 |
| Total External Static Pressure (WG") | 0.3" WG Std, 0.5" WG Max | | | | | |
| Blower Speed setting | "C" SETTING (in field) | "A" FACTORY SETTING | "B" SETTING (in field) | "A" FACTORY SETTING | "A" FACTORY SETTING | "A" FACTORY SETTING |
| Motor rating (HP) | 1/3 HP | | 1/2 HP | | 3/4 HP | 1 HP |
| Airflow arrangement | Upflow, Horizontal L, Horizontal R (Possible) | | | | | |
| **Electrical Data (No Electric Heat Option):** | | | | | | |
| Power supply | 120V / 1 / 60Hz | | | | | |
| Minimum Circuit Amps (MCA) | 6 | 6 | 10 | 10 | 14 | 15 |
| Maximum overcurent protection (MOP) | 15 | 15 | 15 | 15 | 15 | 15 |
| **Physical Data:** | | | | | | |
| Dimension (H x W x D) | 40 x 20 x 20 | | 40 x 23 x 20 | | 48 x 21-1/4 x 28 | |
| Weight (lbs) | 115 | | 170 | | 230 | 290 |
| Insulation type / R-Rating | 1/2" JM TUF-SKIN | | | | | |
| Installation Clearances | U.L. LISTED FOR INSTALLATION WITH ZERO INCHES CLEARANCE TO COMBUSTABLE MATERIALS | | | | | |
| **Connection type** | | | | | | |
| Inlet / Outlet Connections (Inch) | 3/4 | 3/4 | 3/4 | 3/4 | 1 | 1 |
| Connection Type | Sweat | Sweat | Sweat | Sweat | Sweat | Sweat |
| **Feature:** | | | | | | |
| Air Filter (MERV 8 Throwaway) | 18 x 20 x 1 | | 20 x 22 x 1 | | 20 x 25 x 1 | |

Notes:

1. Cooling Capacity is based on 50°F Entering Water Temp and 80°F DB/67°F WB Entering Air Conditions.
2. Heating Capacity is based on 110°F Entering Water Temp and 70°F DB Entering Air Conditions.
3. Refer to detailed capacity tables for further information pertaining to the entire entering water temperature range and for flow rates and pressure drop.



 

# ECM Specifications (230V)

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| Capacity | 018 | 024 | 030 | 036 | 048 | 054 |
|---|---|---|---|---|---|---|
| **Model Number (With Electric Heat Options)** | EFWT024AEVJU** | EFWT024AEVJU | EFWT036AEVJU** | EFWT036AEVJU | EFWT048AEVJU | EFWT060AEVJU |
| **Cooling Performance:** | | | | | | |
| Nominal Capacity (Btu/hr) | 19,100 | 22,600 | 28,600 | 32,000 | 42,700 | 49,600 |
| Nominal Sensible Capacity (Btu/hr) | 14,200 | 17,700 | 22,400 | 25,800 | 34,700 | 39,500 |
| EWT Range (°F) | 40 - 50F | | | | | |
| Nominal Flow Rate (GPM) | 4.5 | 5.0 | 6.0 | 6.0 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 5.5 | 7.7 | 4.8 | 5.5 | 5.4 | 7.9 |
| **Heating Performance:** | | | | | | |
| Nominal Capacity (Btu/hr) | 19,300 | 25,000 | 31,900 | 34,800 | 50,200 | 57,000 |
| EWT Range (°F) | 100 - 125 F | | | | | |
| Nominal Flow Rate (GPM) | 3.0 | 4.5 | 4.5 | 4.5 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 2.5 | 5.5 | 3.0 | 3.0 | 5.4 | 7.9 |
| **Airflow Rate:** | | | | | | |
| Nominal (CFM) | 600 | 800 | 1050 | 1200 | 1600 | 1825 |
| Total External Static Pressure (WG") | 0.3" WG Std, 0.5" WG Max | | | | | |
| Blower Speed setting | "C" SETTING (in field) | "A" FACTORY SETTING | "B" SETTING (in field) | "A" FACTORY SETTING | "A" FACTORY SETTING | "A" FACTORY SETTING |
| Motor rating (HP) | 1/3 HP | | 1/2 HP | | 3/4 HP | 1 HP |
| Airflow arrangement | Upflow, Horizontal L, Horizontal R (Possible) | | | | | |
| **Electrical Data (With Electric Heat Options):** | | | | | | |
| Power supply | 208-230V / 1 / 60Hz | | | | | |
| Minimum Circuit Amps (MCA) | 3 | 3 | 4 | 4 | 6 | 9 |
| Maximum overcurrent protection (MOP) | 15 | 15 | 15 | 15 | 15 | 15 |
| Electrical Heater Options 5 to 25kW | 5kW, 10kW | 5kW, 10kW | 5kW, 10kW, 15kW | 5kW, 10kW, 15kW | 15kW, 20kW, 25kW | 15kW, 20kW, 25kW |
| Electric Heat MCA / MOP Values | REFER TO ELECTRIC HEAT OPTIONS SUMMARY FOR ELECTRICAL SPECIFICATIONS | | | | | |
| Electrical Heat Integral Disconnect | FACTORY INSTALLED SERVICE SWITCH OVER 10KW (NO DISCONNECT) | | | | | |
| **Physical Data:** | | | | | | |
| Dimension (H x W x D) | 40 x 20 x 20 | | 40 x 23 x 20 | | 48 x 23-1/4 x 28 | |
| Weight (lbs) | 115 | | 170 | | 230 | 290 |
| Insulation type / R-Rating | 1/2" IM TUF-SKIN | | | | | |
| Installation Clearances | U.L. LISTED FOR INSTALLATION WITH ZERO INCHES CLEARANCE TO COMBUSTABLE MATERIALS | | | | | |
| **Connection type** | | | | | | |
| Inlet / Outlet Connections (Inch) | 3/4 | 3/4 | 3/4 | 3/4 | 1 | 1 |
| Connection Type | Sweat | Sweat | Sweat | Sweat | Sweat | Sweat |
| **Feature:** | | | | | | |
| Air Filter (MERV 8 Throwaway) | 18 x 20 x 1 | | 20 x 22 x 1 | | 20 x 25 x 1 | |

Notes:

1. Cooling Capacity is based on 50°F Entering Water Temp and 80°F DB/67°F WB Entering Air Conditions.
2. Heating Capacity is based on 110°F Entering Water Temp and 70°F DB Entering Air Conditions.
3. Refer to detailed capacity tables for further information pertaining to the entire entering water temperature range and for flow rates and pressure drop.

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# Electric Heat Scope

- All electric heat options are provided with the electric heat "factory installed".
- Electric heat options are only available for AEVJU models (208-230V / ECM).
- Electric heat size is denoted by the final code in the nomenclature structure (i.e. EFWT036AEVJU-10 = Factory Installed 10kW electric heat)

| Model Number | Factory Installed Electric Heat Options (kW) | Circuit 1 (240/208V) | | Circuit 2 (240/208V) | | Circuit 3 (240/208V) | |
|---|---|---|---|---|---|---|---|
| | | MCA | MOP | MCA | MOP | MCA | MOP |
| EFWT024 | 5 | 29/25 | 30/25 | --- | --- | --- | --- |
| | 10 | 42/36 | 60/50 | --- | --- | --- | --- |
| EFWT036 | 5 | 30/26 | 30/30 | --- | --- | --- | --- |
| | 10 | 56/49 | 60/50 | --- | --- | --- | --- |
| | 15 | 56/49 | 60/50 | 27/23 | 30/25 | --- | --- |
| EFWT048 | 15 | 58/50 | 60/50 | 27/23 | 30/25 | --- | --- |
| | 20 | 58/50 | 60/50 | 53/46 | 60/50 | --- | --- |
| | 25 | 58/50 | 60/50 | 53/46 | 60/50 | 27/23 | 30/25 |
| EFWT060 | 15 | 59/53 | 60/50 | 27/23 | 30/25 | --- | --- |
| | 20 | 59/53 | 60/50 | 53/46 | 60/50 | --- | --- |
| | 25 | 59/53 | 60/50 | 53/46 | 60/50 | 27/23 | 30/25 |



 

# PSC Fan Motor Line

- Reduced cost PSC Fan Motor option for price sensitive applications or where ECM advantages are not required
  - Single A-Coil configured for Hydronic Heating and Cooling Operation
  - Flexible Installation with Up-flow, Horizontal L and Horizontal R configuration possible
  - 3-Speed Blower for improved air flow / temperature control
  - Factory Installed MERV 8 Filter for cleaner indoor air (throwaway type)
  - Minimal Cabinet Dimensions with 1/2" TUF-SKIN Cabinet Insulation
  - 5yr Parts Warranty

**120V Model**
**No Electric Heat Options**

| Capacity | Daikin Model Number |
|---|---|
| 18MBH | EFWT024APVLU (610 CFM) |
| 24MBH | EFWT024APVLU (750 CFM) |
| 30MBH | EFWT036APVLU (960 CFM) |
| 36MBH | EFWT036APVLU (1185 CFM) |
| 48MBH | EFWT048APVLU (1540 CFM) |
| 60MBH | EFWT060APVLU (1825 CFM) |



 

# PSC Specifications (120V)

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| Capacity | 018 | 024 | 030 | 036 | 048 | 054 |
|---|---|---|---|---|---|---|
| **Model Number (No Electric Heat Options)** | **EFWT024APVLU**** | **EFWT024APVLU** | **EFWT036APVLU**** | **EFWT036APVLU** | **EFWT048APVLU** | **EFWT060APVLU** |
| **Cooling Performance:** | | | | | | |
| Nominal Capacity ($Btu_H/hr$) | 19,100 | 22,600 | 28,600 | 32,000 | 42,700 | 49,600 |
| Nominal Sensible Capacity ($Btu_H/hr$) | 14,200 | 17,700 | 22,400 | 25,800 | 34,700 | 39,500 |
| EWT Range (°F) | 40 - 50F | | | | | |
| Nominal Flow Rate (GPM) | 4.5 | 5.0 | 6.0 | 6.0 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 5.5 | 7.7 | 4.8 | 5.5 | 5.4 | 7.9 |
| **Heating Performance:** | | | | | | |
| Nominal Capacity ($Btu_H/hr$) | 19,300 | 25,000 | 31,900 | 34,800 | 50,200 | 57,000 |
| EWT Range (°F) | 100 - 125 F | | | | | |
| Nominal Flow Rate (GPM) | 3.0 | 4.5 | 4.5 | 4.5 | 8.0 | 10.0 |
| Nominal Pressure drop (Ft Hd) | 2.5 | 5.5 | 3.0 | 3.0 | 5.4 | 7.9 |
| **Airflow Rate:** | | | | | | |
| Nominal (CFM) | 600 | 800 | 1000 | 1200 | 1600 | 1825 |
| Total External Static Pressure (WG") | 0.3" WG Std, 0.5" WG Max | | | | | |
| Blower Speed setting | Med-High Setting | High Speed Setting | Med-High Setting | High Speed Setting | High Speed Setting | High Speed Setting |
| Motor rating (HP) | 1/5 HP | | 1/3 HP | | 1/2 HP | 3/4 HP |
| Airflow arrangement | Upflow, Horizontal L, Horizontal R (Possible) | | | | | |
| **Electrical Data (No Electric Heat Option):** | | | | | | |
| Power supply | 120V / 1 / 60Hz | | | | | |
| Minimum Circuit Amps (MCA) | 3.75 | 3.75 | 7.5 | 7.5 | 10 | 13.1 |
| Maximum overcurent protection (MOP) | 15 | 15 | 15 | 15 | 15 | 15 |
| **Physical Data:** | | | | | | |
| Dimension (H x W x D) | 40 x 20 x 20 | | 40 x 23 x 20 | | 48 x 21-1/4 x 28 | |
| Weight (lbs) | 115 | | 170 | | 230 | 290 |
| insulation type / R-Rating | 1/2" JM TUF-SKIN | | | | | |
| Installation Clearances | U.L. LISTED FOR INSTALLATION WITH ZERO INCHES CLEARANCE TO COMBUSTABLE MATERIALS | | | | | |
| **Connection type** | | | | | | |
| Inlet / Outlet Connections (Inch) | 3/4 | 3/4 | 3/4 | 3/4 | 1 | 1 |
| Connection Type | Sweat | Sweat | Sweat | Sweat | Sweat | Sweat |
| **Feature:** | | | | | | |
| Air Filter (MERV 8 Throwaway) | 18 x 20 x 1 | | 20 x 22 x 1 | | 20 x 25 x 1 | |

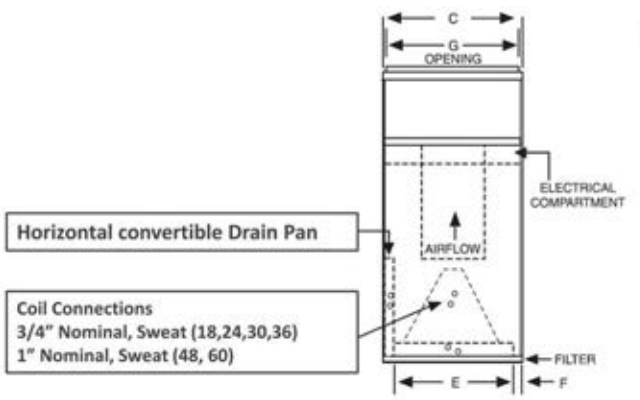
Notes:

1. Cooling Capacity is based on 50°F Entering Water Temp and 80°F DB/67°F WB Entering Air Conditions.
2. Heating Capacity is based on 110°F Entering Water Temp and 70°F DB Entering Air Conditions.
3. Refer to detailed capacity tables for further information pertaining to the entire entering water temperature range and for flow rates and pressure drop.



# Dimensions

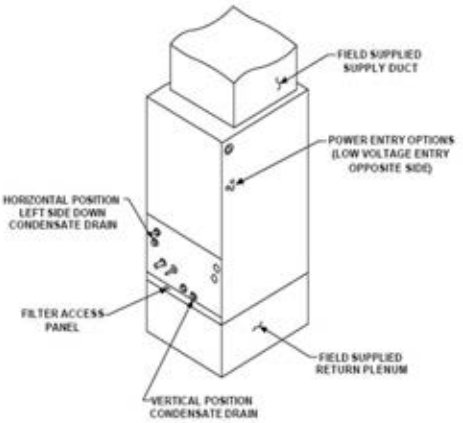



| Model | A | B | C | D | E | F | G | H | Filter |
|---|---|---|---|---|---|---|---|---|---|
| EFWT024 (Including 018 Configuration) | 40 | 20 | 20 | 18-1/2 | 16 | 2 | 18 | 16 | 18 x 20 x 1 |
| EFWT036 (Including 030 Configuration) | 40 | 23 | 20 | 21-1/2 | 16 | 2 | 18 | 17 | 20 x 22 x 1 |
| EFWT048 | 48 | 28 | 21-1/4 | 26-1/4 | 17 | 2 | 19-1/4 | 18-1/4 | 20 x 25 x 1 |
| EFWT060 | 48 | 28 | 21-1/4 | 26-1/4 | 17 | 2 | 19-1/4 | 18-1/4 | 20 x 25 x 1 |

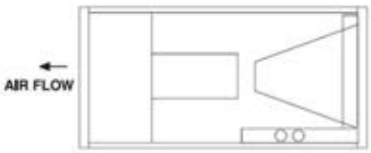


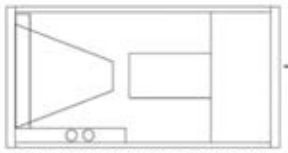
# Field Configurable




**3-WAY AIRFLOW**




(STANDARD HORIZONTAL POSITION)




(ALTERNATE HORIZONTAL POSITION)
(FIELD-CONVERTIBLE)



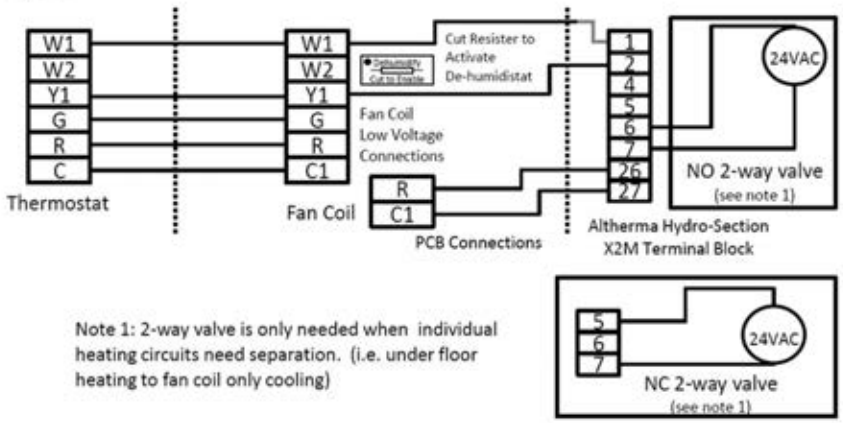
 

# Control Wiring Example

## All Fan Coil Unit Models – No Electric Heat

Fig. 9-4

### 1 Stage Heat / 1 Stage Cool Thermostat




Note 1: 2-way valve is only needed when individual heating circuits need separation. (i.e. under floor heating to fan coil only cooling)




**Refer to installation instructions for further details**

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# Performance Tables

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## Heating Mode – All Model Types

= Specific to Nominal Unit Sizes

| Unit Model | Nom. CFM | GPM (HTG) | PD (FT. Water) | Heating BTUH @ Entering Water Temp. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 °F | 105°F | 110 °F | 115 °F | 120 °F | 125 °F |
| EFWT024 | 800 | 6.0 | 9.5 | 19.5 | 22.8 | 26 | 29.3 | 32.6 | 35.8 |
| | | 4.5 | 5.5 | 18.8 | 21.9 | 25 | 28.2 | 31.3 | 34.4 |
| | | 3.0 | 2.5 | 17.5 | 20.5 | 23.4 | 26.3 | 29.2 | 32.2 |
| | 700 | 6.0 | 9.5 | 17.7 | 20.7 | 23.7 | 26.6 | 29.6 | 32.5 |
| | | 4.5 | 5.5 | 17.1 | 20 | 22.8 | 25.7 | 28.5 | 31.4 |
| | | 3.0 | 2.5 | 16.0 | 18.7 | 21.4 | 24.1 | 26.7 | 29.4 |
| | 600 | 4.0 | 4.4 | 15.1 | 17.6 | 20.1 | 22.6 | 25.1 | 27.6 |
| | | 3.0 | 2.5 | 14.4 | 16.8 | 19.3 | 21.7 | 24.1 | 26.5 |
| | | 2.0 | 1.2 | 13.5 | 15.7 | 17.9 | 20.2 | 22.4 | 24.7 |
| | 500 | 4.0 | 4.4 | 13.2 | 15.4 | 17.6 | 19.8 | 22.0 | 24.2 |
| | | 3.0 | 2.5 | 12.7 | 14.8 | 16.9 | 19.1 | 21.2 | 23.3 |
| | | 2.0 | 1.2 | 11.9 | 13.9 | 15.9 | 17.9 | 19.9 | 21.9 |
| EFWT036 | 1200 | 6.0 | 4.8 | 27.5 | 32.0 | 36.6 | 41.2 | 45.8 | 50.3 |
| | | 4.5 | 3.0 | 26.1 | 30.5 | 34.8 | 39.2 | 43.5 | 47.9 |
| | | 3.0 | 1.5 | 24.0 | 28.0 | 32.0 | 36.0 | 39.9 | 43.9 |
| | 1050 | 6.0 | 4.8 | 25.1 | 29.2 | 33.4 | 37. | 41.8 | 45.9 |
| | | 4.5 | 3.0 | 23.9 | 27.9 | 31.9 | 35.9 | 39.8 | 43.8 |
| | | 3.0 | 1.5 | 22.1 | 25.8 | 29.5 | 33.1 | 36.8 | 40.5 |
| | 900 | 4.0 | 2.4 | 21.1 | 24.6 | 28.1 | 31.6 | 35.2 | 38.7 |
| | | 3.0 | 1.5 | 20.0 | 23.4 | 26.7 | 30.0 | 33.4 | 36.7 |
| | | 2.0 | 0.70 | 17.2 | 20.0 | 22.9 | 25.8 | 28.6 | 31.5 |
| | 750 | 4.0 | 2.4 | 18.6 | 21.7 | 24.8 | 27.9 | 31.0 | 34.1 |
| | | 3.0 | 1.5 | 17.7 | 20.7 | 23.7 | 26.6 | 29.6 | 32.5 |
| | | 2.0 | 0.70 | 15.4 | 17.9 | 20.5 | 23.0 | 25.6 | 28.2 |

| Unit Model | Nom. CFM | GPM (HTG) | PD (FT. Water) | Heating BTUH @ Entering Water Temp. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 °F | 105°F | 110 °F | 115 °F | 120 °F | 125 °F |
| EFWT048 | 1600 | 10.0 | 7.9 | 39.0 | 45.5 | 52.0 | 58.5 | 65.0 | 71.5 |
| | | 8.0 | 5.4 | 37.7 | 44.4 | 50.2 | 56.5 | 62.8 | 69.1 |
| | | 6.0 | 3.3 | 35.8 | 41.8 | 47.8 | 49.2 | 59.7 | 65.7 |
| | 1400 | 10.0 | 7.9 | 35.4 | 41.3 | 47.3 | 53.2 | 59.1 | 65.0 |
| | | 8.0 | 5.4 | 34.3 | 40.1 | 45.8 | 51.5 | 57.2 | 63.0 |
| | | 6.0 | 3.3 | 32.8 | 38.2 | 43.7 | 49.2 | 54.6 | 60.1 |
| | 1200 | 6.0 | 3.3 | 29.5 | 34.4 | 39.3 | 44.2 | 49.1 | 54.0 |
| | | 5.0 | 2.4 | 28.6 | 33.4 | 38.1 | 42.9 | 47.7 | 52.4 |
| | | 4.0 | 1.6 | 27.5 | 32.0 | 36.6 | 41.2 | 45.8 | 50.3 |
| | 1000 | 6.0 | 3.3 | 26.0 | 30.3 | 34.7 | 39.2 | 43.5 | 47.7 |
| | | 5.0 | 2.4 | 25.2 | 29.4 | 33.6 | 38.0 | 42.2 | 46.3 |
| | | 4.0 | 1.6 | 24.2 | 28.2 | 32.3 | 36.5 | 40.5 | 44.5 |
| EFWT060 | 1825 | 13.0 | 12.5 | 44.2 | 51.6 | 59.0 | 66.4 | 73.7 | 81.1 |
| | | 10.0 | 7.9 | 42.7 | 49.8 | 57.0 | 64.1 | 71.2 | 78.3 |
| | | 7.0 | 4.3 | 40.2 | 46.9 | 53.6 | 60.3 | 67.0 | 73.7 |
| | 1800 | 12.0 | 10.9 | 43.4 | 50.6 | 57.9 | 65.1 | 72.3 | 79.6 |
| | | 10.0 | 7.9 | 42.3 | 49.3 | 56.4 | 63.5 | 70.5 | 77.6 |
| | | 7.0 | 4.3 | 39.9 | 46.5 | 53.1 | 59.8 | 66.4 | 73.1 |
| | 1600 | 9.0 | 6.6 | 38.4 | 44.8 | 51.2 | 57.6 | 64.0 | 70.4 |
| | | 7.0 | 4.3 | 36.8 | 43.0 | 49.1 | 55.3 | 61.4 | 67.6 |
| | | 5.0 | 2.4 | 34.6 | 40.3 | 46.1 | 51.9 | 57.6 | 63.4 |
| | 1400 | 9.0 | 6.6 | 34.8 | 40.5 | 46.4 | 52.4 | 58.2 | 63.9 |
| | | 7.0 | 4.3 | 33.2 | 38.7 | 44.3 | 50.1 | 55.6 | 61.1 |
| | | 5.0 | 2.4 | 31.2 | 36.4 | 41.7 | 47.1 | 52.3 | 57.4 |

Based on 70°F entering air condition

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Thank You
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# Daikin Altherma™
# Selection & Simulation Software

**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name

Presenter's Title

## Introduction

- The following explanation is for the Daikin Altherma selection and simulation software….Version 3.9.0 onwards.
- The software is tuned to make **"mono-energetic "** selections
- Each tab in the program has handy "callouts" defined by , use these by clicking for additional information.
- Be sure to utilize the most applicable LWT range for Cooling and Heating as required for the application.
- If there is flexibility on the LWT requirements (especially for Fan Coil Units), make sure to put the minimum LWT that is possible into the selection settings.

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# Open Program, Accept Disclaimer


1. Select ~ I Accept
2. Click ~ Continue

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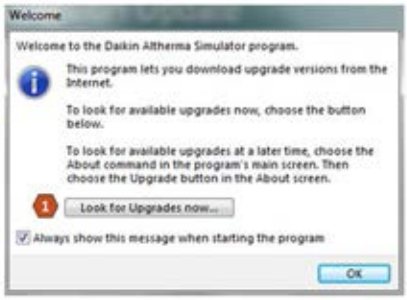
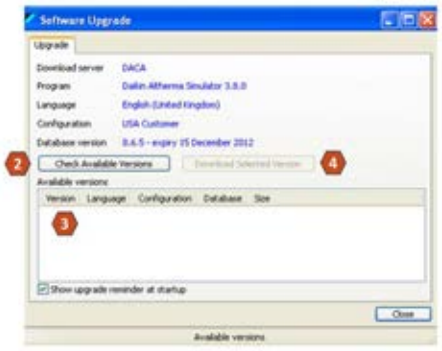
# Check for Version Update




1. Click to check for updates version
2. Click to see if any updates are available for download
3. If update is available, version number will be shown here. Highlight the available version
4. Once highlighted, click Download Selected Version to refresh your copy of the program

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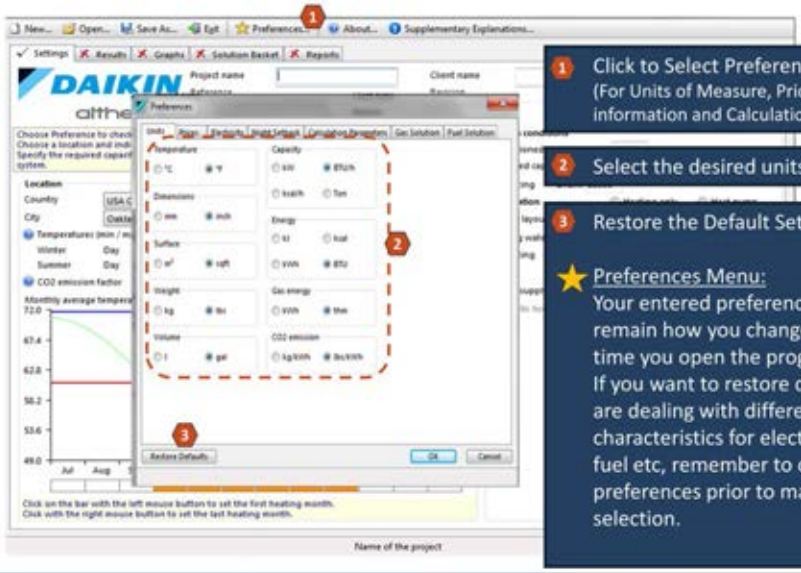
# Daikin Altherma Simulator set-up(units)




1. Click to Select Preferences
(For Units of Measure, Prices information and Calculation Parameters)

2. Select the desired units of measure

3. Restore the Default Setting

★ Preferences Menu:
Your entered preferences will remain how you change them each time you open the program.
If you want to restore defaults, or are dealing with different characteristics for electricity, gas, fuel etc, remember to change the preferences prior to making a selection.

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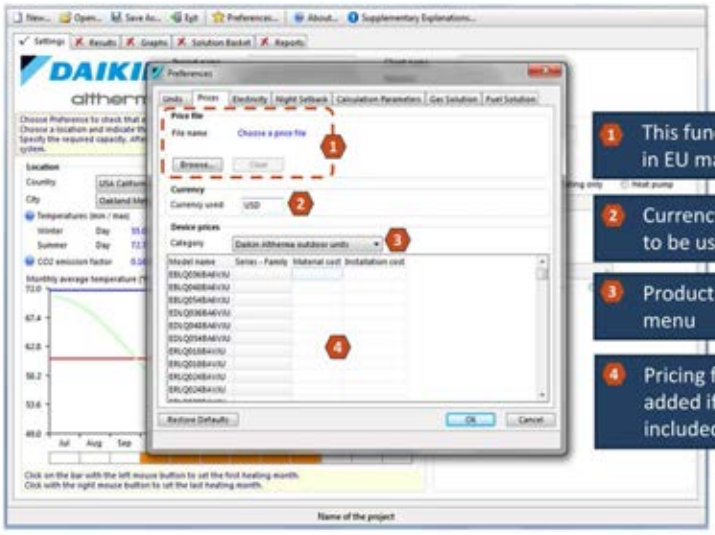
# Daikin Altherma Simulator set-up (prices)



1. This function is only applicable in EU market
2. Currency field - Fill in Currency to be used for analysis
3. Product category dropdown menu
4. Pricing for each item "can" be added if desired (pricing then included in the report)

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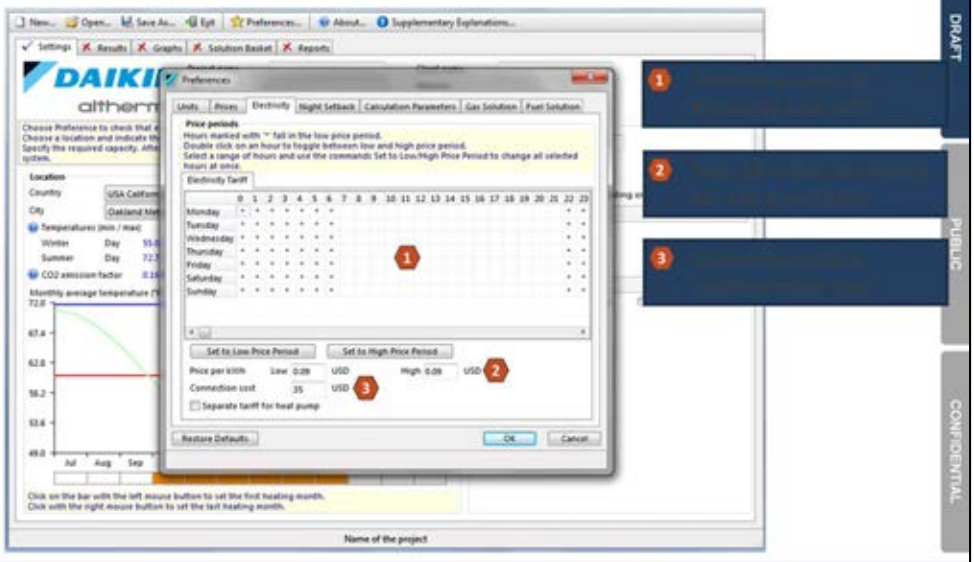
# Daikin Altherma Simulator set-up (electricity)

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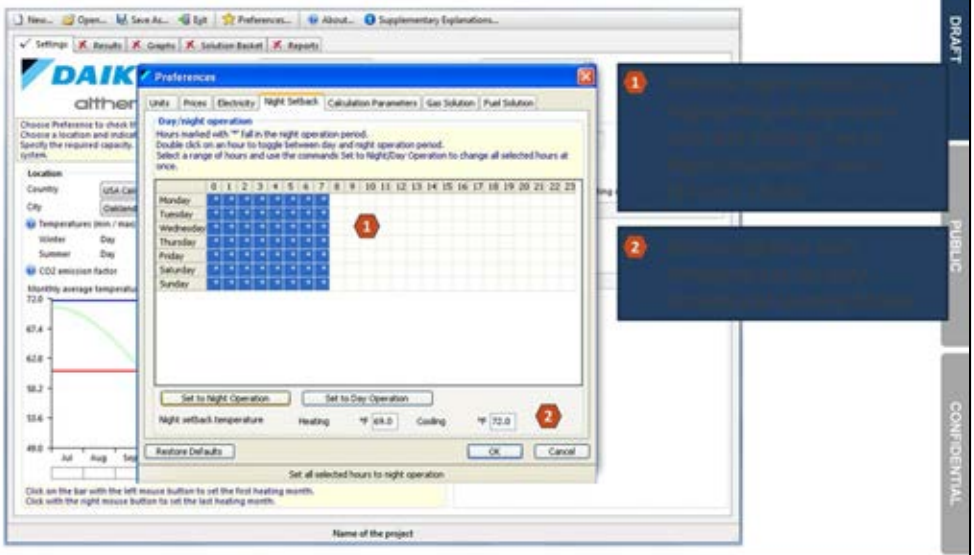
# Daikin Altherma Simulator set-up (night setback)

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# Daikin Altherma Simulator set-up (calculation)

1. Zero heating capacity temp (no space heating required above this ambient temperature)
2. Zero cooling capacity temp (no space cooling required below this ambient temperature)
3. Minimum heat pump coverage (80% minimum recommended) Range: 30% - 100%
4. Define the ranking Priority characteristic for a selection to be made (Efficiency, Cost Redundancy)

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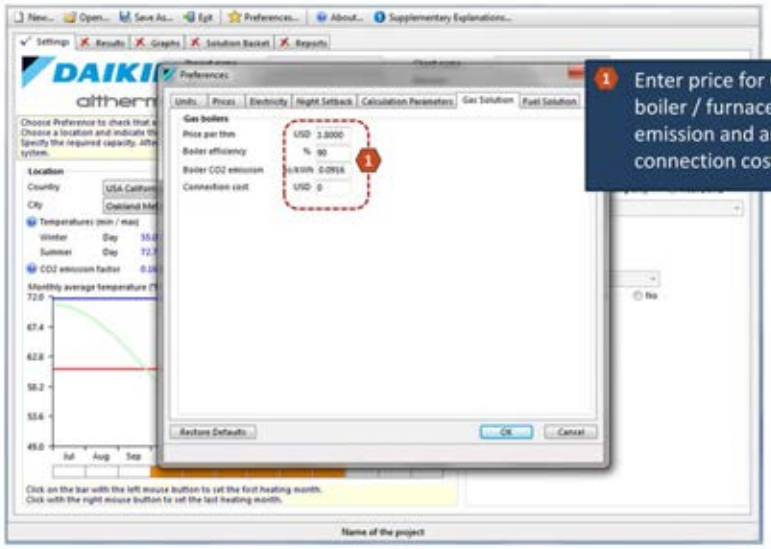
# Daikin Altherma Simulator set-up (gas)

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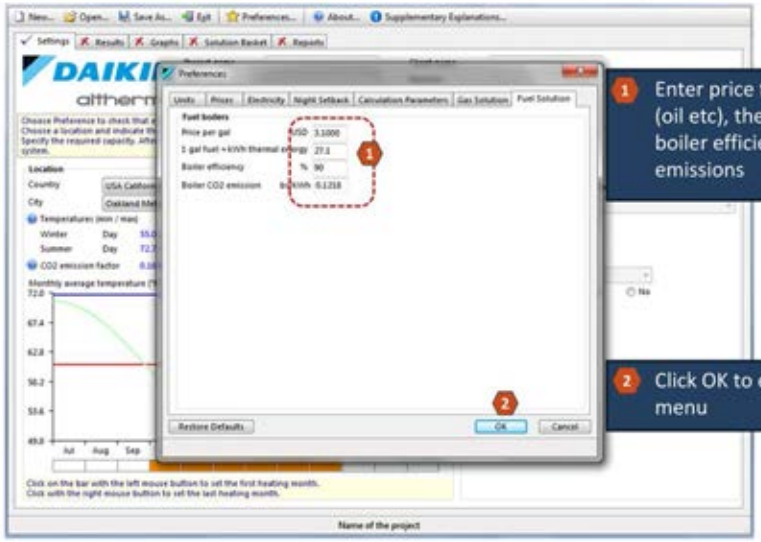
# Daikin Altherma Simulator set-up (fuel)




1. Enter price for fuel (oil etc), thermal efficiency, boiler efficiency and CO2 emissions
2. Click OK to exit preferences menu

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# Equipment Selection – Defining the settings


1. Project Enquiry Fields (must be filled in to complete a Selection and make a report)
2. Select Location/State and City (from Drop down menu)
3. To Edit Climate Data or $CO_2$ Emission Factor of Local power station or State Energy Supply click
4. Zero Cooling Ambient Temperature (71.6°F Default Temp)
5. Zero Heating Ambient Temperature (60.8°F Default Temp)
6. Climate Curve

# Equipment Selection – Defining the settings

1. Heating Months Highlighted Orange

- Left Click to Add Month
- Right Click to Add Month
- Left Click to Delete Previous Month
- Right Click to Delete Next Month

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# Equipment Selection – Defining the settings


1. Input Conditioned Surface
2. Required Heat/Cool Load (Based on Load Calculation)
3. Select Application Type – Heat only or Heatpump
4. Heating Solution ( Select System Configuration from Drop Down Menu)
5. Select system layout (Split or Monobloc)
6. Input the water temperature range (Based on Heat Emitter type and Load Calculation)
7. Power Supply
8. Optional Domestic Hot Water

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# Equipment Selection – System Configuration


**1 Select system configuration (From drop down menu)**

For Mono-Valent and Mono-Energetic application, Select Daikin Altherma only as an option

For Covalent Select Co-valent
(Electric Heat is considered at this time only)

For Bi-Valent application Select Bi-Valent and specify which fuel is to be used

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# Daikin Altherma Simulator System Configuration


**Daikin Altherma only**
**(Mono-Energetic Configuration)** Selection

1. Input Conditioned Surface
2. Required Capacity (Based on Load Calculation)
3. Select the Application (Heating only or Heat pump)
4. Select system layout (Split or Monobloc)
5. Input the Leaving Water Temperature range (Based on Type of Heat Emitter to be used)
6. Domestic Hot Water

Heating
8
Cooling

Min.= Lowest permitted Temp for O/D Reset Function
Max.= Design Temp for Design Degree day
Min.=
Max.= (Set Same Value) based on Heat emitter type

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# Equipment Selection – System Configuration

Selection for "projects in **Mono-valent** configuration":

1. Go to preferences menu, switch to the "calculation parameters" tab.
2. Set the "Minimum % covered by heat pump" to 100%.

- Simulator results will only show possible solutions that can meet the entire requirement with heat pump only (no back up heat)




 

# System Configuration


| | |
|---|---|
| 3 | 10.236 |
| 5 | 17.060 |
| 6 | 20.472 |
| 8 | 27.296 |
| 10 | 34.120 |
| 15 | 51.180 |
| 20 | 68.240 |
| 25 | 85.300 |

## Covalent, electric Configuration Selection

1. Input Conditioned Surface
2. Required Capacity (Based on Load Calculation)
3. Select the Application (Heating only or Heat pump)
4. Capacity of Electric Boiler or Element (kW value is shown as reference)
5. Select system layout (Split or Monobloc)
6. Input the Leaving Water Temperature range (Based on Type of Heat Emitter to be used)
7. Domestic Hot Water

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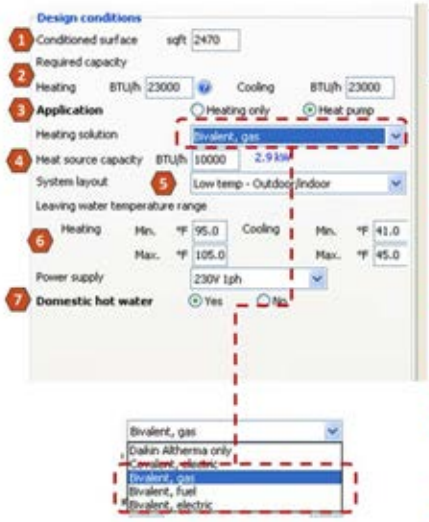
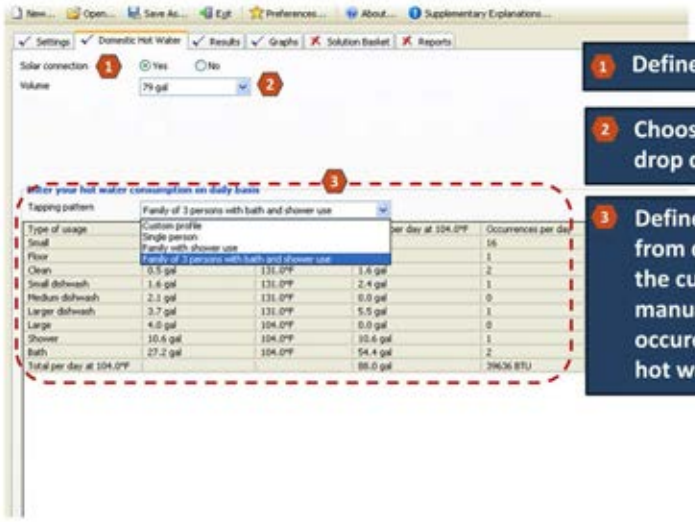
# Daikin Altherma Simulator System Configuration




## Bivalent (Gas, Fuel, Electric) Configuration Selection

1. Input Conditioned Surface
2. Required Capacity (Based on Load Calculation)
3. Select the Application (Heating only or Heat pump)
4. Capacity of additional Heat source system (Where applicable – kW shown as reference)
5. Select system layout (Split or Monobloc)
6. Input the Leaving Water Temperature range (Based on Type of Heat Emitter to be used)
7. Domestic Hot Water

# Equipment Selection – DHW Selection

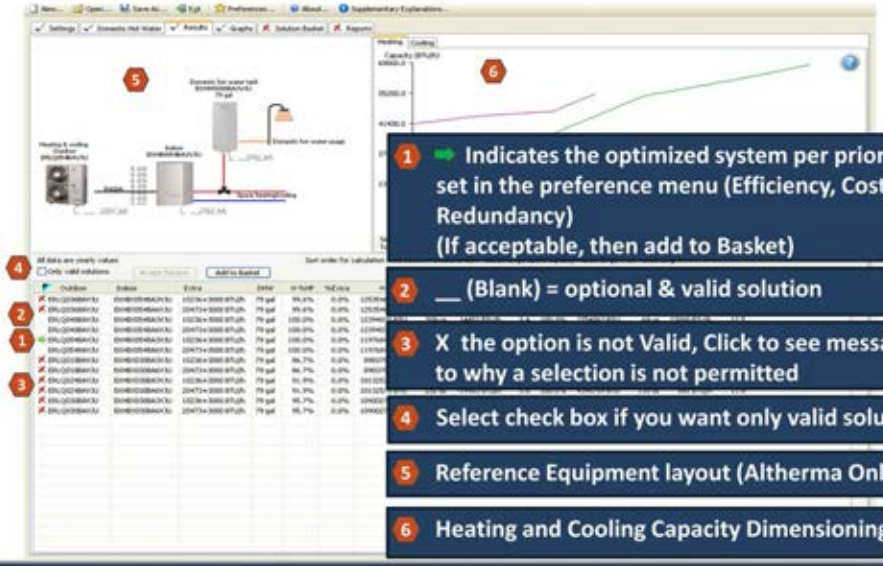



1. Define if Solar Kit is needed
2. Choose DHW Tank size from drop down menu
3. Define DHW Consumption from drop down menu or use the custom profile option to manually enter daily occurences of each type of hot water usage.



# Equipment Selection – Results summary



1. ➡ Indicates the optimized system per priorities set in the preference menu (Efficiency, Cost, Redundancy)
   (If acceptable, then add to Basket)
2. __ (Blank) = optional & valid solution
3. X the option is not Valid, Click to see message as to why a selection is not permitted
4. Select check box if you want only valid solutions
5. Reference Equipment layout (Altherma Only)
6. Heating and Cooling Capacity Dimensioning

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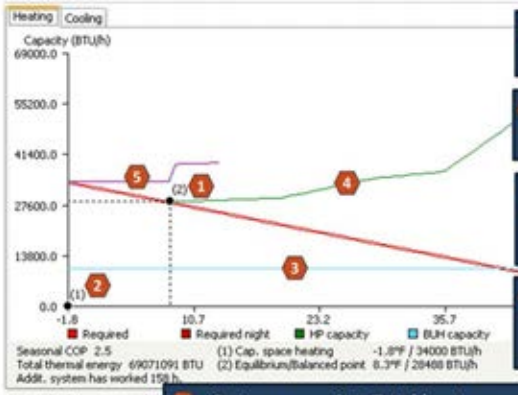
# Equipment Selection – Results graphs




1. Equilibrium/Balance point or temperature
2. Design Condition, Capacity entered for the selection
3. BUH capacity (Backup heater capacity): The nominal heat generation capacity of the electrical backup heater
4. HP capacity (Heat pump capacity): The integrated heat generation capacity of the heat pump
5. System capacity: Total heat generation capacity of the system, i.e. the sum of heat pump capacity and heater capacity. Below the equilibrium point the system capacity is the capacity of the additional system (gas, fuel, electric).

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# Equipment Selection – Results graphs

1 A Variety of Result Graphs Can be viewed (From drop down menu)

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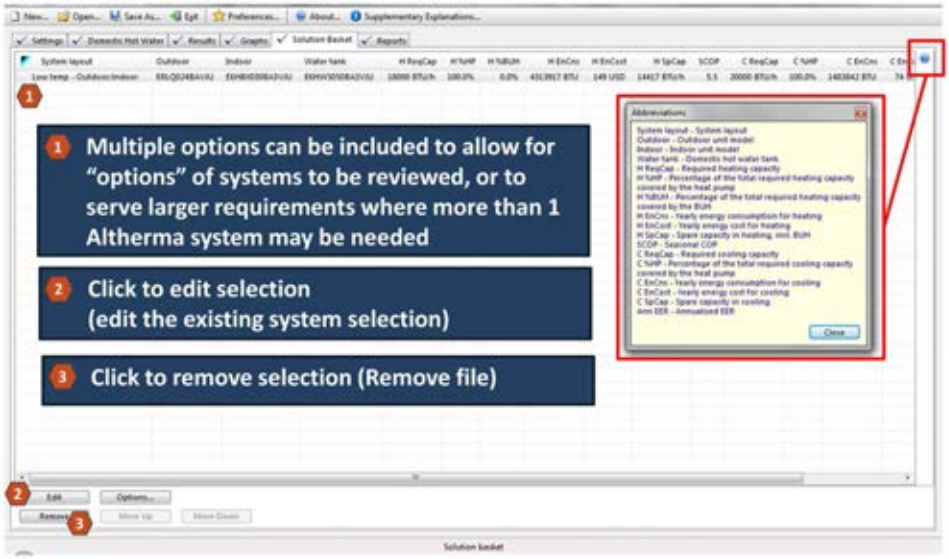
# Equipment Selection – Solution Basket (1)




1. Multiple options can be included to allow for "options" of systems to be reviewed, or to serve larger requirements where more than 1 Altherma system may be needed
2. Click to edit selection (edit the existing system selection)
3. Click to remove selection (Remove file)

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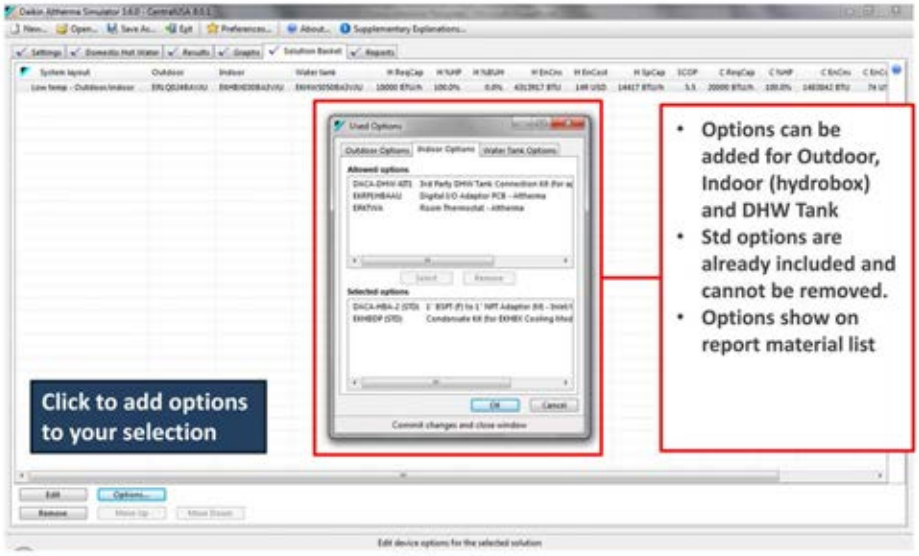
# Equipment Selection – Solution Basket (2)




- Options can be added for Outdoor, Indoor (hydrobox) and DHW Tank
- Std options are already included and cannot be removed.
- Options show on report material list

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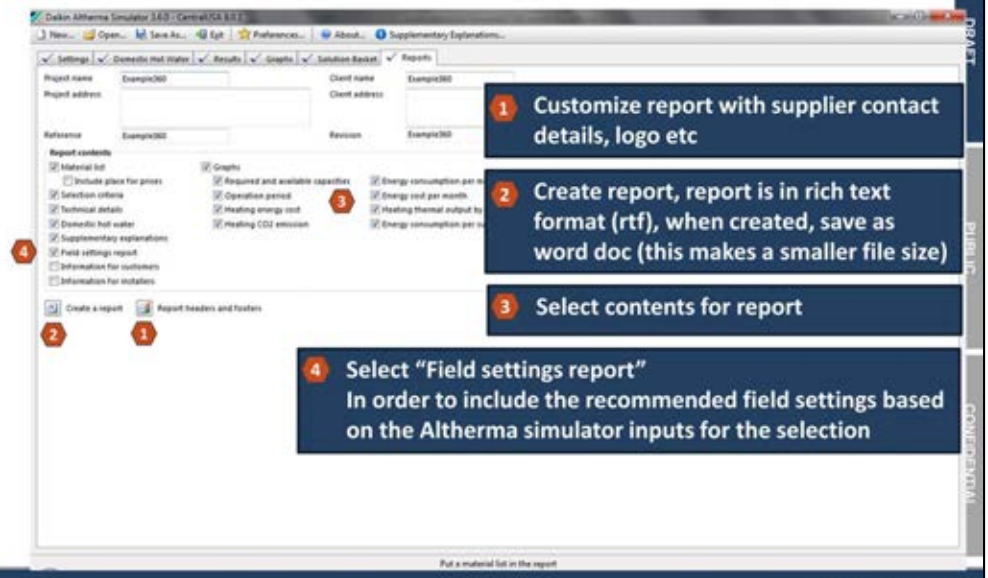
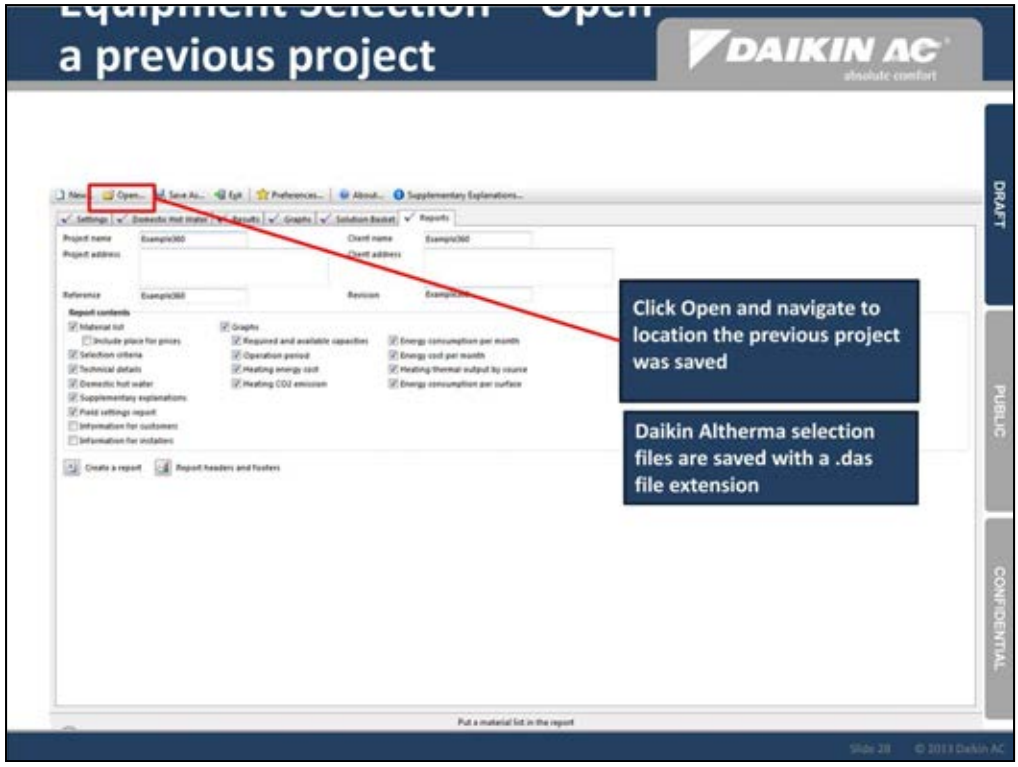
# Equipment Selection – Creating a report

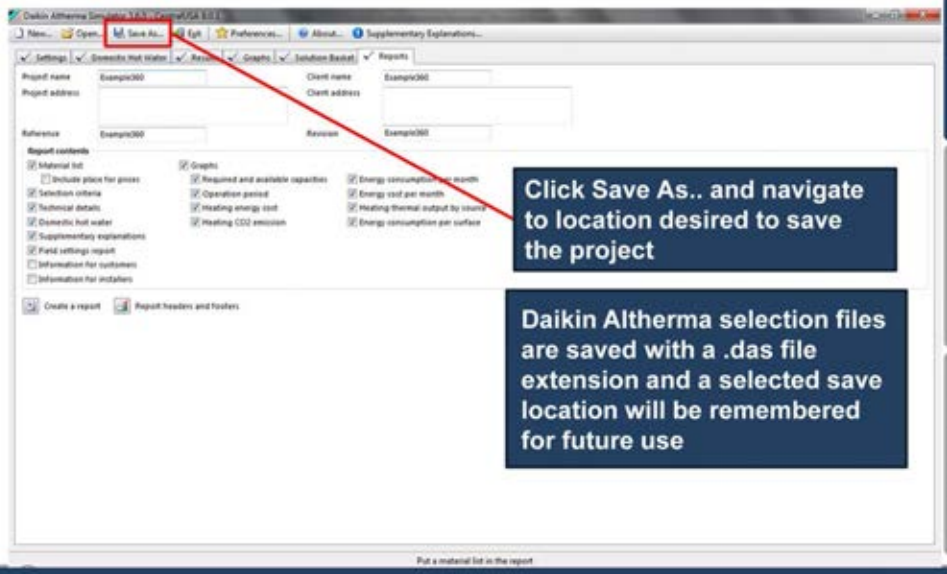


# Equipment Selection – Report

# Equipment selection – Open a previous project



# Equipment selection
## Saving your project

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## Tips and Tricks

- Selection for "projects with multiple Altherma systems for the same building": -
  - Define the breakdown of the total space.
  - Decide how much sq/ft and load each Altherma system needs to satisfy.
  - Select each system based on these break out parameters.
  - Add each solution to the solution basket and then create a report with all solutions included.
- Selection for "projects with multiple Altherma systems in multi family applications": -
  - Determine requirements at a "floor plan" level.
  - Create individual files for each floor plan, and name / save as with a filename indicative of the floor plan (i.e. Condo-1BR-800sqft)



 

# What if you need assistance?

- If you have any needs or questions, please contact: -
  - altherma@daikinac.com

    Or
  - Your Residential Solutions Sales Specialist
- We are always happy to help!

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# Daikin Altherma™
# Solar Thermal Overview



**RESIDENTIAL | LIGHT COMMERCIAL | COMMERCIAL**

Presenter's Name
Presenter's Title

# Contents



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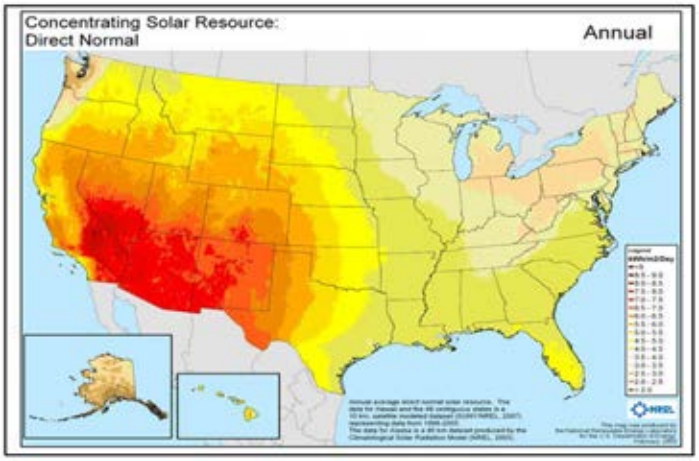
## Solar Energy – Irradiation in USA

- An abundance of Solar Energy is available throughout the U.S.

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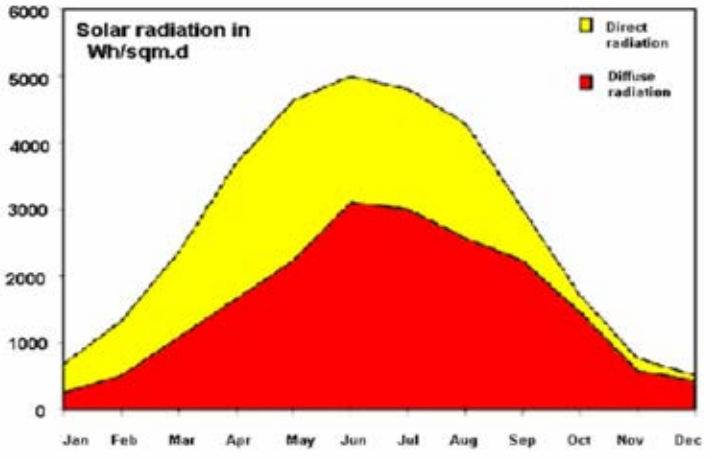
# Typical Direct and Diffuse Radiation

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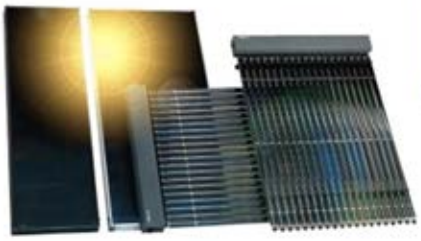
## Solar Energy

**Thermal solar panels: takes up more than 90% of the total solar market**

- Hot water preparation
- Space heating
- District heating
- Industrial applications



**Photovoltaic solar panels: to produce electricity**

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## Solar Energy

- Use of solar energy is categorized into two applications
  - Electrical use:
    - Photovoltaic
  - Thermal use:
    - Solar thermal makes up more than **90%** or the solar energy capacity installed worldwide
      ESTIF: Solar Thermal Action Plan for Europe
      - Hot water preparation, Space heating
      - District heating, Air conditioning, cooling
      - Industrial applications
    - **90%** of solar thermal market volume in small residential sector in EU

**Key benefits of solar thermal**

| | |
|---|---|
| Inexhaustible (Finite) | - Reduces the dependency on fuels |
| Saves $CO^2$ emissions at low costs | - Curbs urban air pollution |
| Reliable renewable energy source | - Immediately available |



 

## Solar Thermal

- Solar Thermal Systems
  - Natural flow system
    the water tank is also mounted on or under the roof, above the collector. This set-up makes it possible to use gravity for circulation.
  - Forced circulation system

Typical in Asia

Typical in North America

Natural flow system
*Domestic hot water*

Forced ciculation system
*Solar Combi – Hot water and space heating*

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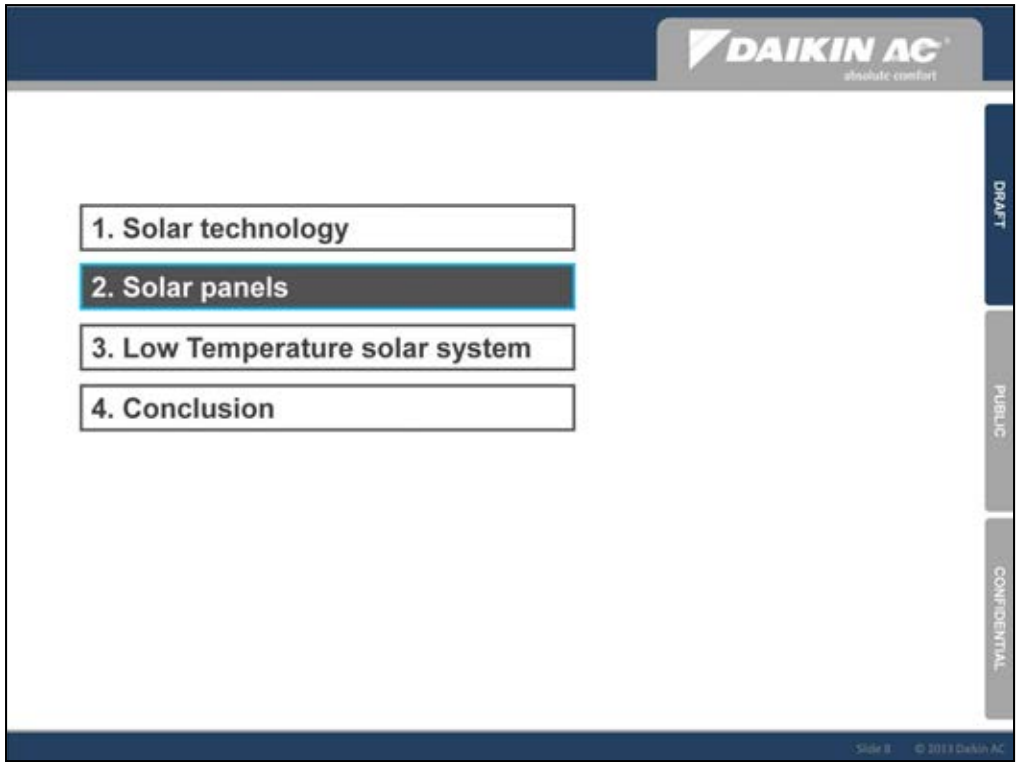
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2. Solar panels
3. Low Temperature solar system
4. Conclusion
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## Solar Thermal Technology – Heat Collectors

**Flat pate collectors**

- Productive
- Easy installation

**Vacuum collectors**

- More expensive but obtain higher temperature adapted to cold climate
- Industrial applications

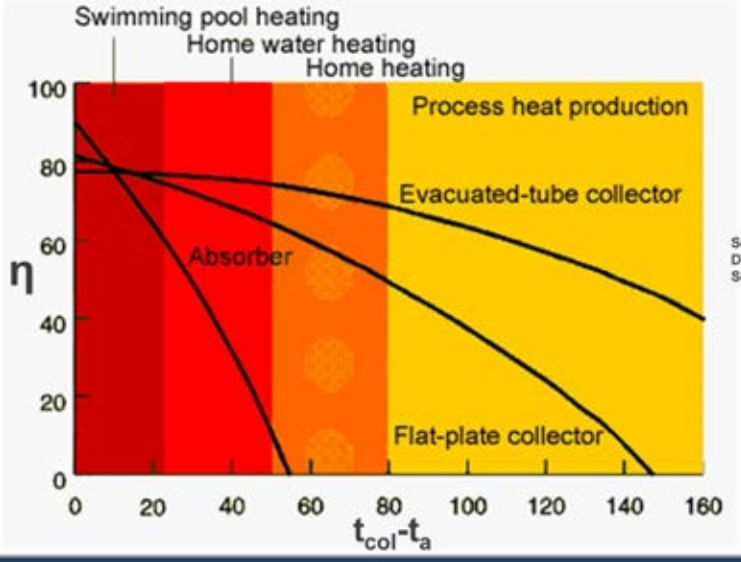
**Unglazed collectors**

- Obtain low temperature (for pools)
- Much cheaper



## Differences in Collectors and Efficiencies




Source:
Deutsche Gesellschaft für Sonnenenergie e.V.

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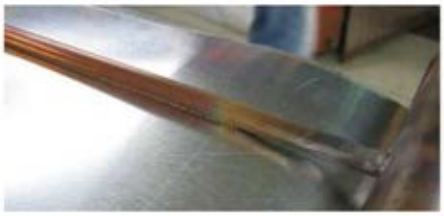
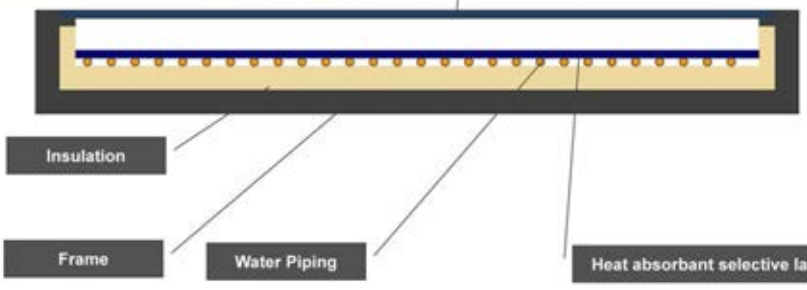
# Types of Collector – Flat Plate Collector



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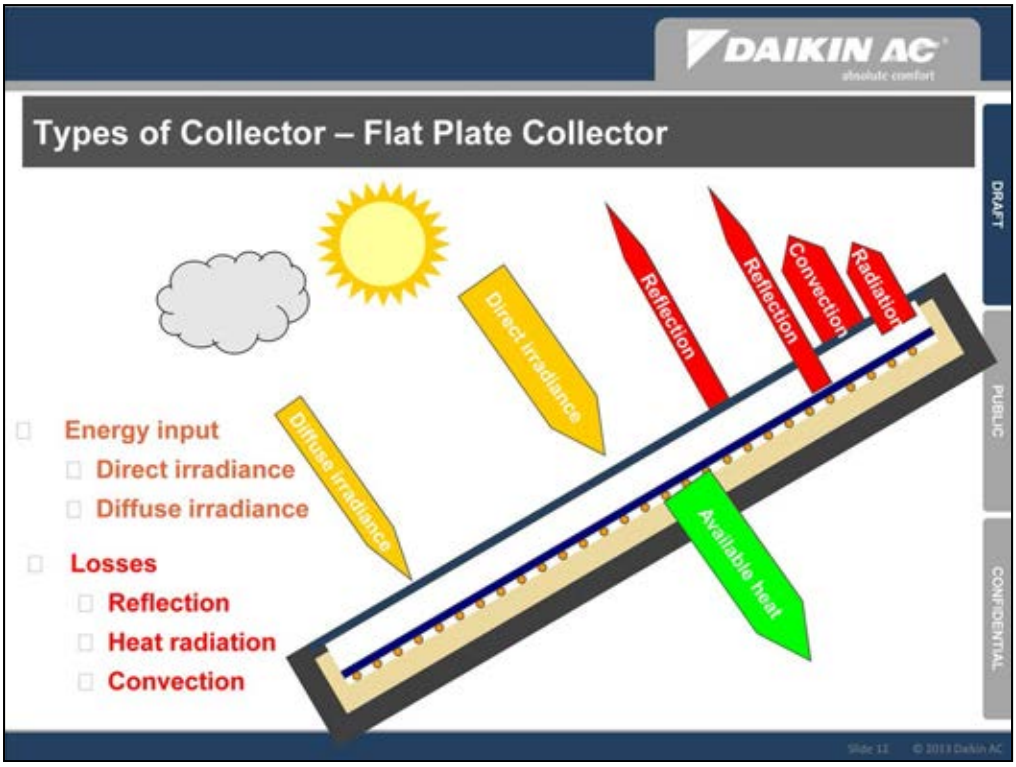
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Types of Collector – Flat Plate Collector
Energy input
Direct irradiance
Diffuse irradiance
Losses
Reflection
Heat radiation
Convection
Diffuse irradiance
Direct irradiance
Reflection
Reflection
Convection
Radiation
Available heat
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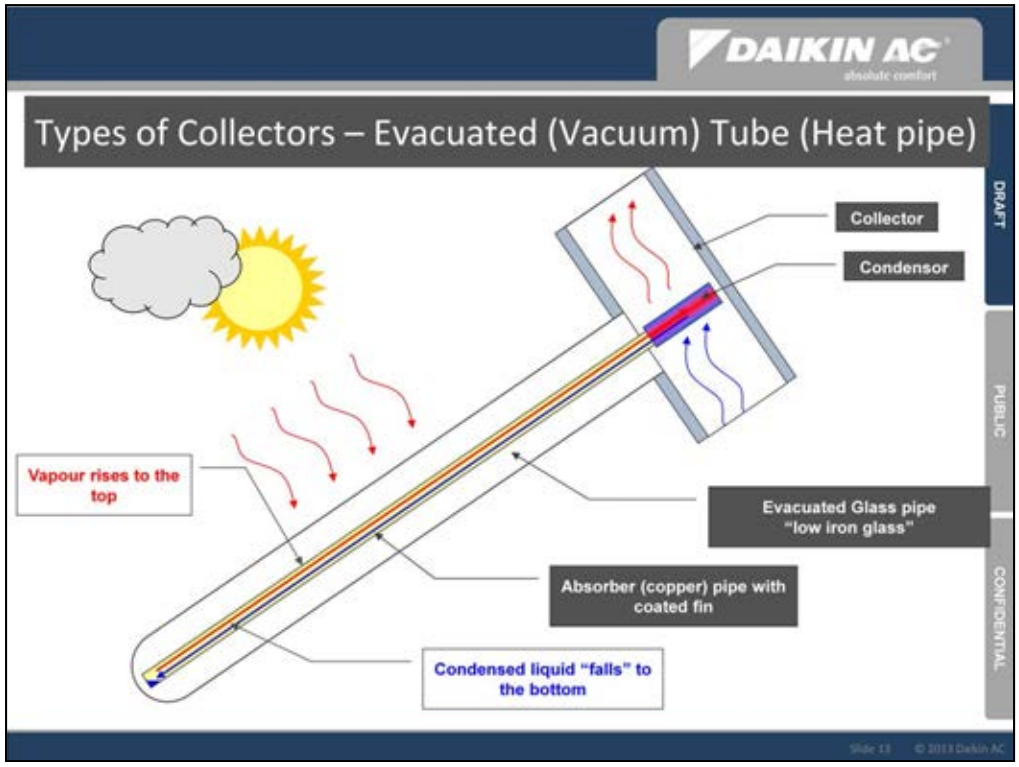
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Types of Collectors – Evacuated (Vacuum) Tube (Heat pipe)
Collector
Condensor
Vapour rises to the top
Evacuated Glass pipe "low iron glass"
Absorber (copper) pipe with coated fin
Condensed liquid "falls" to the bottom
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## Different Installations of Solar Panels

**On-roof installation**

- The solar panels are installed above the roof covering.
- This is a simple and fast installation method.

**On-roof installations, cover 70% of the total market**

**In-roof installation**

**Flat-roof installation**

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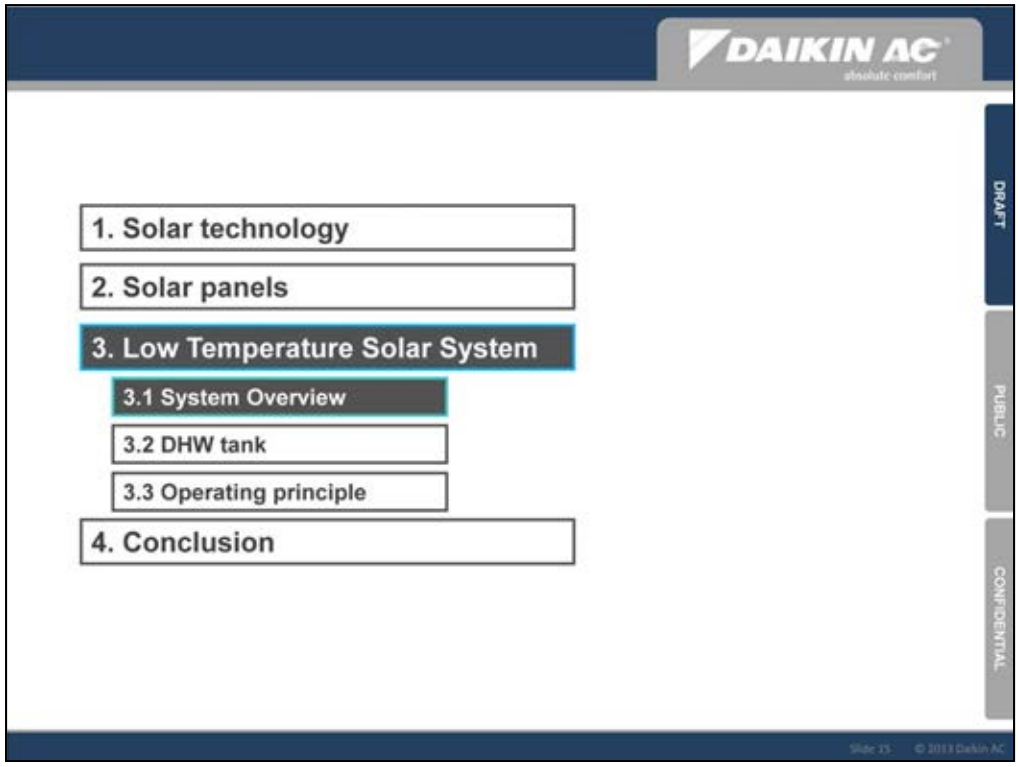
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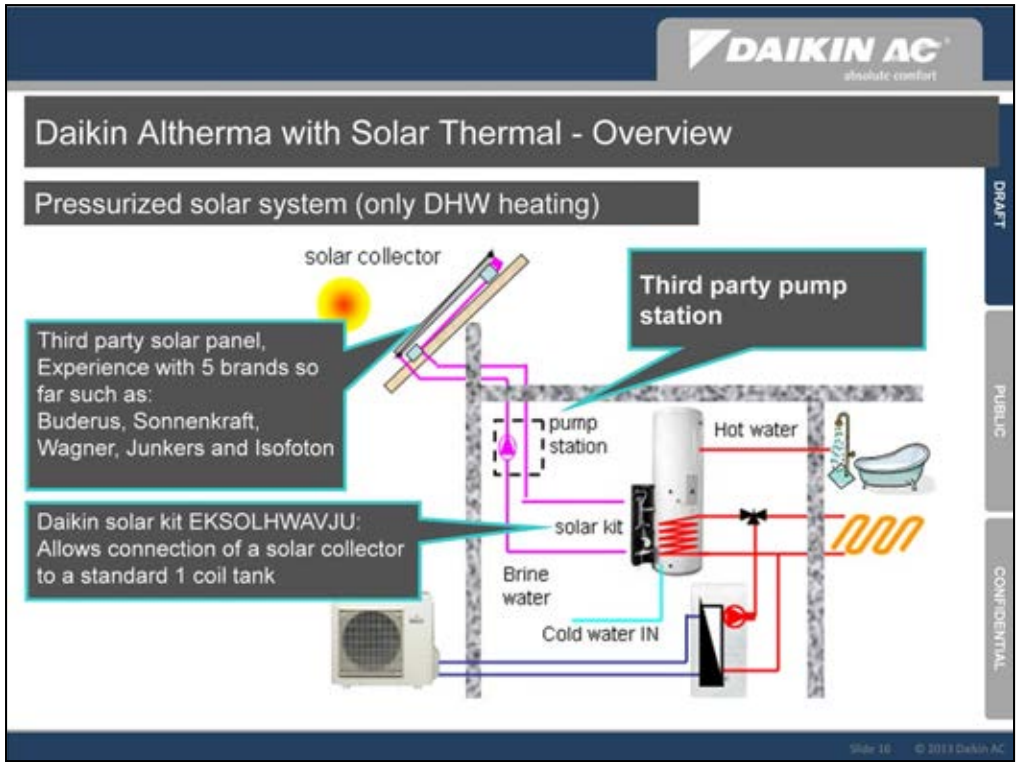
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Daikin Altherma with Solar Thermal - Overview
Pressurized solar system (only DHW heating)
solar collector
Third party pump station
Third party solar panel, Experience with 5 brands so far such as: Buderus, Sonnenkraft, Wagner, Junkers and Isofoton
pump station
Hot water
Daikin solar kit EKSOLHWAVJU: Allows connection of a solar collector to a standard 1 coil tank
solar kit
Brine water
Cold water IN
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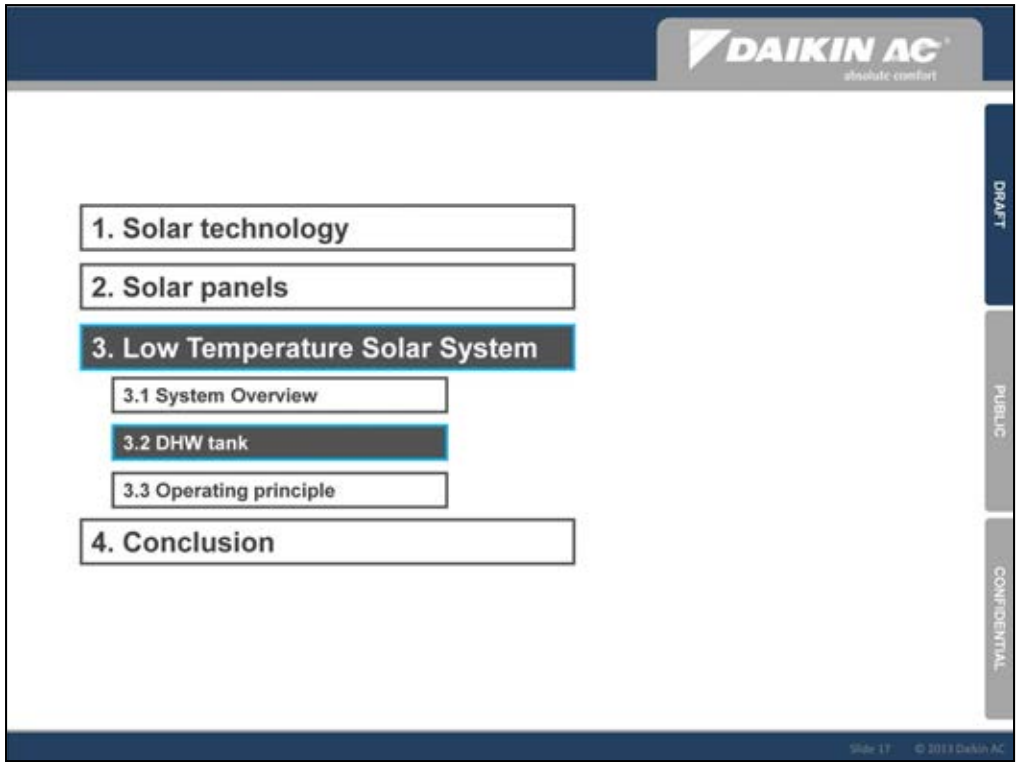
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# Daikin Altherma DHW Tank Options

| 50 G | 80 G | Kit |
|---|---|---|

Stainless steel EKHWS

Floor standing

- PUR insulation (Polyurethane)
- 3 kW booster heater
  - 3VJU : 1 x 230V
- Including 3 way valve
- Daikin Tanks are ETL Certified
- Tank complies to state of MA requirements

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# Daikin Altherma DHW Tank Options

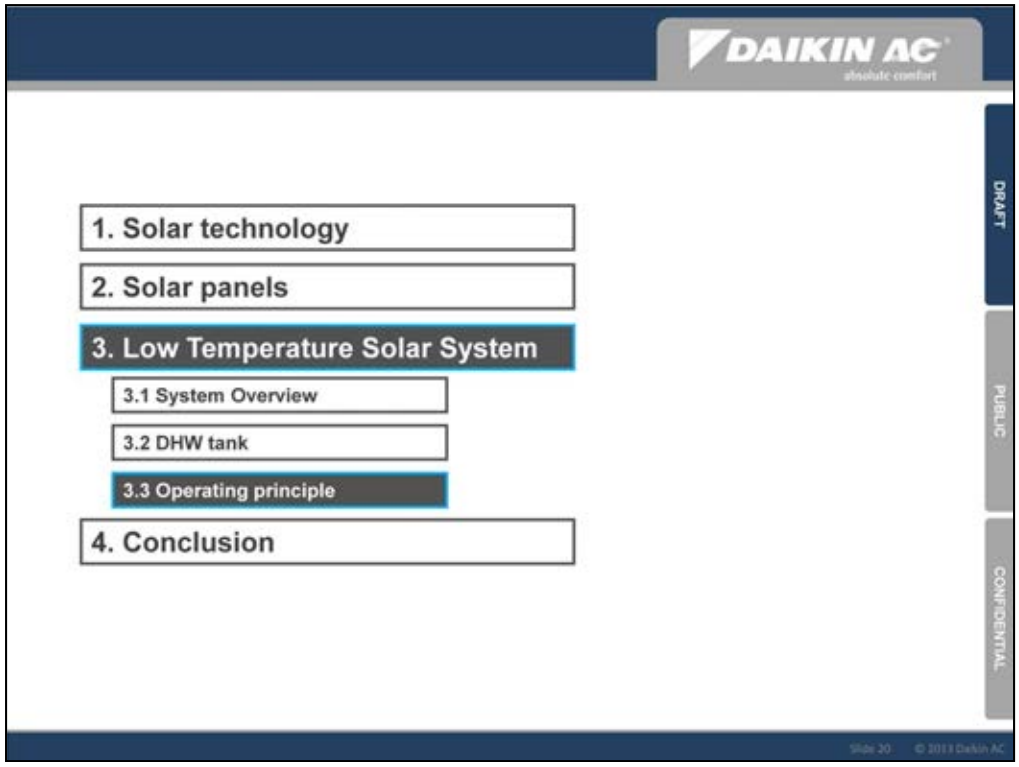
## Stainless steel LT DHW tank

| | | | EKHWS050BA3VJU | EKHWS080BA3VJU |
|---|---|---|---|---|
| Water volume | | gal. | 52.8 | 79.2 |
| Max.water temperature | | °F (°C) | 185 (85) | |
| Max.water pressure | | PSI | 145 | |
| Insulation (Polyurethane foam) Min. thickness | | in. | 1 5/8 | |
| Height | | in. | 45 3/8 | 63 |
| Diameter | | in. | 22 7/8 | |
| Booster heater | | kW | 3 | |
| Piping connections | Water inlet H/E Diameter | in. | ø 3/4 FBSP | |
| | Water outlet H/E Diameter | in. | ø 3/4 FBSP | |
| | Cold water in Diameter | in. | ø 3/4 FBSP | |
| | Hot water out Diameter | in. | ø 3/4 FBSP | |
| Minimum Circuit Amps (MCA) | | A | 14.3 | |
| Maximum Overcurrent Protection (MOP) | | A | 20 | |
| Power supply | | | 208-230V/1Ph/60Hz | |
| Material inside tank | | | Stainless steel (DIN 1.4521) - 316L | |
| Material outside casing | | | Epoxy-coated mild steel | |
| Color | | | Neutral white | |
| Dimensions (Net) | HxWxD | in. | 45 9/32 x 22 27/32 x 22 27/32 | 63 x 22 27/32 x 22 27/32 |
| Empty weight | | lbs. | 99 | 129.8 |

Note: 3-Way Valve is factory included with the Domestic Hot Water Tank for field installation

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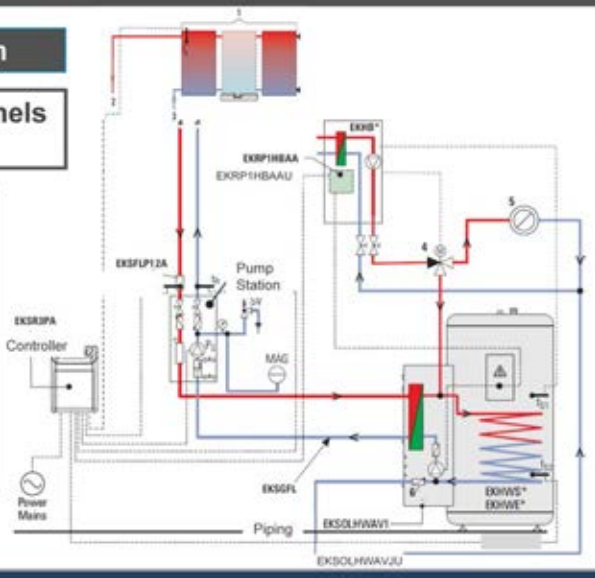
# Typical Piping Diagram

## Pressurized solar system

**Maximum three solar panels per DHW tank**

1. Solar panels
2. Flow piping
3. Return piping
4. 3 way valve
5. Space heating
6. Non return valve
7. $t_{S1}$ : DHW sensor for indoor unit
8. $t_{S2}$ : DHW sensor for solar controller
9. $t_V$ : solar flow temperature sensor
10. $t_R$ : solar return temperature sensor
11. $t_K$ : solar panel temperature sensor

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# Daikin Altherma Solar Kit - Specifications

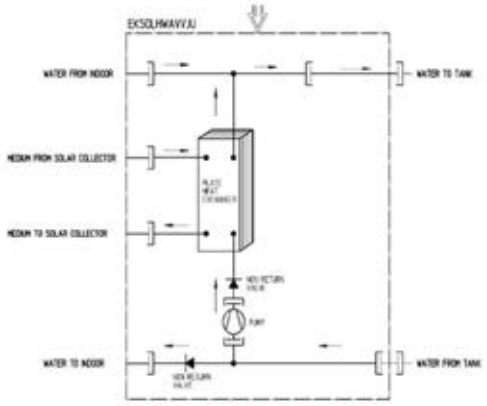
| | | | EKSOLHWBAVJU |
|---|---|---|---|
| Heat exchanger | pressure drop | psi | 3.12 |
| | max.inlet temp | °F (°C) | 230 (110) |
| | heat exchange capacity | W/K | 1,400 |
| | Logarithmic mean temperature difference (LMTD) | K | 5 |
| Pump | Number of speeds | | 3 |
| | Power input | W | 46 |
| Water circuit | Piping connections diameter | in. | 3/4 FBSP |
| Ambient temperature | max. | °F | 95 (35) |
| | min. | °F | 33.8 (1) |
| Power supply | | | 208-230V/1Ph/60Hz |
| Power supply intake | | | from indoor unit |
| Dimensions (Net) | HxWxD | in. | 30 1/32 x 12 x 10 1/32 |



# Daikin Altherma Solar Kit - Overview

- The solar kit is mounted on the outside of the domestic hot water tank.
- The solar kit is a heat exchanger:
  - It gets his heat from the glycol cycle which is running from the solar panels to the solar kit.
  - It delivers his heat to the water cycle which is running from the solar kit to the hot water tank.

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## Possibilities for Heating DHW

- Heating of the domestic hot water is possible with the heat pump, the booster heater or the solar panels.
- Three possibilities:
  1. Heat pump (possibly in combination with booster heater) OR
  2. Solar panels (possibly in combination with booster heater)OR
  3. Booster heater
- Note: heat pump and the solar panels can not be used for heating at the same time.
- The decision between these three possibilities occurs automatically with the Altherma 'Solar priority mode setting' depending on the current conditions (availability of solar energy indicated by Solar Thermal controller).



 

# Solar Priority Mode Setting

- Two different types of solar priority mode ([C-00]) operations can be set.
  1. [C-00] = 0: Solar operation has priority
  2. [C-00] = 1: Heat pump has priority
- A typical controller measures 4 temperatures:
  1. DHW temperature $t_{S2}$
  2. Solar panel temperature $t_K$
  3. Solar flow temperature $t_V$
  4. Solar return temperature $t_R$
- Based on these temperatures, the controller indicates to I/U if solar energy is available or not via potential free contact (BSK)
- Altherma follows automatically a decision flow, depending on:
  1. Availability of solar energy as indicated by the controller
  2. Priority mode setting

  => Decision calculated concerning the heating mode



 

**When Solar Priority Mode Setting ON ([C-00] = 0)**

- Solar energy available
  1. Solar kit will operate (no booster heater)

- Solar energy not available
  1. Heat pump will operate if:
     - DHW T I/U ≤ heat pump ON temperature
     - Allowed by schedule timer
     - Highest demand towards the DHW
  2. Booster heater will operate if:
     - DHW T I/U ≤ booster heater ON temperature
     - Allowed by schedule timer
     - Booster heater delay time over



 

## When Solar Priority Mode Setting OFF ([C-00] = 1)

- Solar energy available
  1. Heat pump will operate if:
     - DHW T I/U ≤ heat pump ON temperature
     - Allowed by schedule timer
     - Highest demand towards the DHW
  2. Booster heater will operate if:
     - DHW T I/U ≤ booster heater ON temperature
     - Allowed by schedule timer
     - Booster heater delay time over
  3. Solar kit will operate if:
     - DHW T I/U > heat pump ON temperature

## When Solar Priority Mode Setting OFF ([C-00] = 1)

- Solar energy not available
  1. Heat pump will operate if:
     - DHW T I/U ≤ heat pump ON temperature
     - Allowed by schedule timer
     - Highest demand towards the DHW
  2. Booster heater will operate if:
     - DHW T I/U ≤ booster heater ON temperature
     - Allowed by schedule timer
     - Booster heater delay time over

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# Solar Priority Mode Setting

- To avoid shortage of domestic hot water in case of
  1. Solar radiation is very weak
  2. Solar radiation only became high shortly before domestic hot water demand is expected.
  - By default: heating of the tank by the heat pump has priority over heating by the sun ([C-00] = 1).
- This default setting can be changed to 'solar priority ON' ([C-00] = 0)
  - When solar heat becomes available: water heating by the heat pump will be (if busy) interrupted and taken over by the sun
- Recommended: keep the mode setting in 'solar priority OFF' ([C-00] = 1).
  - **=> heating of the water by heat pump and booster heater will be limited to the minimum required**
  - **=> solar heat will be stocked in the domestic hot water tank to the maximum**

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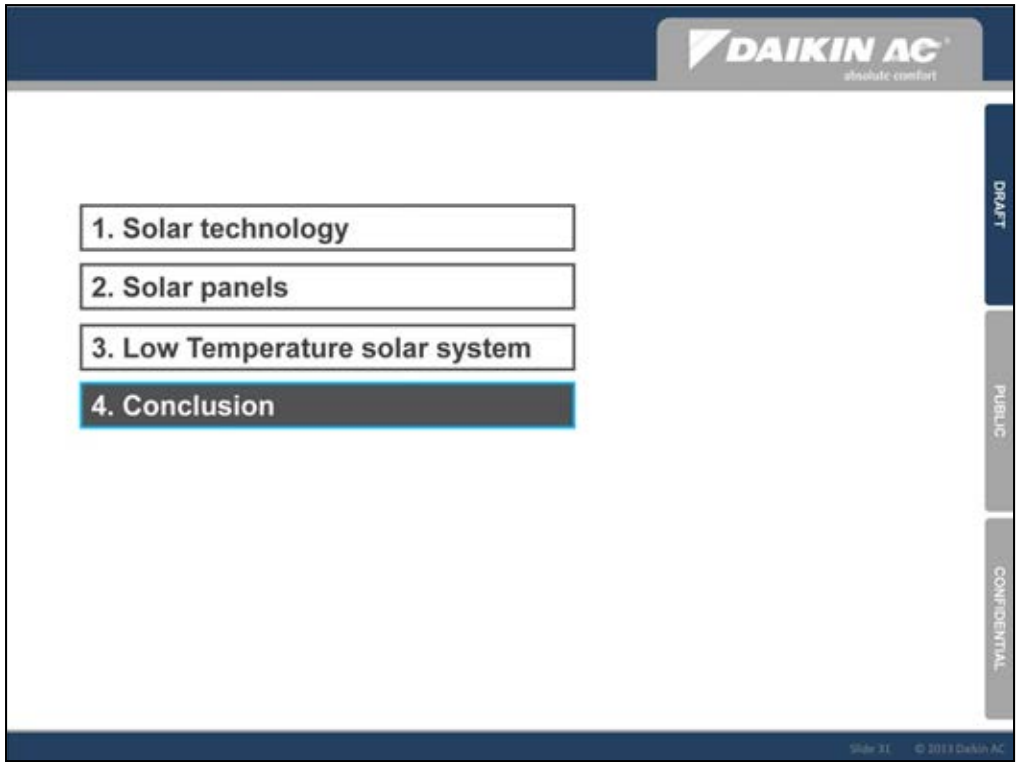
## Stagnation of the Solar Thermal Panels

- At periods of high heat input and low demand, the absorbed heat can no longer be stored in the DHW tank.
  - Steam can form in the solar collectors
- Once steam has formed, solar panels can no longer operate (no more circulation of fluid is possible due to vapor lock)
  - Controller may indicate error, due to minimum flow not being reached at startup
  - Solar panels need to cool down, so that steam can condensate.
  - Controller will try again after two hours.
- Expansion vessel should always be installed lower than solar panels
- Stagnation can be avoided by correct selection of panels (avoid over selection)

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## Solar Thermal Conclusions

**By utilizing Solar Thermal solutions in combinations with Daikin Altherma, you are able to offer your customers a full renewable energy package:**

1. Solar energy can be used for DHW heating, whenever solar radiation is available
2. Free air can be used by heat pump operation, for space heating and additional DHW heating

- **Reduction of energy cost**
- **Lower indirect CO2 emissions**
- **Complete renewable solution package**
- **Infinite source of energy**
- **Answer to political legislations**
- **Visually attractive solutions**
- **Easy installation**

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# Daikin Altherma™

## Use as an Auxiliary to a Solar Thermal Solution

## Why use Daikin Altherma in a Solar Thermal Application?

- All Solar Thermal solutions need some sort of "auxiliary" system that can produce hot water in the event that there isn't sufficient Solar energy available to do so.
  - Excerpt from OG (Solar) Standards: -
    - 6.1.1.4 Auxiliary Water

      Heating Equipment a backup system shall be provided such that the combined system will provide the same degree of reliability and performance as a conventional system. Auxiliary (non-solar) water heating equipment shall be compatible with the solar system heat output, temperatures, flow rates and fluid types.
      Auxiliary equipment shall be listed and labeled by a recognized third party listing agency.

    - 6.1.6.11 Piping System

      The piping system shall be provided with valves which can be closed for the purpose of isolating the solar hot water supply system from the auxiliary hot water heater, thereby permitting operation of the auxiliary hot water heater when the solar hot water system is inoperative or being serviced.

    - 6.5.2 Auxiliary System

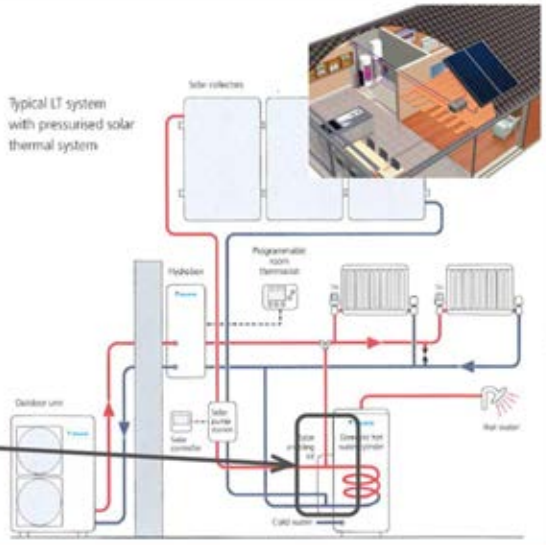
      Interconnection of the auxiliary system to the solar energy system shall be made in a manner which will not result in excessive temperature or pressure in the auxiliary system or bypassing of safety devices of the auxiliary system.



## Why use Daikin Altherma in a Solar Thermal Application?

- Daikin Altherma when applied with the DHW option, can additionally have a “Solar Kit” included that then connects to a Solar Thermal solution.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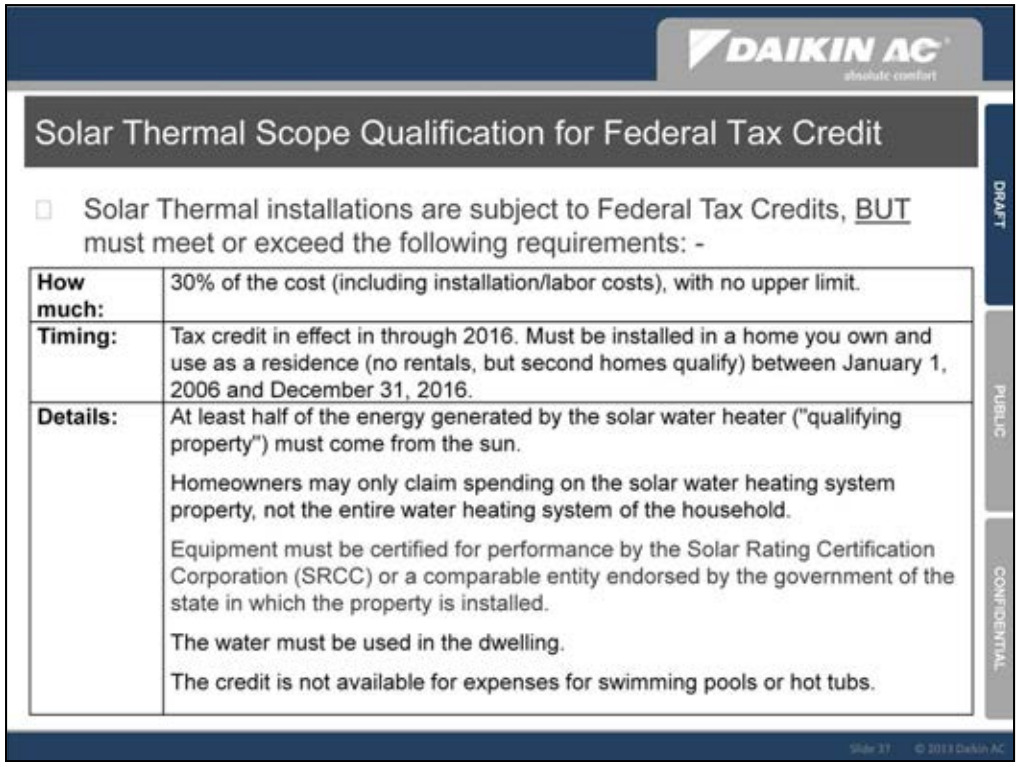
## Why use Daikin Altherma in a Solar Thermal Application?

- The Solar Thermal system then considers “Altherma” as the auxiliary source to create hot water and only creates hot water via the Altherma Heat Pump, Backup Heater and Booster Heater, when the solar thermal system cannot meet the demand due to lack of solar energy.
- The Daikin Altherma DHW Tank **CANNOT** work as a standalone device. It MUST be connected to a Hydrobox, which in turn MUST be connected to a Condensing Unit. As such, the “auxiliary” for Solar Thermal in this instance is the entire Daikin Altherma system.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Solar Thermal Scope Qualification for Federal Tax Credit
Solar Thermal installations are subject to Federal Tax Credits, BUT must meet or exceed the following requirements: -
How much:
30% of the cost (including installation/labor costs), with no upper limit.
Timing:
Tax credit in effect in through 2016. Must be installed in a home you own and use as a residence (no rentals, but second homes qualify) between January 1, 2006 and December 31, 2016.
Details:
At least half of the energy generated by the solar water heater ("qualifying property") must come from the sun.
Homeowners may only claim spending on the solar water heating system property, not the entire water heating system of the household.
Equipment must be certified for performance by the Solar Rating Certification Corporation (SRCC) or a comparable entity endorsed by the government of the state in which the property is installed.
The water must be used in the dwelling.
The credit is not available for expenses for swimming pools or hot tubs.
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## How are Solar Thermal Solutions normally certified?

- Solar Thermal Solutions can either be certified as OG100 (Panel, Pump Station Only) or OG300 (Panel, Pump Station plus Tank and auxiliary DHW creation power supply – normally electric resistance or gas).
- The OG certification is done through SRCC.
- For Energy Star, you have to achieve OG300 – this is no good for Altherma is no Altherma + Solar Thermal solution is certified.
- For the Federal Tax Credit, SRCC is stated, but OG100 or OG300 is not specified

## How are Solar Thermal Solutions normally certified?

- At the state level, it's a mixture of needing to be OG100 certified ONLY, either OG100 or OG300 certified, or OG300 certified ONLY for Solar Thermal solutions to be installed as follows: -
  - AZ, GA, CO, IL, HUD, NV, OR, TX - OG300
  - DE, CA, LA*, MD, MN, NM, NC*, WI, DC – OG100 or OG300
  - HI, PA, UT, VT, WY – OG100
- As such, if states permit OG100 certification ONLY, then Altherma could be the auxiliary DHW solution, and as such could be eligible for the 30% Renewable Energy Federal tax credit.
- The basis of this is that Equipment and Installation Costs are included in what can be claimed and Altherma becomes part of the necessary equipment and installation.

## What to do next?

- Work with your customers and advise them of the added benefit of matching Daikin Altherma and a Solar Thermal Solution.
- Utilize the Manufacturer Statement prepared that helps summarize the Solar Thermal requirements and the relationship to Daikin Altherma.
- Many Solar Thermal providers exist, but Daikin has experience matching with Buderus, as well as others.

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Manufacturer's Statement

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## Frequently Asked Questions

- **Is Altherma certified for a Tax Credit?**
  - *No – Altherma is NOT recognized for tax credit directly. This presentation and the manufacturer statement provides guidance as to how Altherma can be utilized in a Solar Thermal application, and serve as the 'back-up or auxiliary' system to the Solar Thermal equipment for creating Hot Water.*
- **How do I promote this to our customers / contractors?**
  - *Explain what "IT" is – i.e. guidance of how Altherma fits into a Solar Thermal application and how Tax Credits, by means that the "Installation Costs" are eligible, could be possible.*
- **Why should I promote this if its not a definitive statement?**
  - *Based on all the tax credit criteria and supporting documentation of fact, this is a real opportunity for Altherma and it should be informed to customers, plus it results in a more energy efficient installation than using straight electric or gas as the solar thermal auxiliary system.*
- **Have any customers been successful in receiving a tax credit, including the cost of their Altherma system to date?**
  - *Yes – Daikin are aware of 4 to 5 homeowners who purchased Altherma tied into Solar Thermal application in 2010, were successful in claiming the tax credit, including the Altherma costs as part of the installation, when they filed their 2010 return.*



 

## References for further information

### Resource Websites

http://www.dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=US37F&re=1&ee=1

http://www.energystar.gov/index.cfm?c=tax_credits.tx_index

http://energystar.supportportal.com/ics/support/default.asp?deptID=23018&task=knowledge&questionID=19345

http://energystar.supportportal.com/ics/support/default.asp?deptID=23018

### Certified Products List (downloads as PDF)

http://www.energystar.gov/index.cfm?fuseaction=solar_wheat.display_products_pdf

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