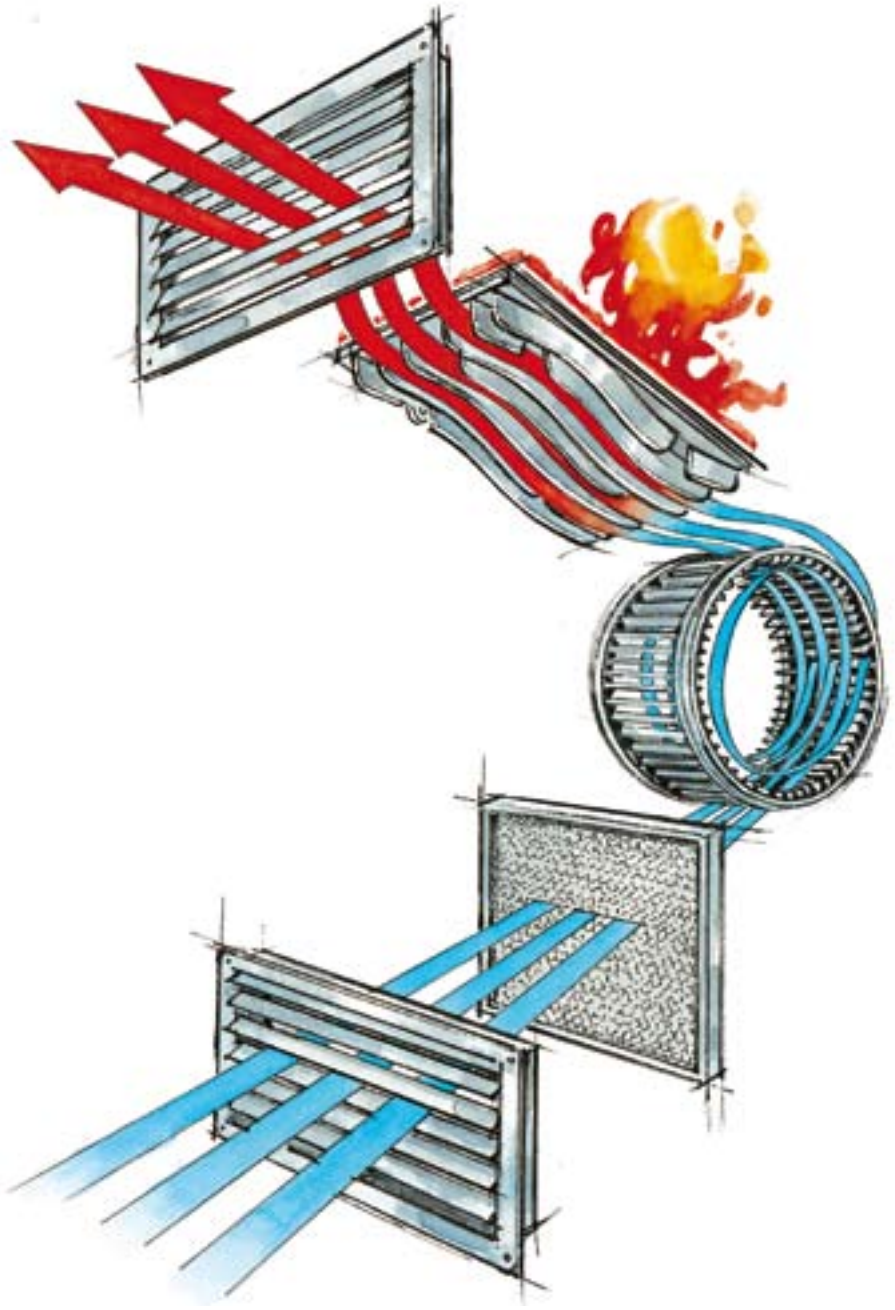
DRY SYSTEM TECNOCLIMA

the reasons of its CONVENIENCE



EXAMPLE OF AN INSTALLATION AND ITS ECONOMIC EVALUATION

HEATING SYSTEM: INSTALLED HEATERS

N° 2 WARM AIR HEATERS:

- CABINET VERSION
- DIRECT AIR DIFFUSION ON THREE SIDES OPENING
- FORCED DRAUGHT BURNER

UNITARY HEATING CAPACITY INPUT	280.000 kcal/h	325,6 kW
EFFICIENCY	94%	
UNITARY HEATING CAPACITY OUTPUT	263.200 kcal/h	306,0 kW
UNITARY AIR FLOW RATE	28.360 Nm^3/h	
TEMPERATURE DEVIATION	32°K	
AIR DIFFUSION AVERAGE SPEED	6,1 m/s	

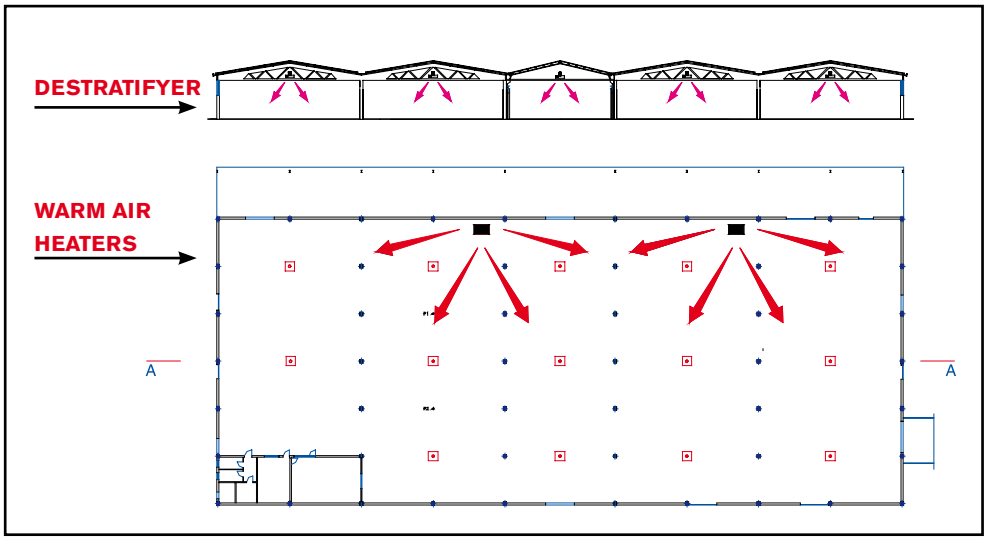
N° AIR DESTRATIFYER:

UNITARY AIR FLOW RATE	3.500 m^3/h

TREATED AIR VOLUME:

WARM AIR HEATERS AIR FLOW RATE	28.360x2 = 56.720 Nm^3/h
AIR DESTRATIFYER AIR FLOW RATE	3.500x14 = 49.000 Nm^3/h
TOTAL AIR FLOW RATE	56.720+49.000 = 105.720 Nm^3/h
TREATED AIR IN RELATION TO THE BUILDING VOLUMETRY	4 : 1

HEATING PLANT LOCATION



COVERED SURFACE 3.800 m^2 - VOLUMETRY 25.600 m^3

HEATING CYCLE

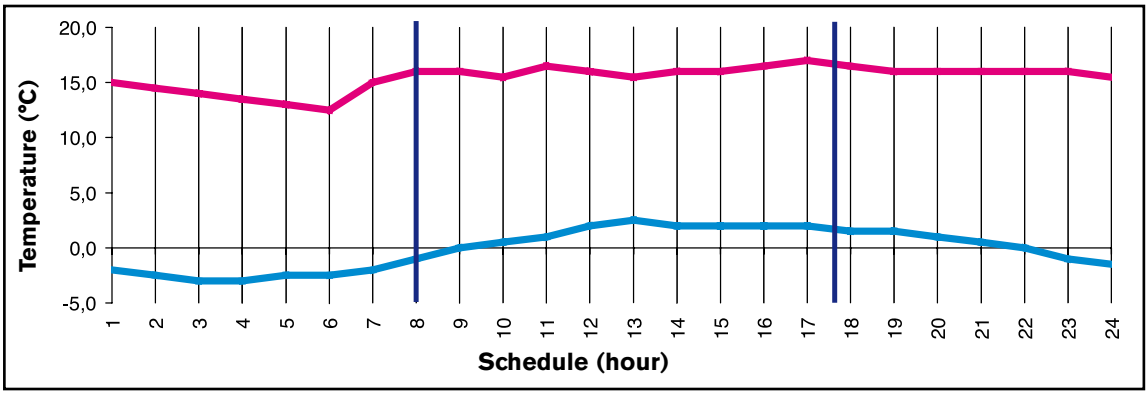
Heating the working department requires 17/18°C room temperature during working hours and an antifreeze temperature (5°), during an inactive time.
Controlled by a chronothermostat the warm air heaters run automatically.
The air destratifyer, runs automatically controlled by an on-board installed thermostat, only if the air temperature reaches settled value.

WORKING TIMETABLE:

08.00 - 12.00 • 13.30 - 17.30

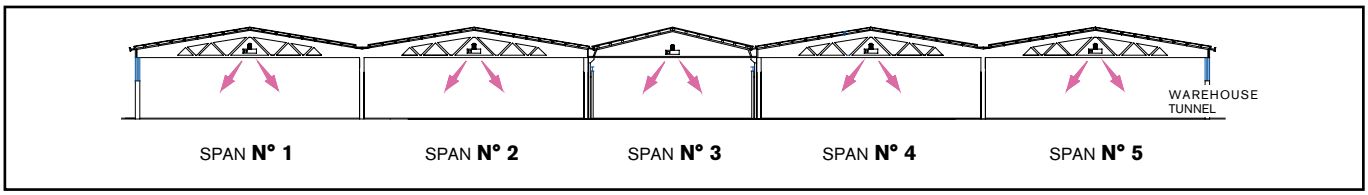
CRONOTHERMOSTAT PROGRAM:

ON 06.00 - 12.00 • **OFF** 12.00 - 13.30 • **ON** 13.30 - 16.30 • **OFF** 16.30 - 06.00



Temperature course inside and outside the industrial building, checked during the testing day

ROOM AIR TEMPERATURE



THE AIR TEMPERATURE WITH RUNNING DESTRATIFYER (ON):

MEASURING LEVEL (meters)	SPAN QUANTITY					ΔT MEDIUM (°C/m)
	1	2	3	4	5	
7	18,6	19,5	18,6	18,2	18,2	
6	18,2	18,9	18,5	18,1	17,9	
5	18,0	18,9	18,0	18,3	17,7	
4	17,8	18,8	17,6	18,2	17,5	
3	17,7	18,5	17,3	17,7	17,3	
2	17,6	18,3	17,2	17,2	17,1	
1	17,5	18,1	17,0	16,9	16,8	
ΔT	1,1 °C 0,18 °C/m	1,4 °C 0,15 °C/m	1,6 °C 0,15 °C/m	1,3 °C 0,21 °C/m	1,4 °C 0,23 °C/m	0,18 °C/m

THE AIR TEMPERATURE WITHOUT RUNNING DESTRATIFYER (OFF):

MEASURING LEVEL (meters)	SPAN QUANTITY					ΔT MEDIUM (°C/m)
	1	2	3	4	5	
7	20,3	20,7	19,6	19,1	18,8	
6	20,0	20,5	19,3	18,9	18,7	
5	19,8	20,2	19,1	18,5	18,5	
4	19,6	20,0	18,7	18,3	18,4	
3	19,4	19,5	18,3	18,1	17,8	
2	18,8	19,1	18,0	17,8	17,2	
1	18,5	18,8	17,8	17,1	16,5	
ΔT	1,8 °C 0,30 °C/m	1,9 °C 0,31 °C/m	1,8 °C 0,30 °C/m	2,0 °C 0,33 °C/m	2,3 °C 0,38 °C/m	0,32 °C/m

DAILY OPERATION COSTS

NATURAL GAS:

Total natural gas consumption of warm air heaters	141 m^3
TOTAL COST OF NATURAL GAS	**141 x 0,40 = 56,40 Euro**

ELECTRICAL ENERGY:

Unitary electrical capacity: • fan motor • burner	 4,0 kW 0,6 kW
Total electrical consumption of warm air heaters	20,8 kW/h
Destratifyer capacity	0,13 kW
Total electrical consumption of destratifyer	16,4 kW/h
TOTAL COST OF ELECTRICAL POWER	**(20,8+16,4) x 0,16 = 5,94 Euro**

TOTAL DAILY OPERATION EXPENSES → **56,40 + 5,94 = 62,34 Euro**

DATA SUMMARY

DAILY OPERTATION COSTS IN RELATION TO VOLUMETRY:	62,34 Euro : 25.600 m^3 = **0,0024 Euro/m^3**
DAILY OPERATION COSTS IN RELATION TO SURFACE:	62,34 Euro : 3.800 m^2 = **0,016 Euro/m^2**
INSTALLED HEAT CAPACITY IN RELATION TO VOLUMETRY:	(306 kW/h x n°2) : 25.600 m^3 = **23,9 W/m^3**
INSTALLED HEAT CAPACITY IN RELATION TO SURFACES:	(306 kW/h x n°2) : 3.800 m^2 = **161,1 W/m^2**

(The data mentioned above represents European average values)

CONCLUSIONS

✔ ΔT air supply < 30°C	➤ Very low air stratification ≤ 0,3°C/m
✔ High thermal efficiency over 100% if settled in condensation	➤ Always restrained reduced consumption
✔ Significant low thermal inertia	➤ Fast and simple tuning up, ideal for discontinuous and irregular functioning
✔ Running heaters only when the working environment is employed	➤ Substantial financial cutback of operation
✔ Total absence of intermediate fluids such as water or steam	➤ Absence of frost or inefficient transformation stages
✔ Option of installing a filter section ✔ Option of taking exterior fresh air for air volume exchange in the room ✔ Summer only fan functioning option	➤ An air treatment system, that assures immediate comfort
✔ Monoblock autonomous heaters	➤ Systems that are easily improvable in case of building surface extensions ➤ Easy full recovery of heaters, in case of displacement
✔ Installation into or outside the rooms to be heated	➤ Central heating station is not required meaning less overall costs

DRY SYSTEM PHENOMENOLOGY

DIRECT EXCHANGE (DRY) AIR HEATING AND COOLING:

the reasons of its CONVENIENCE

Traditionally, the energy consumption of a thermal system is given by the amount of fuel burned to heat the room and the amount of fuel burned but not used due to dispersion as a result of the transformation stages between the energy produced by fuel and the energy actually transmitted to heated rooms.

SYSTEM EFFICIENCY

The transformation stages, from the source to the actual use of the heat (heat production, distribution, emission and regulation), have their own energy consumption for steady operation, and result in a considerable reduction in the thermal system's global efficiency and in the overall performance.

OPERATING COSTS

Unlike the traditional air heating via an intermediate fluid (WET), using water as vector fluid, the innovative direct exchange air heating technology (DRY) uses water as the vector fluid producing a concrete reduction in operating costs, as well as substantially lowering the system costs.

PERFORMANCE

The most important feature of this system is that the produced heat is directly and immediately transferred to the room to be heated, thus skipping the inefficient transformation stages and having as a result, a much better overall performance.

ENERGY SAVING

The direct exchange (DRY) technology, makes it possible to cut the time required to reach and obtain the steady conditions inside the room to be heated, ensuring a better global efficiency of the system and consequently, a satisfactory energy saving and a reduction of the amount of noxious emissions with the same power input. It achieves it thanks to the absence of thermal inertia required by the pre-heating of the vector fluid (water or steam) and by the loss caused by the production and distribution equipment.

HEATING AND CONDITIONING

As for the heating also for the conditioning of the air, the peculiarity of the direct exchange technology (DRY) is that it delivers the energy directly to the room with no loss, reaching the highest effectiveness. Products using the direct exchange technology (DRY) are autonomous and independent from other energy sources, always giving them a considerable flexibility in energy utilization. As a result, DRY technology assures in air heating as well as in air conditioning by far the best result in terms of global efficiency.