

# Heat pump systems



# HEAT PUMP SYSTEMS FOR ENERGY EFFICIENT HOT WATER GENERATION IN HOTELS, HOSPITALS AND RESIDENTIAL APARTMENTS.

**Most residential buildings use decentralized individual electric storage geysers or instantaneous outflow geysers for hot water generation.**

**In locations where natural gas/ LPG is available these geysers are fired by Natural gas/ LPG burners.**

**Most hotels & hospitals have centralized hot water generation & distribution with fuel fired (Diesel / Natural Gas) hot water generators / steam boilers**

# ELECTRICAL COSTS & AVAILABILITY

Electricity costs are around Rs.6.00 / kw (including demand charges) in major cities for residential, and Rs. 8.00 -10.00 / kw for commercial establishments like hotels.

Current Diesel costs are around 38 / LTR with Natural gas at around Rs. 25.00 – Rs 27.00 / m<sup>3</sup> ( 1 m<sup>3</sup>  $\equiv$  8500 Kcal)

These costs are proving to be a major burden on consumers.

Availability of electric power at will is also a problem in almost all parts of India excepting cities like Mumbai.

Provision of backup DG sets involving higher costs of DG based power (Rs. 10.00 Rs. - 12.00 / Kw) has become a norm rather than an exception.

# RESIDENTIAL COMPLEX

- ▶ **Expensive high rise apartment buildings necessarily have to resort to backup power due to unreliability of grid power, and also for emergency requirements like lifts and elevators.**
- ▶ **A high rise apartment complex with 100 apartments of 3 bedrooms each will have a connected power load of 900 Kw due to the electric geyser requirements for hot water (3Kw / Geyser). The backup power has to factor this into account.**
- ▶ **This high capacity connected power which is at best is used only over 2-3 hours a day puts a tremendous pressure on the grid availability.**
- ▶ **The Power facilities have to provide for this limited use requirement in their peak generation capacity - a national Burden.**
- ▶ **The carbon foot print to cater to this peak requirement puts a tremendous burden on the system. Backup power has also to have fuel storage.**
- ▶ **Use of centralized hot water generation with Heat Pump Systems can reduce power consumption and costs to 15%-20% of current power requirements.**

# HOTELS & HOSPITALS

Hotels (& Hospitals) use Diesel fuel steam boilers / hot water generators for hot water production.

A 150-200 room hotel facility with a hot water consumption of around 70m<sup>3</sup> /day spends over Rs.10,000 / day in fuel costs.

Fuel cost (Diesel /N gas ) are moving upwards regularly on a 6 month basis in current times.

Use of centralized Heat Pump System to generate hot water can reduce costs by 75%-80% in Hotels and Hospitals.

# HEAT PUMP

- ▶ A heat pump is a machine we are all familiar with.
- ▶ The window air-conditioner is an air to air Heat Pump which pumps out the room heat to the outside ambient.
- ▶ The Heat Pump System to produce hot water is an air to water Heat Pump, or a water to water Heat Pump.
- ▶ Whilst heating up water on one side, it simultaneously cools air on the other side or produces chilled water which can be used for air-conditioning.
- ▶ It therefore can give you the double benefit of producing hot water and comfort cooling at a much reduced cost.
- ▶ When you do not need hot water it can run as a pure cooling machine.
- ▶ In north India when you do not need cooling in winter, it can produce only hot water, for winter heating (as an air to water Heat Pump which can operate at an ambient of -10°C).

# SIMULTANEOUS HEATING AND COOLING

The Heat Pump can be designed and configured as a multi mode machine.

- To generate only hot water from ambient air
- To simultaneously generate hot water and cooling energy.
- To generate only cooling for comfort

Hotels and hospitals continuously need air-conditioning, and therefore on a multimode basis, the OPEX costs of a Heat Pump come down to 15% -20% of fuel fired boilers.

Differential cost of investment of the Heat Pump System could be recovered well within one year. Retrofits payback possible in one year.

# BENEFITS TO RESIDENTIAL COMPLEX

- ▶ For residential apartment complexes it is a win-win situation both for the User and Developer
- ▶ The Users' hot water component of the electricity bill comes down to 20% of his would be bill.
- ▶ With centralized hot water on tap (for 24 hours) even the kitchen can get hot water without an extra geyser connection.
- ▶ A 900Kw (geysers) connection in a building can come down to less than 100 Kw.
- ▶ The Developer saves on expensive CAPEX costs in connected power. A saving of 800 Kw of connected power could be around Rs 60.00 lakhs (@ Rs 7500 / kw).
- ▶ The Developer's overall CAPEX costs would come down, the backup DG power capacity also comes down.
- ▶ The Power companies are relieved of the burden of providing this extra connected power ----- a definite positive input for demand side management

# Centralized Hot Water Supply For High Rise Residential Buildings.

Consider a high rise apartment complex of 30 storeys, 4 apartments / floor / wing with two wings.

## Data

1. Requirement of hot water : 25 litres / person / day at 40 C at bathing point
2. No. of users / apartment = 5 Nos.
3. No. of apartments / floor = 4 Nos. / wing.
4. No. of wings – 2 nos
5. Ambient water temperature 25 C.

## Requirement

1. Hot water requirement for morning peak period :

$$25 \times 5 \times 4 \times 2 \times 30 = 30,000 \text{ ltrs at } 40 \text{ C}$$

2. Hot water generator storage at 50 C will be

$$30,000 \times \frac{(40 - 25)}{(50 - 25)} = 18,000 \text{ ltrs at } 50 \text{ C during peak hours (7am - 9am)}$$

**(Hot water generation to be spread over 4 hours)**

3. Storage tank capacity

$$2 \times 4500 \text{ ltrs} = 9000 \text{ ltrs (2 hours storage capacity)}$$

4. Hot water generation = 4500 lph (for 2 hours)

Therefore Heat load / hour

$$4500 \text{ ltrs/hr} \times 25 \text{ C} = 1,12,500 \text{ Kcal / Hr} = 130 \text{ KW}$$

**Equipment chosen –**

**Hot water generator of 130KW capacity consuming 37.5KW input power**

**Also delivers 92.8 KW of cooling. (= 26.3 TR) with a power saving of 25 KW**

5. Storage Geysers cost :

(2 KW) x no of bedrooms x no. of Apartments x no. of wings x no. of storeys

(2 KW) X 3 x 4 x 2 x 30 = 720 storage geysers x Rs. 6000/- = Rs. 43,20,000/-

**NOTE: Electrical connections costs considering 0.8 diversity factor and Rs.7500 / KW = Rs. 86,40,000**

HEAT PUMP DETAILS

Heat output 130 KW

Input power 37.5 KW (inclusive of 25KW for cooling)

**Therefore net power is = (37.5 KW – 25 KW = 12.5 KW for heating)**

POWER CONSUMPTION

Geyser = (18000 ltrs x 25 C) 860 Kcal/KW = 523 KW

Heat pump = 12.5 x 4 (hours) = 50 KW

Savings in power (KW) = 523 KW – 50 KW = 473 KW say 470 KW

Hence annual savings in Rs. = 470 x Rs.6/ = Rs. 2820/- x 360 = Rs. 10,15,200/- per year.

## Capital Costs

	<u>Geyser System</u>	<u>Heat Pump System (2 x 65 KW each)</u>
1. Cost for	Rs. 43.20 lacs	Rs. 25.00 lacs (2 nos)
2. Storage Tanks, Pumps & interconnected pipe work	-	Rs. 15.00 lacs
3. Main Header Piping	-	Rs. 15.00 lacs
3. Electricals & Accessories	Rs. 86.40 lacs	-
3. Miscellaneous		Rs. 10.00 lacs
<b>TOTAL</b>	<b>Rs. 129.60 lacs</b>	<b>Rs. 65.00 lacs</b>

# CASE STUDY FOR HOTELS

Comparative Analysis between Fuel Fired Boiler & Heat Pump			
Parameters	Units	Systems	
		Boiler	Heat Pump
Requirement of hot water from 20 °C to 50 °C	lts/day	80,000.00	80,000.00
Energy required for heating	kCal/day	2,400,000.00	2,400,000.00
Peak load (13000 lts over 2 hrs. (morning & evening))	lts/hr	6,500.00	6,500.00
Efficiency of Boiler	%	85	
Specific gravity of Diesel		0.89	
Calorific value of Diesel	kCal/kg	9850	
Diesel consumption	lts/day	322	
Rate of Diesel	Rs./lts	38	
<b>Operational Cost of Fuel fired Boiler per day</b>	<b>Rs./day</b>	<b>12236</b>	
Heat Pump capacity	kCal/hr		200,000.00
No. of hours of operation of Heat Pump for 80000 lts	hrs		12.00
Gross connected power	kW		68.30
Cooling benefit ( 47 TR X 1.2 kW/TR for Air Cooled M/c)	kW		56.40
Net Power (68.3 - 56.4 = 11.9 kW, say 12 kW)	kW		12.00
Cost of Power in Bangalore	Rs. /kWh		6.00
<b>Operational Cost of Heat pump per day ( 12 x 12 x 6 = 864)</b>	<b>Rs /day</b>		<b>864.00</b>
Operational Saving per day (12086 - 864 = 11372)	Rs./day		11,372.00
<b>Annual operational Saving ( 11654 x 360)</b>	<b>Rs./annum</b>		<b>4,093,920.00</b>
Difference in Capital Cost of Heat Pump vs. Fuel Fired Boiler (including Standby)	Rs.		2,400,000.00
<b>Time Period for payback for Difference in investment</b>	<b>Months</b>		<b>7.2</b>

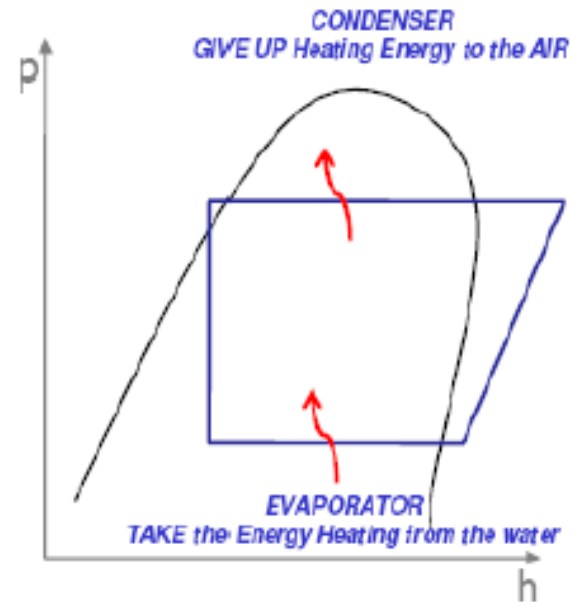
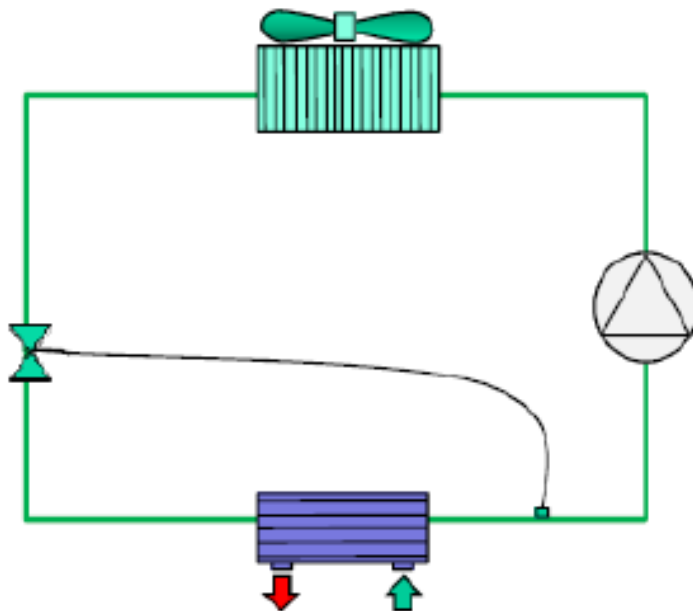


BLUE BOX

THE ENERGY RECOVERY SOLUTIONS

# Recovery Blue Box Solutions

CHILLER: Standard Thermodynamic Cycle



## ***Recovery Blue Box Solutions***

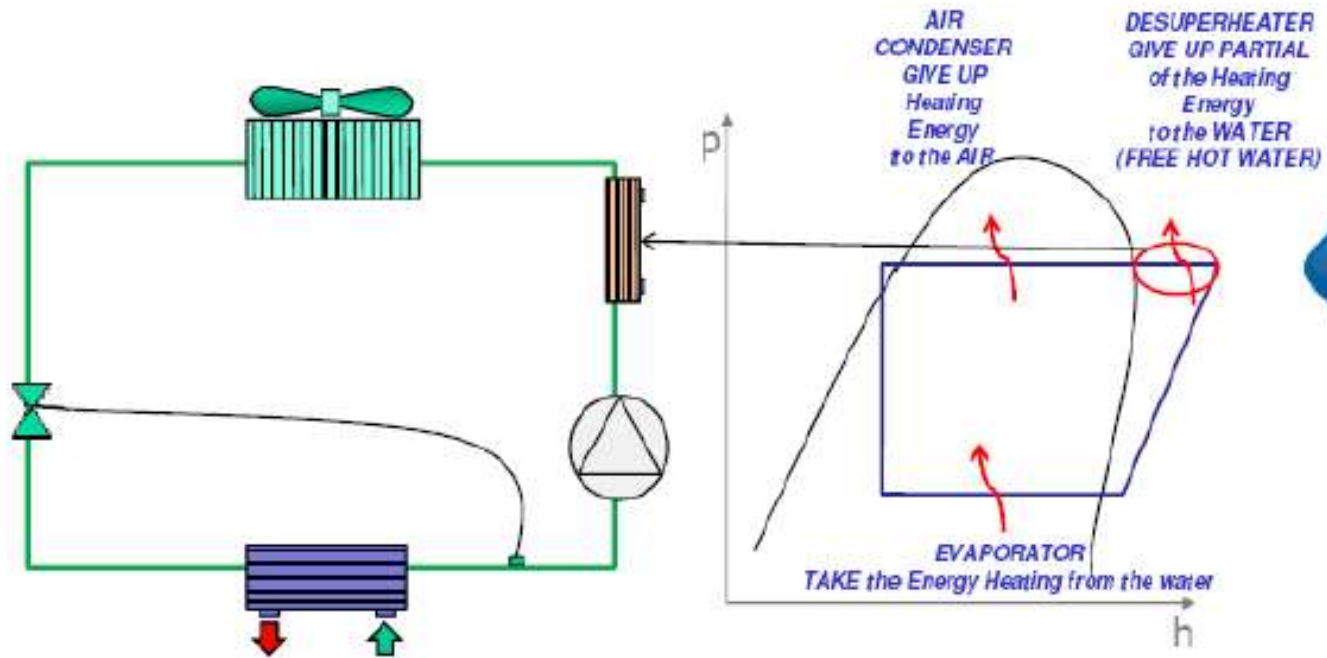
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- *How is possible to have Partial or Total Heat Recovery ?*
- *How is possible to have the FREE-HEATING without EXTRA COST ?*

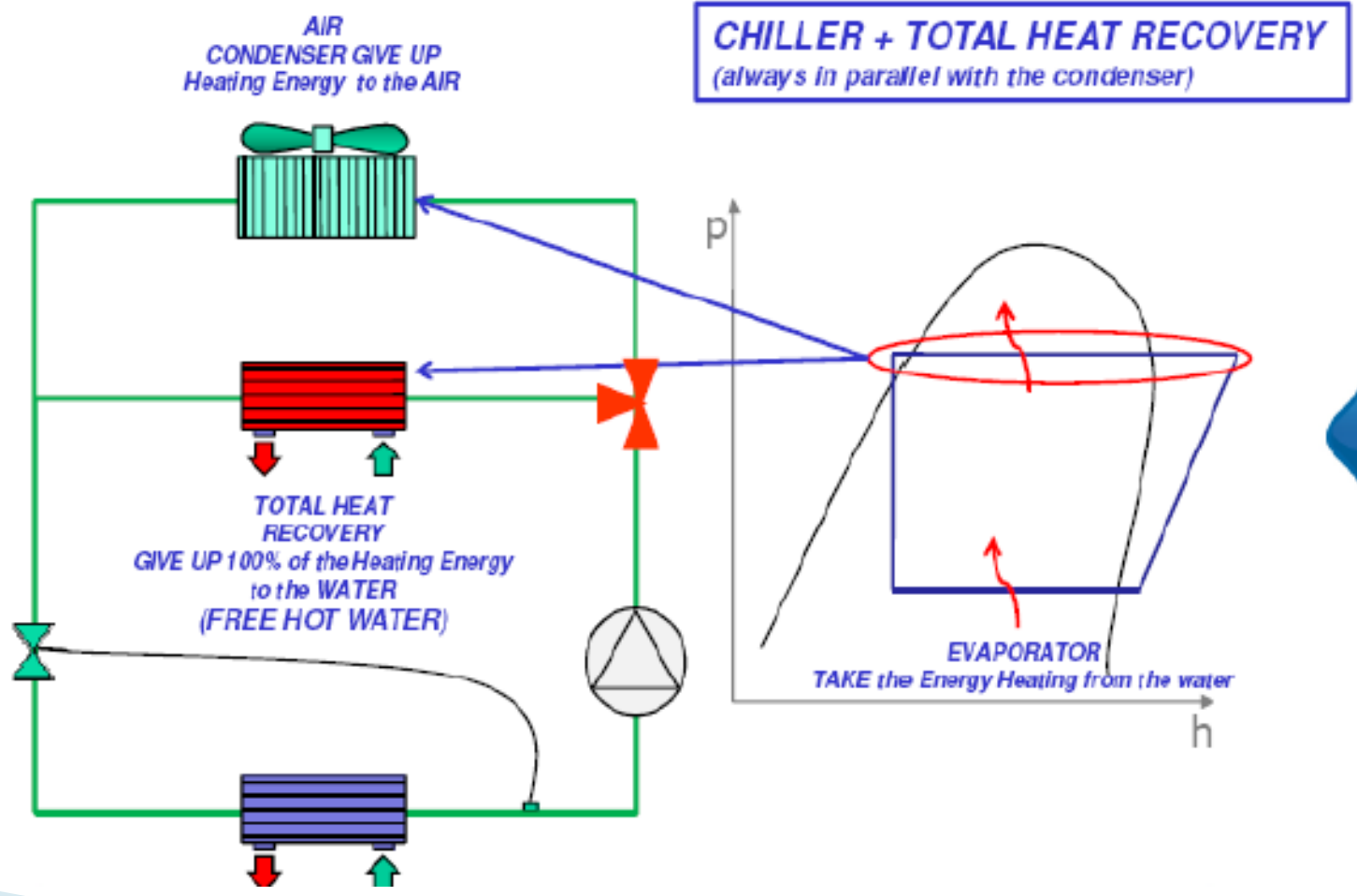
# Recovery Blue Box Solutions

## CHILLER + DESUPERHEATER

(always in series between the compressor and the condenser)



# Recovery Blue Box Solutions



## *Recovery Blue Box Solutions*

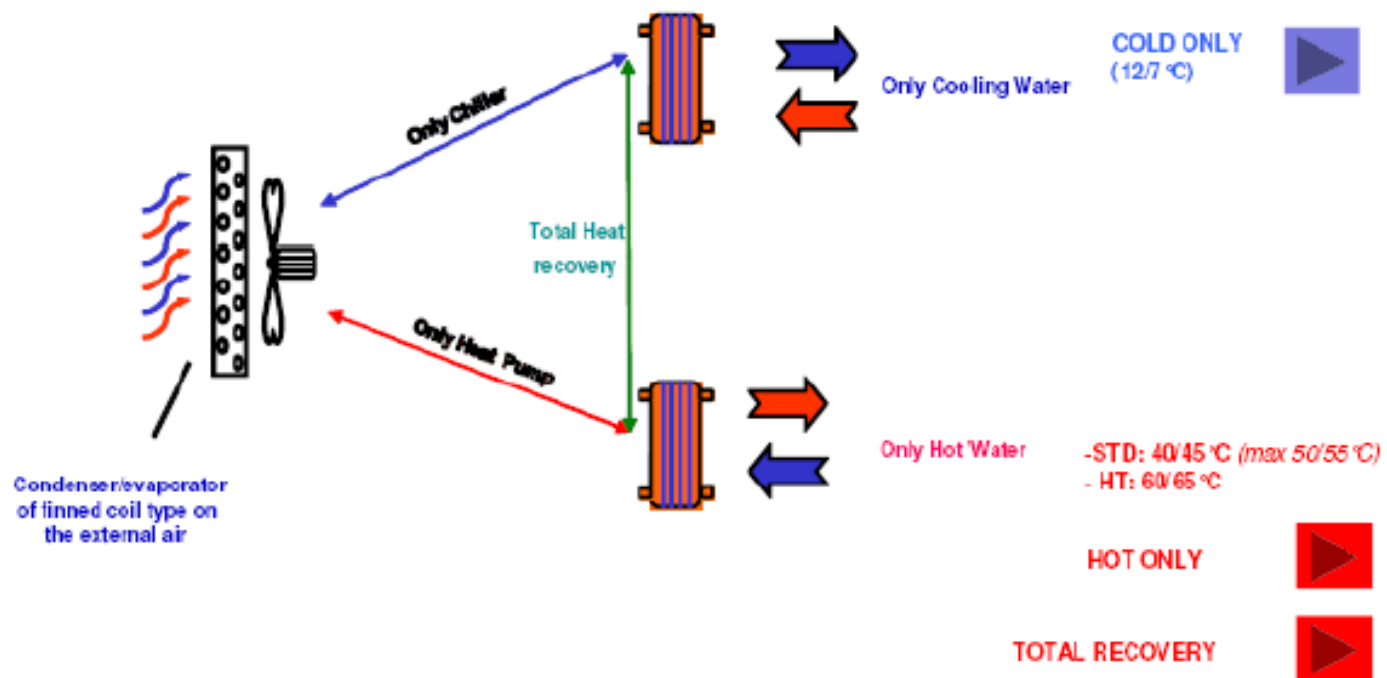
### **MULTIFUNCTION UNITS**

#### Can Work:

- **Independently Cooling Water Production = Chiller**
- **Independently Heating Water Production = Heat Pump**
- **At the same time Cooling and Heating Water Production = Total Heat Recovery**

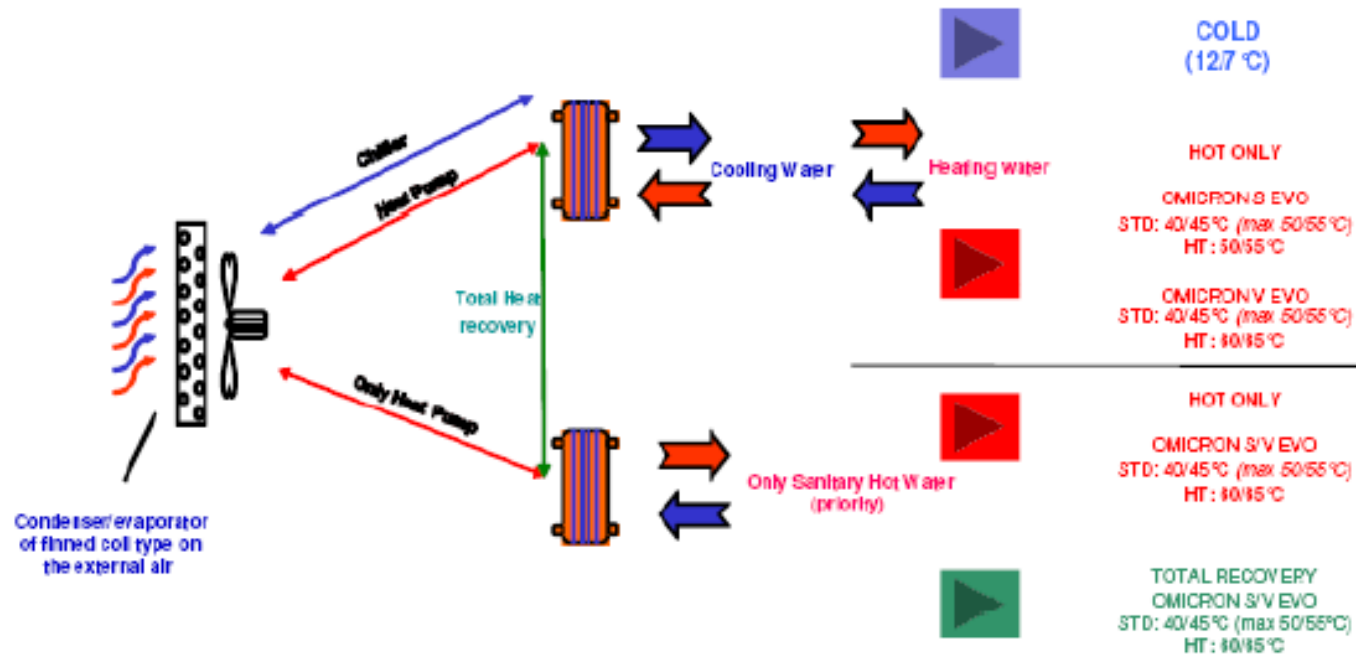
# OMICRON EVO MULTIFUNCTION UNITS

## 4 PIPES APPLICATION



# OMICRON EVO MULTIFUNCTION UNITS

## 2 PIPES APPLICATION



# OMICRON EVO

MULTIFUNCTION UNITS



# OMICRON S EVO MULTIFUNCTION UNITS

## Operational Versions:

- a. *Standard*: Basic version with production of hot water up to 55 [°C]
- b. *HT (High Water Temperature)*: Version with production of hot water up to 65 [°C] **[ONLY HEAT RECOVERY SIDE]** with extension of functioning limits without overloading the electric motors
- c. *LT (Low Temperature)*: Version that allows the machine to work to external air temperatures of -7,5 [°C]



## Noise Configuration:

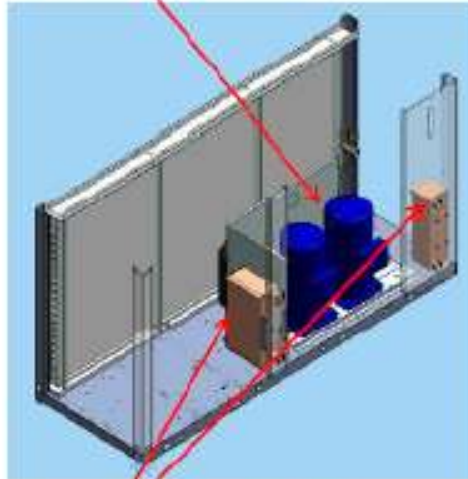
- a. *LN (Low Noise)*: Compressor compartment noise insulation
- b. *SLN (Super Low Noise)*: Compressors compartment noise insulation+ Fan speed reduction (Change condenser/framework part)

## AVAILABLE COMBINATIONS:

- |    |      |         |        |          |
|----|------|---------|--------|----------|
| 1. | STD, | STD-LN, | HT,    | HT-LN,   |
| 2. | LT,  | LT-LN,  | LT-HT, | LT-HT-LN |
| 3. | SLN, |         | SLN-HT |          |

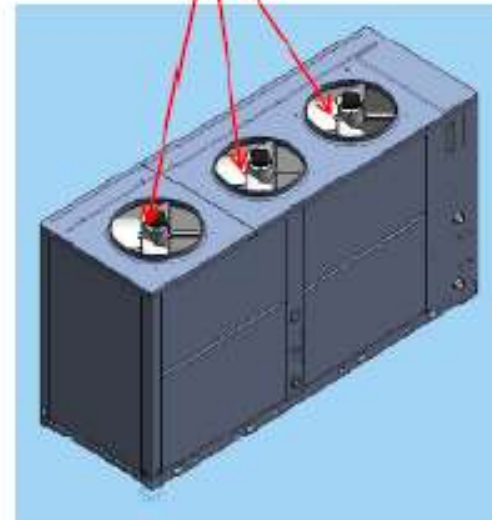
## OMICRON S EVO

Hermetic scroll compressors  
with steps partialisation



Plates exchangers  
Braze-welded in stainless steel

Axial fans with  
revs. regulator  
with phase cut.  
Standard



# OMICRON V EVO MULTIFUNCTION UNITS



## OMICRON V EVO

Cooling Capacity <sup>(1)</sup> = 231 at 773 kW

Heating Capacity <sup>(2)</sup> = 245 at 865 kW

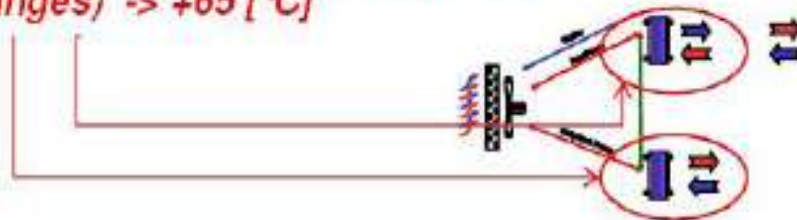
NUMBER OF SIZES= 18

LT

1. Low Air Temperature -> -10 [°C]
2. Higher Efficiency at nominal conditions
3. High Air Temperature -> +48 [°C]

HT

1. High Water Temperature (Both Heat exchanges) -> +65 [°C]



# OMICRON V EVO MULTIFUNCTION UNITS

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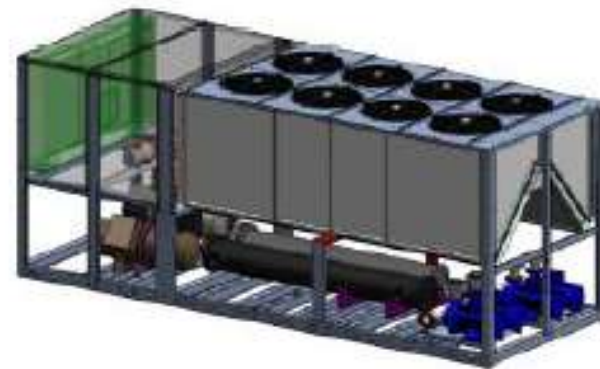
- |    |      |         |        |          |
|----|------|---------|--------|----------|
| 1. | STD, | STD-LN, | HT,    | HT-LN,   |
| 2. | LT,  | LT-LN,  | LT-HT, | LT-HT-LN |
| 3. | SLN, |         | SLN-HT |          |

## OMICRON V EVO



Electric control board

Axial fans  
with speed regulator  
with phase cut.  
Standard



## PATENTED DEFROSTING

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Patented innovative defrosting system (N. 1335232) by Blue Box allows to activate the cycle inversion procedure, optimising the duration.

! plus:

- With respect to traditional systems, 10% reduction of electric input during heat pump operation
- Increase of useful energy transferred to the system in the interval between defrosting cycles.

IN ONE MOMENT -> THE UNIT BLASTS OUT THE WATER/ICE



STANDARD

# UNIDYNE ENERGY ENVIRONMENT SYSTEMS Pvt Ltd.



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