History of Daikin Applied

• Founded in 1924, Daikin is a trusted brand name within the HVAC industry and is synonymous with expertise in technology and excellence in engineering

• Daikin Industries purchased OYL (AAF, McQuay International and J&E Hall Ltd) in 2006. This group of companies now comprise the world's largest HVAC equipment manufacturer

• Daikin Industries a Fortune 1000 company

• Rebranded from McQuay to Daikin Applied in April 2015

• Dedicated trained engineers

• EU and US factory service support (if required)
Cramlington (AHU)
Daikin Applied (UK) Ltd

Office area of 450m²
Factory area of 7550m²
Total working area of 8000m²

120 employees

Product capacity – 1000 units
Facility includes:
Sales Department
Engineering Department
Customer Service
Service & Warranty Departments

Cecchina
(Chillers & Compressors)
Daikin Applied
Headquarters
EMEA Region

Offices: 2.410 m²
Factory: 20.467 m²
Total area: 22.877 m²
280 employees

Production capacity:
- 5000 Screw Compressors per year
- With 2500 chillers per year
Not only and production plant, also:
- Engineering Department
- Sales Department,
- After Sales Department,
- Customer Service Department
“A Heat Pump extracts heat from a source and transfers it to a sink at a higher temperature”

“In engineering, however, the term Heat Pump is generally reserved for equipment that **heats for beneficial purposes**, rather than that which removes heat for cooling only”
## Commercial Heat Pump Applications - Overview

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT STYLE</th>
<th>COMMENT</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source Temperatures</td>
<td>Water to Water</td>
<td>Typically 10°C to 25°C entering water/glycol</td>
<td>Delta T = 6 - 8°C.</td>
</tr>
<tr>
<td>Sink Temperatures</td>
<td>All</td>
<td>Typically 35°C to 55°C leaving water temps.</td>
<td>60 – 65°C may be available if source/equipment style allow. Limiting factor is compressor “lift”. Delta T = 6 – 8°C vs 11 - 20°C on LPHW systems</td>
</tr>
<tr>
<td>Refrigerants</td>
<td>All</td>
<td>Currently HFCs moving towards lower GWP HFC/HFOs</td>
<td>R32 and R513a with some R1234ze machines.</td>
</tr>
</tbody>
</table>

Reduced capacity at lower Ambient conditions.
# COMMERCIAL HEATPUMP APPLICATIONS - OVERVIEW

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>SOURCE</th>
<th>PART L</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water to Water</td>
<td>Ground Water</td>
<td>Assists Part L Compliance</td>
<td>Can be expensive to install</td>
</tr>
<tr>
<td>Water to Water</td>
<td>Condenser Circuit from Existing W2W Chillers</td>
<td>Does not assist Part L compliance * TBC</td>
<td>Recovers heat, reduces water consumption (open cct towers), improves chiller efficiency. Flexible.</td>
</tr>
<tr>
<td>Water to Water</td>
<td>Chilled water Circuit</td>
<td>Does not assist Part L compliance * TBC</td>
<td>Requires balanced system as available heat is dependent on cooling load. Less flexible.</td>
</tr>
<tr>
<td>Water to Water</td>
<td>Exhaust Air Heat Recovery</td>
<td>Does not assist Part L compliance* TBC</td>
<td>Can be difficult to implement</td>
</tr>
</tbody>
</table>
## COMMERCIAL HEATPUMP APPLICATIONS - OVERVIEW

<table>
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<tr>
<th>APPLICATION</th>
<th>SOURCE</th>
<th>PART L</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air to Water – Heatpump Only</td>
<td>Ambient Air</td>
<td>Assists Part L Compliance</td>
<td>Requires Defrost cycle, heating duty lowest when most needed.</td>
</tr>
<tr>
<td>Air to Water – Reverse cycle 2-pipe.</td>
<td>Ambient Air</td>
<td>Assists Part L Compliance</td>
<td>2 Pipe change over system. Less flexible/ less suitable to changeable Irish conditions.</td>
</tr>
<tr>
<td>Air to Water – 4-pipe Multipurpose.</td>
<td>Ambient Air/ Chilled Water</td>
<td>Assists Part L Compliance</td>
<td>4 Pipe system. Flexible to suit changeable Irish conditions.</td>
</tr>
</tbody>
</table>
SYSTEMS DESIGN
WITH THE NEW DAIKIN HIGH EFFICIENCY MULTIPURPOSE UNITS
The seasonal comfort

The typical seasonal comfort application provides heating during winter season and cooling during summer season. There is a scheduled seasonal change over of the system from heating to cooling.
The traditional solution: chiller + boiler
THE COMFORT EVOLUTION
Big multipurpose buildings
offices, hotels, malls, hospitals are examples of buildings characterized by
different environments with various climatic needs
Greater expectation for comfort
the users are more demanding on their comfort level obtained by accurate temperature and humidity control.
Reduction of the running costs without losing comfort
The comfort evolution

In this scenario the need for cooling and heating is not strictly related to the season but to the actual condition and purpose of each environment. As a result, there is no seasonal scheduled change over of the system from heating to cooling.
The traditional solution: chiller + boiler
Two separate systems providing cooling and heating
The traditional solution: chiller + boiler
Two separate systems providing cooling and heating
The MULTIPURPOSE solution
A single system provides cooling and heating on two separate loops
A single system provides cooling and heating all round year ...
.....recovering energy every time there is contemporary request for HOT and COLD energy
Definitions
A cooling only chiller is a 2 pipes unit able to provide only chilled water. A single exchanger on water side operating always as evaporator. Typical application is comfort cooling during summer season.

![Diagram of a cooling only chiller]

![Bar chart showing loads by season and month]

**COOLING ONLY CHILLER**
REVERSIBLE HEAT PUMP

A reversible heat pump is a 2 pipes unit able to provide chilled or hot water.

A single exchanger on water side operating as evaporator or as condenser. Typical application is seasonal comfort cooling or heating (with scheduled change over).
A reversible heat pump is a 2 pipes unit able to provide chilled or hot water.

A single exchanger on water side operating as evaporator or as condenser.

Typical application is seasonal comfort cooling or heating (with scheduled change over).
A multipurpose unit is able to provide chilled and hot water independently during all the year. Two heat exchangers on water side: one operating always as evaporator and the other always as condenser. Whenever there is simultaneous request for cooling and heating the unit can recover energy.
MULTIPURPOSE unit

A multipurpose unit is able to provide chilled and hot water independently during all the year.

Two heat exchangers on water side:
- one operating always as evaporator
- the other always as condenser

Whenever there is simultaneous request for cooling and heating the unit can recover energy.
HOW DOES IT WORK?
HOW DOES IT WORK?

Two separate circuits can run independently.

The unit can operate in 5 different modes:

1. Cooling only
2. Heating only
3. Cooling = Heating
4. Cooling < Heating
5. Cooling > Heating
HOW DOES IT WORK?
HOW DOES IT WORK? – COOLING ONLY

The 4Z unit operates like a chiller providing only chilled water while the hot heat exchanger is OFF and the heating energy is rejected to the air.
A circuit operates in water to water mode providing the heating load and part of the cooling load while the other circuit provides the remaining part of cooling load operating in air to water mode and the exceeded heating energy is rejected to the air.
HOW DOES IT WORK? – COOLING ≈ HEATING

The unit operates only in water to water mode providing chilled and hot water while the air side Heat Exchanger is OFF.
HOW DOES IT WORK? – COOLING < HEATING

A circuit operates in water to water mode providing the cooling load and part of the heating load; the other circuit provides the remaining part of heating load operating in air to water mode while the exceeded cooling energy is rejected to the air.

[Diagram of the system showing heat exchangers, compressors, and valves for water loops and airflow.]
HOW DOES IT WORK? – HEATING ONLY

The 4Z operates like a heat pump providing only hot water while the Cold Heat Exchanger is OFF and the Cooling energy is rejected to the air.
HOW DOES IT WORK?

- Cooling only
- Cooling > Heating
- Cooling ≈ Heating
- Cooling < Heating
- Heating only
DAIKIN 4Z

The new Multipurpose unit suitable for 4 pipe systems
FULL INVERTER TECHNOLOGY

- Daikin Single screw compressor with integrated VFD and VARIABLE VOLUME RATIO
- Inverter controlled fans
- Variable speed pumps control
DAIKIN 4Z

CAPACITY RANGE

from 400 kW..

..Up to 800 kW

cooling
heating

400 kW 800 kW
DAIKIN 4Z

SOUND CONFIGURATION

✓ 3 sound configurations

STANDARD SOUND

STANDARD SOUND + OP76b

REduced SOUND
How to select a multipurpose unit?
HOW TO SELECT A MULTIPURPOSE UNIT?

- REQUIRED LOAD [kW]
  - DESIGN LOAD COOLING
  - DESIGN LOAD HEATING
  - COOLING LOAD
  - HEATING LOAD

- MONTHS: JAN, FEB, MAR, APR, MAY, JUNE, JULY, AUG, SEP, OCT, NOV, DEC

- DESIGN LOAD:
  - HEATING: 300 kW
  - COOLING: 400 kW
The design load in **COOLING** must be satisfied by the unit operating in **COOLING ONLY** (air to water mode) at the design conditions for Cooling.

**Design Load:**
- **400 kW**

**Design temperature (summer season):**
- **28°C**

**HOW TO SELECT A MULTIPURPOSE UNIT?**
HOW TO SELECT A MULTIPURPOSE UNIT?

The design load in **HEATING** must be satisfied by the unit operating in **HEATING ONLY** (air to water mode) at the design conditions for Heating. All Heatpumps derate substantially at low ambient. “Standard” Eurovent data is at +7°C

- Design load: **300 KW**
- Design temperature (winter season): **-5°C**
## HOW TO SELECT A MULTIPURPOSE UNIT?

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COMMENT</th>
<th>REASON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>Select 2 or more Heatpumps in parallel if possible</td>
<td>Units need to defrost at low ambient on Air to Water Heating Mode. Having two eliminates simultaneous defrost.</td>
</tr>
<tr>
<td>Quantity</td>
<td>Select 2 or more Heatpumps in parallel if possible</td>
<td>If the loads can be significantly imbalanced, allows more flexible operation and heat recovery. A circuit can only operate in one mode at a time.</td>
</tr>
<tr>
<td>Hot water temperatures</td>
<td>Select as low as possible</td>
<td>More efficient.</td>
</tr>
</tbody>
</table>
DAIKIN SINGLE SCREW COMPRESSOR
with INTEGRATED VFD and VARIABLE VOLUME RATIO

THE BEST TECHNOLOGY FOR MULTIPURPOSE APPLICATIONS

Multipurpose unit operates most of the time at part load

INVERTER FOR BEST PERFORMANCES

Multipurpose unit operates in extremely variable conditions

VVR FOR HIGHEST EFFICIENCY IN EVERY CONDITION
DAIKIN expertise are not only on compressors.....

DAIKIN 4Z

NEW DAIKIN High Efficiency Fan

Optimized refrigerant circuit

Advanced control logic
Applications
Simple 4-Pipe System
Add Domestic Hot Water – Stepup Heatpump
Add Buffer Tanks (Chiller Protection 3.5 to 6 l/kW)
Add Buffer Tanks (Thermal Storage for load shaving)
Add Ice Build (Thermal Storage for load shaving)
APPLICATIONS

To better understand the benefits of DAIKIN 4Z technology we can make an evaluation of the energy consumption

Comfort Cooling and Heating plus Pool Heating for an Hotel located in Rome
APPLICATIONS

Comfort Cooling and Heating plus Pool Heating for an Hotel located in Rome

Below the required loads for cooling and heating

We can compare 2 different solutions:

1. Reversible Heat pump + Cooling only chiller
2. Multipurpose unit
APPLICATIONS

DAIKIN TZ

Sol. 1

DAIKIN BZ

Chiller + Heat Pump

DAIKIN 4Z

Sol. 2
APPLICATIONS

Comfort Cooling and Heating plus Pool Heating for an Hotel located in Rome

To compare the two solutions we use the BIN method based on the frequency for each temperature during all the year.
APPLICATIONS

Comfort Cooling and Heating plus Pool Heating for an Hotel located in Rome

Chiller + Heat pump

Multipurpose

Energy [kWh]

0  200000  400000  600000  800000  1000000  1200000  1400000  1600000

Cooling Energy  Heating Energy  Energy Consumption C+H

DAIKIN BZ

DAIKIN TZ

DAIKIN 4Z

53
APPLICATIONS

Comfort Cooling and Heating plus Pool Heating for an Hotel located in Rome

Chiller + Heat pump

Multipurpose

same Cooling and Heating energy delivered

-32% Energy consumption

DAIKIN BZ+TZ

DAIKIN 4Z

DAIKIN TZ

DAIKIN 4Z

Energy [kWh]

0

200000

400000

600000

800000

1000000

1200000

1400000

1600000

Cooling Energy

Heating Energy

Energy Consumption DAIKIN BZ+TZ

Energy Consumption DAIKIN 4Z
A solution only made of a multipurpose unit is always the best solution?
A solution only made of a multipurpose unit is always the best solution?
a solution made of **DAIKIN 4Z** (multipurpose) + **DAIKIN TZ** (cooling only) is the **BEST SOLUTION**
a solution made of **DAIKIN 4Z** (multipurpose) + **DAIKIN TZ** (cooling only) is the **BEST SOLUTION**

20% recovered energy
DAIKIN MASTER/SLAVE
Provided as standard allows to connect up to 4 units together combining multipurpose unit with cooling only screw chillers
Connectivity

DAIKIN brings your system in to the cloud
With Daikin On Site it is possible to have a complete remote access to the unit controller through the cloud.
DAIKIN on Site (DoS)
DAIKIN on Site (DoS)

It is possible to analyze the trend of all the parameters.