Multipurpose System for 4 and 6 pipes...

LOOK INTO THE FUTURE.
Since the launch in 1994 of its first multi-purpose unit, Thermocold has accumulated a vast background of experience and knowledge, especially in terms of integration between the machine and the system, certainly one of the most sensitive issues in the use of multi-purpose groups.

In fact, it is not sufficient to bring the product but you need to integrate it in the context of plant in such a way as to exalt the potential and take full advantage of the economic and energy benefits.

In buildings destined to users of the Service sector, like shopping centers, office complexes, hotels, wellness center, is more and more evident the need to satisfy opposites thermal loads in different environments throughout the whole year. Hence the need to provide heating and cooling energy for the simultaneous heating, cooling rooms, air handling renewal and production of domestic hot water.

The valid solution to meet the complex energy demands are multi-purpose groups: special thermo storage unit equipped with additional heat exchangers designed for the partially or entirely recovery of heat condensation.

Different profiles according to the type of application
The new energy efficiency standards for buildings (2010/31/EU), the coexistence in the same building of some space dedicated to different functions and high heat load variations, the increase of the internal loads given by (multimedia computer systems, lighting, etc.) together with the ever-increasing demand for air quality, make the simultaneously request of hot and cold throughout the year a feature more frequent.

Each building has a characteristic profile of load resulting from:
- climatic region;
- materials used;
- type of buildings.

**THE VARIABILITY OF THERMAL LOADS**

Two separate plants that simultaneously require loads of opposite sign.

**Thermal loads of directional complex**
In planning practice there are various ways of approaching the problems of contemporaneity of the loads. We summarize comparing different solutions.

**A  CHILLER + BOILER**
- The plant is simple.
- NO ENERGY RECOVERY.
There is no possibility for energy saving, the energy provided is the sum of the two loads.

**B  RECOVERY CHILLER + BOILER**
- PARTIAL ENERGY RECOVERY.
Simultaneously with the production of cold water, the chiller recovers energy to provide a part of the hot water demand. The rest of the energy is supplied from the boiler.

**C  REVERSIBLE HEAT PUMP + BOILER**
- Higher complexity of the plant.
- NO ENERGY RECOVERY.
The heat pumps are able to supply hot and cold water at the same time (one producing cold water and the other producing hot water), nevertheless for the hot water production a boiler integration is still required.

**D  MULTITUBE SYSTEM**
- Simplicity of installation, only one unit does all the work.
- FULL ENERGY RECOVERY (heat and cold).
The Multitube system autonomously handles all thermal loads and adjusts itself in order to reach the most efficient condition.
Analyzing the red curve in the graph or the curve of the energy consumption on the application of heat pump and boiler and the blue curve on the Multitube system, it is noted as from the point of view of the plant the solution with Multipurpose System is the most versatile systems suitable and efficient, both in terms of system simplicity, energy saving and consumption.

Multitube vs traditional: **ENERGY SAVING.**

**POSSIBLE COMBINATIONS OF EXERCISE FOR MULTIPURPOSE SYSTEM**

<table>
<thead>
<tr>
<th>HEATING LOADS</th>
<th>COOLING LOADS</th>
<th>CIRCUIT 1</th>
<th>CIRCUIT 2</th>
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<td>100 %</td>
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C  CHILLER MODE
H  HEAT PUMP MODE
C+R  CHILLER + RECOVERY MODE
THE INTELLIGENT SYSTEM: MULTITUBE SYSTEM AND ITS OPERATING MODES.

Born with intended to meet the demand of variable thermal loads of the building during the entire exercise - daily, weekly and annual - and especially climate regardless of season, Multitubes System can simultaneously satisfy the needs of hot and cold users typical of hydronic system. One of the strengths of the system Multitube is the ability to flexibly manage the total power supplied by the unit and its distribution among the various features on the basis of the load actually required by the installation. A key aspect is definitely the kind of self-adaptive adjustment; the multi-purpose units are able to independently determine the operating cycle of the most suitable according to the demand of the plant, and then to the variability of thermal loads of the building.

100% COOLING 100% HEATING

In the total recovery operation multipurpose group behaves as a chiller water - water using all the energy produced for the conditioning of the building. Both condensation and evaporation takes place in the refrigerant heat exchangers - water, while the battery remains unused.

50% COOLING 50% HEATING

Even in this situation the unit behaves as if it were a group of water-water, allocating all the energy of evaporation and condensation for the benefit of the system. Saw that the energy required by the system is 50% of the total, each circuit partializes output power of the compressors.

100% COOLING 50% HEATING

In this condition both circuits contribute to the production of the energy needed for cooling, evaporating all the refrigerant fluid in the two circuits in the heat exchanger plant “cold side”. While for the condensation a circuit performs the condensation on the heat exchanger plant “hot side”, providing in this way 50% of the total energy required for heating the building, the second circuit exchanges the remaining 50% of the thermal energy of condensation excess in the external environment.

50% COOLING 100% HEATING

Such as in the previous case, also in this condition the two circuits work in a different way, in order to provide the system with the correct amount of energy required. In fact, the condensation is carried out for both circuits in the heat exchanger “hot”, for the section of a cooling circuit performs the evaporation on the heat exchanger side ”, and the second circuit exchanges the remaining component of the energy of evaporation of excess in the external environment.
To evaluate the efficiency of vapor compression machines on seasonal operation were defined some indices more appropriately to evaluate the performance of a machine which also operates under the water – water exchange:

**ESEER** (European Seasonal Efficiency Ratio) e **SCOP & SEER** (Seasonal COP & Seasonal EER).

**Both methods are inadequate to evaluate the multifunction machine performance!!!**

The effective coefficient measuring the unit performance during the whole year is the TEP (Total Efficiency Performance) coefficient, an index properly properly developed to measure the multifunction real efficiency.

The TEP indicator is an average year efficiency index considering the efficiency of each operating mode of the unit properly weighted (cooling, cooling + heating, heating), more completely than the standard full-load efficiency ratios (EER, COP) and seasonal one (ESEER).

**Usually the multifunctional unis have TEP value around 5. This means that per each kW of power input there is a useful capacity of 5 kW.**

Measurement of the coefficient TEP

**TEP** = \((EER_{\text{cooling}} \times \alpha + \text{MOER}_{\text{cooling+heating}} \times \beta + \text{COP}_{\text{heating}} \times \gamma})

were:

- \(\alpha\) = weight for only chiller mode operation (%)
- \(\beta\) = weight for chiller + heating mode operation (%)
- \(\gamma\) = weight for only heating mode operation (%)
- \(\text{MOER}\) = Multifunctional operation efficiency ratio = Efficiency in chiller + recovery mode

The MOER Index is the ratio between the sum of the heating and cooling capacity and the compressors electrical power input, in chiller + recovery mode, and reaches the maximum value when the heating and cooling loads are fully balanced. This index was defined to objectively measure the efficiency of a multi-functional unit according to simultaneous load requirement.

**Example:**

<table>
<thead>
<tr>
<th>EER</th>
<th>COP</th>
<th>MOER</th>
<th>TEP</th>
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<tbody>
<tr>
<td>3</td>
<td>3.4</td>
<td>7.8</td>
<td>5.52</td>
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</table>

Considering the unit is working for 20% only for cooling, 30% only for heating and 50% in cooling + heating mode.
WHY CHOOSE THERMOCOLD MULTITUBE SYSTEM?

A SYSTEM FULL OF INNOVATIONS...

IDROFILL TECHNOLOGY

The condensing coil with seamless copper tubes expanded into aluminium corrugated fins are made with IDROFIL technology, a surface treatment made on the surface of the coil fins that allows to improve the heating exchange performance thanks to a better condensate drainage, allowing to maintain high air flow rates, higher evaporation temperatures with high energy efficiency even with low outdoor air temperatures.

CROSS EXCHANGE SYSTEM

The technology CROSS EXCHANGE avoids damage caused by frost alarms. These events occur frequently for all units not equipped with the innovative multi-purpose standard CROSS EXCHANGE SYSTEM, a system designed to increase the reliability of the operation of the refrigeration circuit.

HIGH PERFORMANCE TEMPERATURE HPT

It allows to reach hot water temperature up to 65°C in order to satisfy particular hot water needings or also to program anti-legionella sanification cycles.
ECO-PROFILE fans: EXCELLENT ENERGY AND ACOUSTIC PERFORMANCES.

ECO-PROFILE FANS

The units of the Multitube System use fans with the technology ECO-PROFILE, which thanks to the innovative profile of the blade provide more efficiency by reducing the power consumption and noise emissions.

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EC-BRUSHLES ECO-PROFILE TECHNOLOGY

The new generation EC-BRUSHLESS ECOPROFILE fans ensure a higher efficiency thanks to lower energy consumption compared to traditional AC motors. The EC motors allow therefore lower sound emissions during the air flow modulation.

The blade profile has been studied to reduce noise and ensure high acoustic comfort levels.
WHY CHOOSE THERMOCOLD MULTITUBE SYSTEM?

ELECTRONICS TAKE IT EASY

EEXV TECHNOLOGY: ELECTRONIC EXPANSION VALVE DRIVEN BY MSED 2.

The use of the electronic expansion valve allows to:
- Maximize the heat exchange at the evaporator;
- Minimize the response time according to the load variation;
- Optimize the superheating regulation and ensure the maximum energy efficiency.

MSED 2: THE NEW SUPERVISIONING CONTROL SYSTEM

MSED 2 - Multifunction System Electronic Control

The new generation and the most advanced control system entirely custom made able to manage and optimize the unit operation by coordinating the interaction between all the components: compressors, fans, inverter pumps and electronic expansion valves, maximizing the efficiency of the multi-functional system. It allows the interface with the main BMS system, via RS485.
DIGITAL DEFROST

DYNAMIC LOGIC CONTROL

DYNAMIC SET POINT

ENERGY SAVING
The regulation of compressors, fans and pumps is completely controlled by inverter, with a consequent reduction of the power input at partial loads and at the same time improving comfort levels with high energy savings. Thanks to a more precise, complete, and integrated control of all the electrical components of the unit carried out by a control system able to modulate them simultaneously and promptly according to the continuous variations of load, and thus with the most up to dated hardware and software, it is possible reach energy savings up to 30% compared to traditional systems working under the same conditions.

**FULL INVERTER COMPLEX**

**COMPRESSORE CON INVERTER “BUILT IN”**

The basic concept of the compressors with “built-in” inverter, is to allow their safe, efficient and versatile operation in a frequency range from 30 to 70 Hz. The advantages obtainable are:

- Reduced inverter dimensions.
- Automatic inverter cooling with refrigerant.
- Reduction of the inrush currents in comparison to traditional systems delta-star or part winding.
- Wider setting range.
- Precise capacity adjustment to installation loads requirements.
- High efficiency three-stage Oil separator.
MAXIMUM EFFICIENCY AT PARTIAL LOADS

Inverter units are properly designed and dimensioned with the aim to optimize the unit efficiency at partial loads. Thanks to the full inverter control, reaches ESEER values more than 32% higher, compared to units equipped with constant speed screw compressors.

EXTREMELY LOW NOISE IMPACT

Besides the high ESEER values, inverter units are characterized by extremely low noise impact. The full-inverter units use fans of the new generation brushless EC-ECOPROFILE, which ensure greater efficiency by reducing the power consumption compared to normal engines AC. The EC motors also allow lower noise emissions during modulation of the air flow. When the unit works at partial loads, thanks to the inverter modulation of all components driven by electric motors such as fans, pumps, and compressors, the supplied cooling and heating capacity follows exactly the cooling and heating demand of the plant.

DIGITAL INVERTER DEFROST TECHNOLOGY

DIGITAL INVERTER DEFROST is a digital self-adaptive defrosting system able to intervene only in case of a consistent thickness formation of ice on the coils’ fins. In this way, the unit is subject to a significantly reduced number of defrost cycles. This system will reduce by 70% the number of defrost cycles. The reduction of mechanical stress, due to the lower number of reversing cycle in the heating mode, causes an increase of the useful life of the unit, in addition to advantages in terms of comfort perceived by the user.

WFC TECHNOLOGY AND HIDRONIC KIT WITH INVERTER PUMPS

The pumps are equipped with inverter-controlled motors suitable for frequency modulation and the same performance is obtained with 70% reduction of power input. The WFC technology water flow control allows to adjust the rotation speed of the pumps through the inverter, measuring out the correct amount of water flow according to the needs of the system by reducing the power input due to the pumping of the primary fluid.
Air to water units for 4 pipes plants
QUATTRO PROZONE / HEVA QUATTRO / ISA4-EA

Quattro Prozone
- MA Air-water multi-functional unit.
- LN Low noise version.
- SL Super low noise version.
- PB/PM/PA Hydraulic versions.

Heva Quattro
- MA Air-water multi-functional unit.
- LN Low noise version.
- SL Super low noise version.
- PB/PM/PA Hydraulic versions.

 ISA4-EA
- MA Air-water multi-functional unit.
- SL Super low noise version.
- PB Hydraulic version.

Patented Technology
Covered by several patents since 1996, the multi-purpose units Thermocold are characterized by the efficient logic operation applied to an innovative cooling system.
**Water - water units for 4 pipes plants**

**QUATTRO PROZONE W / HEVW QUATTRO**

**QUATTRO PROZONE W**

MW Water-water multi-functional unit for geothermal applications.

**HEVW QUATTRO**

MW Water-water multi-functional unit for geothermal applications.

**LN:** Low noise with condensing control with reduced fans speed and sound compressors jackets.

**SL:** Super low noise with condensing control with variable fan speed modulation, oversized coils, muffler on the compressor intake and and delivery lines e soundproof box.

**PB:** N.1 pump for chilled water circuit (150kPa) + N.1 pump for hot water circuit (150kPa).

**PM:** N.1 pump for chilled water circuit (250kPa) + N.1 pump for hot water circuit (250kPa).

**PA:** N.1 pump for chilled water circuit (450kPa) + N.1 pump for hot water circuit (450kPa).

- CC: Cooling capacity.
- HC: Heating capacity.
- RHC: Recovery Heating capacity.

The pictures in the catalogues are not binding, accessories represented could be optional. For further information please contact our sales offices.
THE EVOLUTION OF MULTI-PURPOSE 4 PIPE: SYSTEMS FOR 6 PIPES.

The 6-tube multipurpose units are able to satisfy the demand of simultaneous heat and cold on two separate systems, with a partial recovery of energy throughout the year by the use of a desuperheater.

The possible applications of multi-purpose units to 6 tubes are innumerable and how for the multi-purpose unit for 4-pipe result to be the ideal solution for all the typical system requirements for buildings with opposing variables thermal loads during the entire year. Compared to the 4-pipe unit, the main destinations of use are unchanged, with the additional possibility by using a desuperheater for domestic hot water production and feed water coils of air handling units.

The main applications are therefore:
- Buildings with a double and opposite exposure to the sun;
- Hotel;
- Banks;
- Airports;
- Discos and multiscreen cinema, which occurs at the same time need cooling, the area used for the dance floor and heating in areas dedicated to conversation;
- Wellness centers where classically there are areas with seasonal requirements of load opposite;
- Shopping centers with different intended use in terms of cooling or heating air-conditioning;
- Hospitals and in particular the operating rooms where the request for heat and cold is independent of the season.

4 PIPE UNIT SCHEME

As can be noted from the graph, with the addition of a desuperheater, the multitube 4 pipe unit can turn into 6 tubes unit.

The hot water produced by the partial energy in the desuperheater can be used for different purposes, for example:
- power the battery water of the air handling units;
- production of domestic hot water.
Air to water units for 6 pipes plants
SEI PROZONE / HEVA SEI

| CC    | 45 ÷ 484 |
| HC    | 52 ÷ 555 |
| RHC   | 11 ÷ 111 |
| DHC   | 59 ÷ 618 |

SEI PROZONE
MA Air-water multi-functional unit.
LN Low noise version.
SL Super low noise version.
PB/PM/PA Hydraulic versions.

| CC    | 369 ÷ 733 |
| HC    | 412 ÷ 812 |
| RHC   | 82 ÷ 162  |
| DHC   | 482 ÷ 948 |

HEVA SEI
MA Air-water multi-functional unit.
LN Low noise version.
SL Super low noise version.
PB/PM/PA Hydraulic versions.

LN: Low noise with condensing control with reduced fans speed and sound compressors jackets.
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PATENTED TECHNOLOGY
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MULTITUBE SYSTEM: THE RESULT OF A LONG STORY MADE OF KNOWLEDGE AND OVER TWENTY YEARS EXPERIENCE.

PROJECT APPLICATIONS THERMOCOLS MULTITUBE SYSTEM

Hotels and Resorts
Resort Donna Fugata - Ragusa (Italy)
Atlantic Palace Golf Thalasso & Casino Resort - Agadir (Morocco)
Atlas Marina Beach Suites & Spa - Agadir (Morocco)
Four Views Oasis Hotel - Madeira (Portugal)
Holiday Camp - Sardinia (Italy).
La Perla Hotel – Positano (Italy)
Hotel Faro Ria - Faro (Portugal)

Shopping Malls
Shopping malls COOP - Carpi (Italy)

Hospital and Clinic
Centro di riabilitazione - Olhao (Portugal)
Unidade de Saude - Graciosa (Portugal)
Ciclotrone Ospedale - Messina (Italy)
Mazra Hospital - Tel Aviv (Israel)
Medi Clinic - Bloemfontein (South Africa)
Pascale Hospital - Napoli (Italy)
Clinic San Vincenzo - Rome (Italy)

Airports
Reggio Calabria Airport (Italy)
Elmas Airport (Italy)

Offices / Direcional Centres / Banks / Factories
A. Santo - Cascais (Portugal)
NZI - Auckland (New Zeland)
Orange - Barcellona (Spain)
Rabensteiner Company - Sierning (Austria)
Centro Missilistico MBDA - Rome (Italy)
R&D - Salsolburg (South Africa)
Kitchen Factory - Istanbul (Turckey)
Headquarter - Izmir (Turckey)
Wind Offices - Rome (Italy)
Conference Room Turin (Italy)
Telecom Offices - Bari (Italy)
Public Acqueduct Building - Sicily (Italy)
EDP Finish centre - Fridus (Portugal)
Offices Sagit S.p.A. - Naples (Italy)
Highway Offices - Florence (Italy)
Sei Elettroinmobilare - Rome (Italy)
Banco Ambrosiano Veneto - Bari (Italy)
Blu highways - Calenzano (Italy)
Industrial Offices - Aosta (Italy)

Cultural Buildings / Universities/Residence
Politecnico di Bari (Italy)
Mediateca del Mediterraneo - Cagliari (Italy)
Nicanor Parra UDP university library - Santiago de Chile (Chile)
Palazzo Chigi - Rome (Italy)