

**DESIGN OF
COOLING / VENTILATION SYSTEM**

WITH

ColdAIR

Evaporative Coolers

by



Project goal

The goal of the project is to cool and ventilate a large indoor space during the hot season, lowering the internal air temperature with respect to the external one, and creating the air changes necessary to improve the microclimate inside the space.

The lowering of the internal temperature will help neutralize the heat loads from the building structures, from the sun's radiation, from the process equipment and plants.

The air changes will help to dispose of the exhausted air and any fumes, vapors, odors, various aeriform elements often harmful to the health of workers.

To size the system, the following four fundamental elements must be taken into account:

- 1) The external summer conditions of the project
- 2) The installation height of the air diffusers
- 3) The number of air changes needed to ensure climatic comfort
- 4) The evacuation of the exhausted air

1) External summer conditions

COLDAIR adiabatic evaporative cooling is a system that works in a dynamic regime and on the basis of a natural principle. It introduces large quantities of outdoor (fresh) and cooled air into the building and expels the exhausted hot air through doors, windows and other evacuation openings.

The cooling of the air taken from outside and introduced into the building is a function of the different external climatic conditions and therefore varies with them.

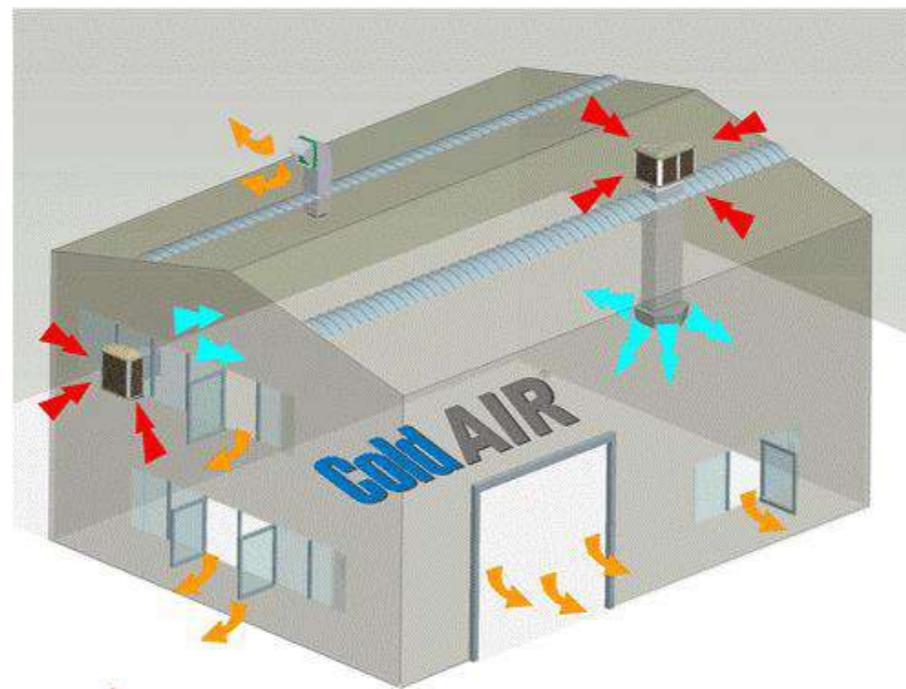
EXAMPLE: RESULTING AIR TEMPERATURE BASED ON OUTDOOR AIR CONDITIONS

Outdoor Rel.Hum.	30%	40%	50%	60%	70%
Outdoor Temperature	Supply Air Temp.	Supply Air Temp.	Supply Air Temp.	Supply Air Temp.	Supply Air Temp.
30°C	19,0°C	21,0°C	23,0°C	24,5°C	26,0°C
35°C	22,5°C	25,0°C	27,5°C	29,5°C	31,0°C
40°C	26,0°C	29,0°C	31,5°C	33,5°C	36,5°C

2) Installation height of the air diffusers

The cooled air produced and supplied by COLDAIR cooler tends to go down to the floor and push the warmer air upwards.

The area of influence of the project is the area where people operate, so the volume to be cooled is that between the floor and a few meters higher.

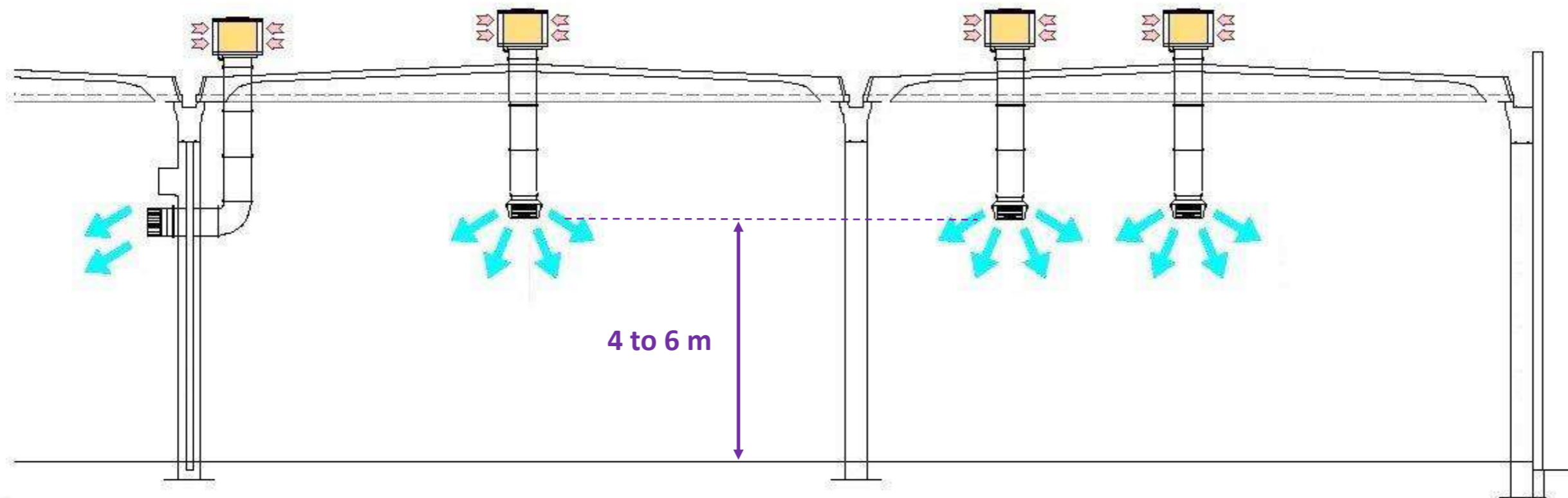
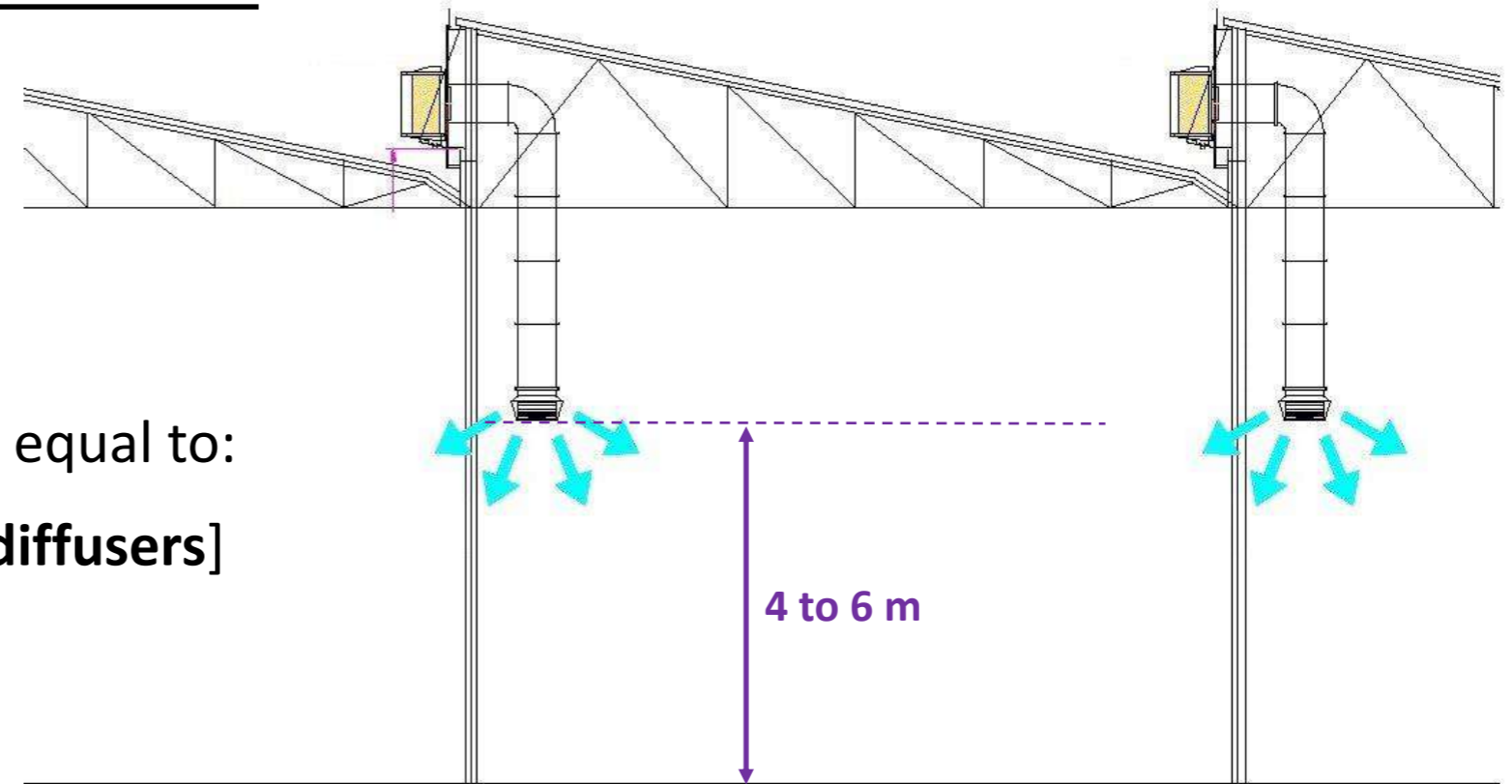


So as not to annoy workers during their work activities, the air diffusers must be installed not less than 4 meters from the ground, and in order not to unnecessarily cool the upper part of the building it is recommended not to exceed 6 meters in height.

Please note that the higher the installation height of the air diffusers, the less is the cooling effect at floor level.

2) Installation height of the air diffusers

The volume of air to be treated is therefore equal to:
[area to be cooled] x [height of the air diffusers]



3) Number of air changes needed to ensure climatic comfort

Before proceeding with the estimate of the volume involved, and therefore the number of hourly air changes that determines the appropriate sizing of the system, it is correct to point out that:

- The number of air changes per hour is directly related to the use of the space object of the design and its characteristics
- The values defined by the regulations for aeraulic systems for wellness purposes represent the minimum requirements for obtaining acceptable levels of health in the various types of premises. As far as cooling systems are concerned, an adequate study of the thermal loads present must be correlated to these values.

3) Number of air changes needed to ensure climatic comfort

The table below shows the required air changes for some types of premises :

INDICATIVE TABLE OF HOURLY AIR CHANGES (Italian Regulations)		
INDUSTRIAL PREMISES		
PACKAGING / STORAGE AREAS	5-10	volumes/h
PRODUCTION DEPARTMENTS (GENERAL)	6-10	volumes/h
CARPENTRY (WELDING)	6-10	volumes/h
MUSHROOMS FARMS	10-20	volumes/h
PRODUCTION DEPARTMENTS (RUBBER)	10-20	volumes/h
PRODUCTION DEPARTMENTS (CARPENTRY)	10-20	volumes/h
AUTOCAR REPAIRS	12-30	volumes/h
PAPER MILLS	15-20	volumes/h
TANNERIES	20	volumes/h
PAINT FACILITIES	20-30	volumes/h
FOUNDRIES	20-30	volumes/h
SERVICES AND SOCIAL SECTOR		
GYMS	6-20	volumes/h
BALLROOMS	8-12	volumes/h
AUDITORIUM	10-12	volumes/h
CINEMAS	10-15	volumes/h
THEATERS	10-15	volumes/h
KITCHENS	20-30	volumes/h
LAUNDRIES	20-30	volumes/h
POOLS	20-30	volumes/h
DYEING FACILITIES	20-30	volumes/h

These values are to be considered indicative and must never replace the regulated values, but can be modified according to particular needs.

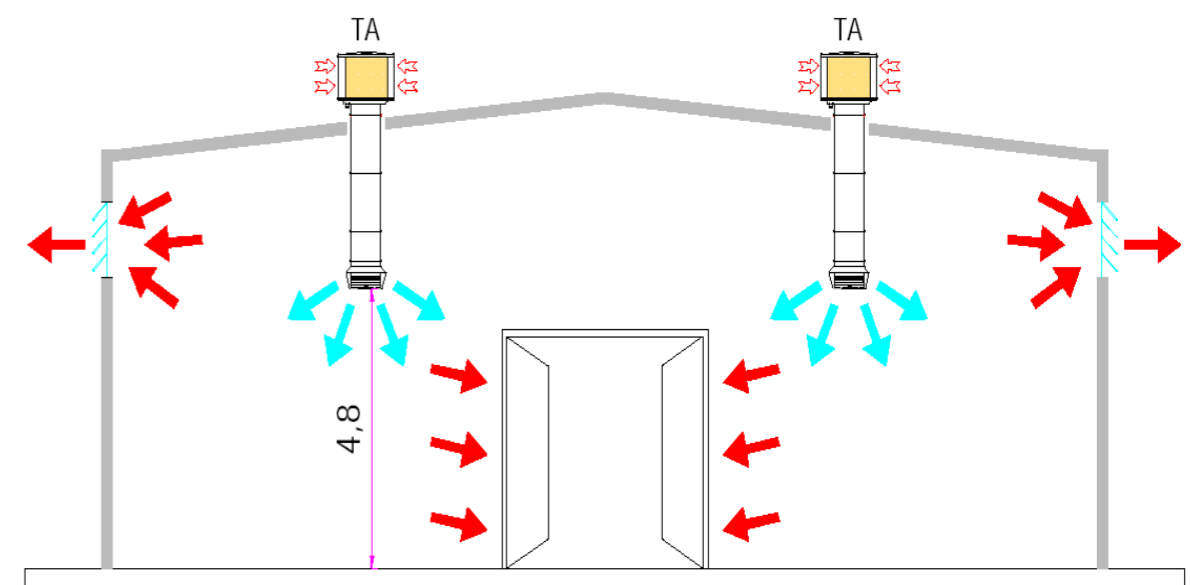
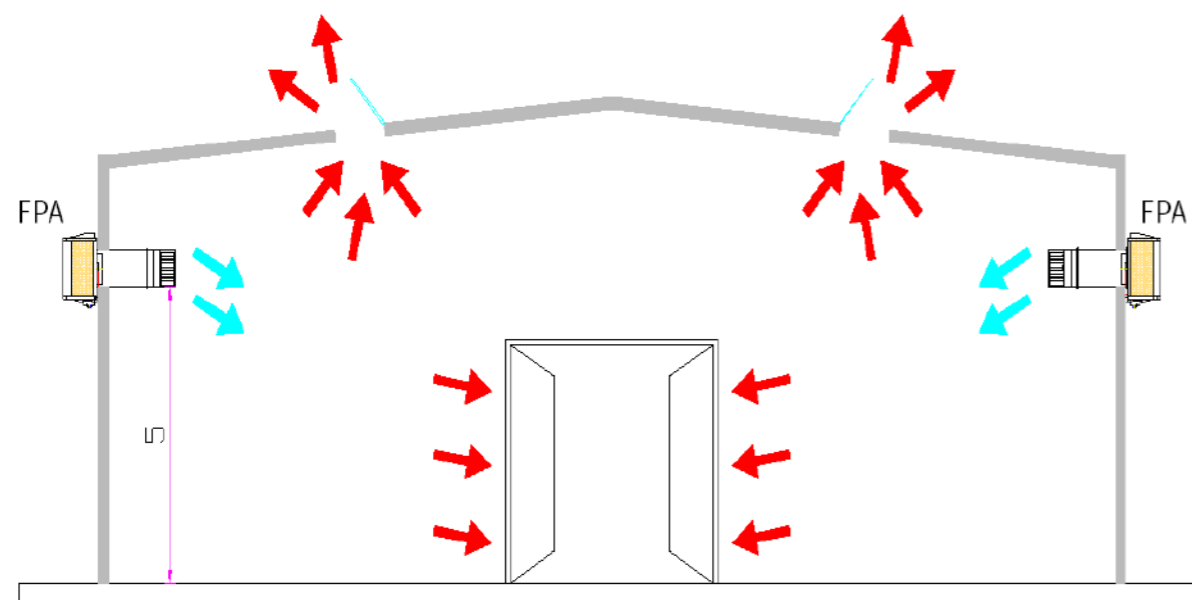
4) Evacuation of the warm / exhausted air

Once the quantity of air to be introduced into the building has been calculated, it is necessary to estimate the size of the openings necessary for the evacuation of the exhausted air.

The COLDAIR coolers provides for the introduction of cooled air into the building and its complete evacuation through natural openings or forced extraction systems.

The evacuation of a quantity of air equal to that introduced is essential to guarantee the renewals envisaged, to guarantee the cooling effect and to avoid an increase in the percentage of relative humidity in the environment.

The air produced by evaporative coolers contains a percentage of relative humidity higher than that of the external air and that of the ambient air: it is precisely this characteristic that produces the cooling effect, but it must pass through the room and then exit. In this way, the percentage of relative humidity of the ambient air will not increase and the cooling effect will be ensured.



4) Evacuation of the warm / exhausted air

To evacuate the exhausted air, natural openings of approximately 1 sq.m. per 1.000 cubic meters of air are required.

For example, to evacuate 10.000 cubic meters of air, 10 square meters of natural openings are needed.

- It is important that the openings (windows, doors, gates, skylights...) are not concentrated in a single position or only in one part of the building, but that they are distributed almost everywhere, to allow ventilation and cooling of the whole space and not only a part of it.
- The best result is obtained when there are also ceiling openings, such as skylights or natural extractors: through these openings it is possible to "discharge" the mass of hot air that normally accumulates under the ceiling and stagnates over time.

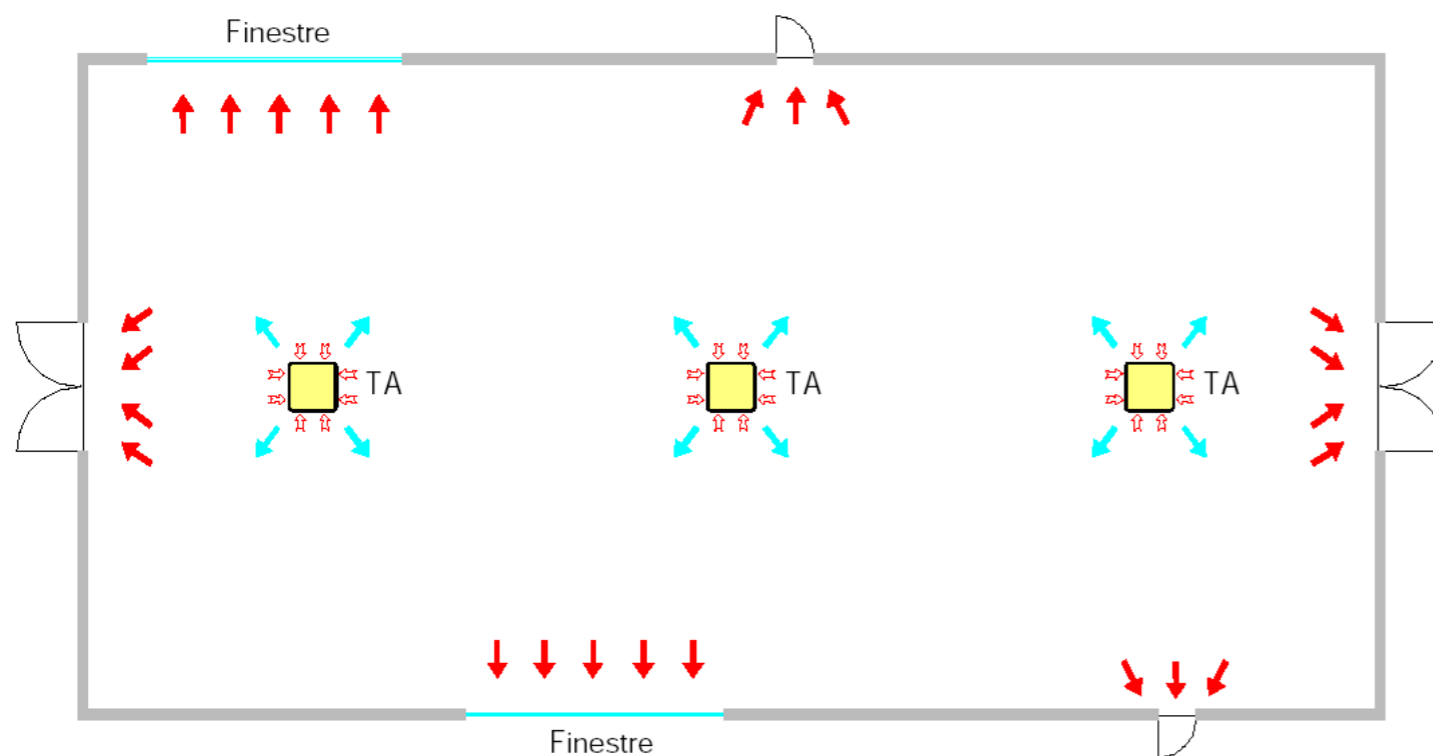
ATTENTION

If the total natural openings are in quantities greater than that necessary for the evacuation of the exhausted air, there is a risk of attracting the hot air from the outside and reducing the cooling effect. If there are already forced extraction systems in the building that are in operation, their capacity must be taken into account and subtracted from the calculation of the necessary openings.

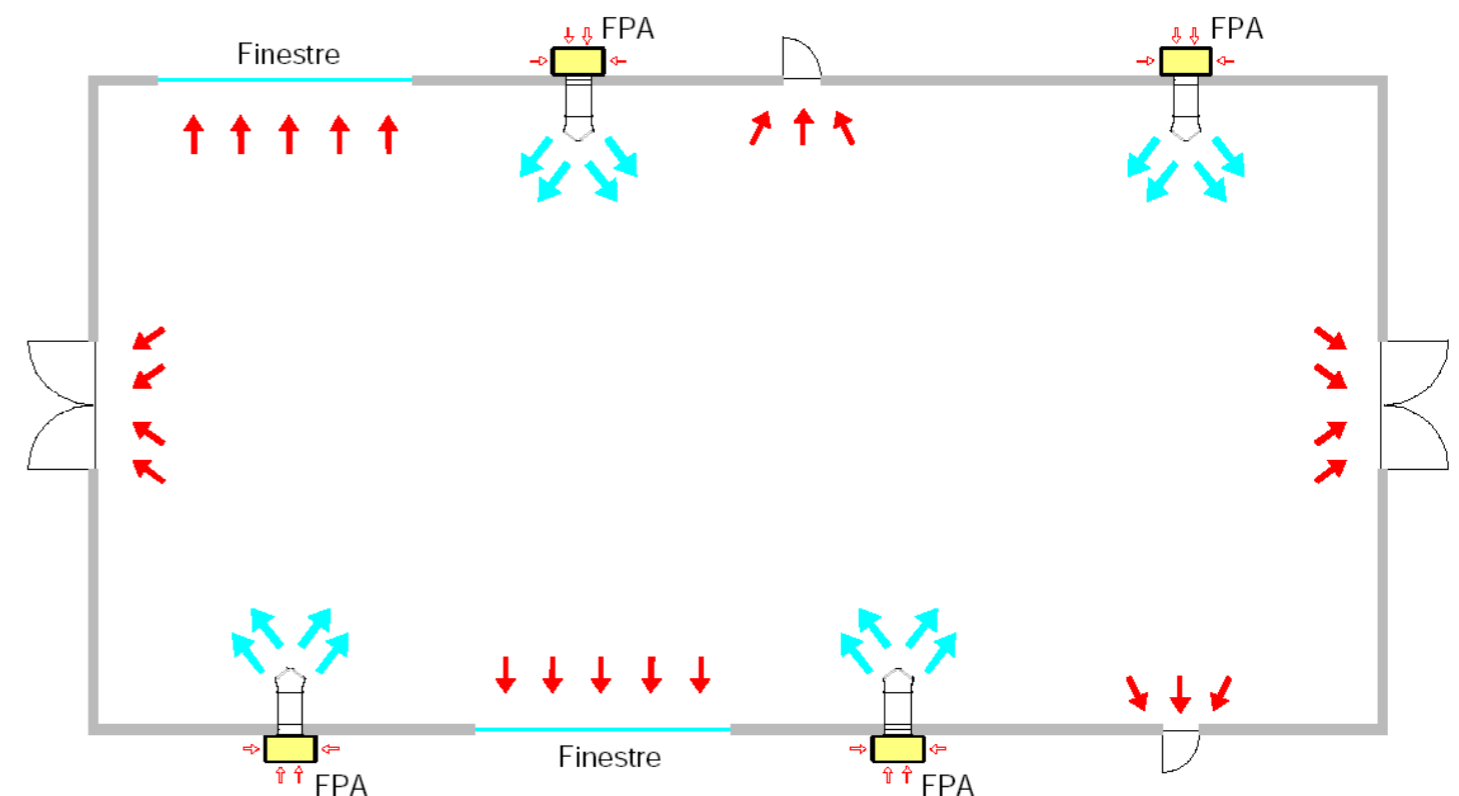
It is absolutely necessary to ensure that there is a balance between the quantity of incoming and outgoing air.

MODEL SELECTION

The choice of models and the number of units to be installed depends on the Client's needs and on the different positioning possibilities of the coolers and air ducts, without forgetting that the installation height of the air diffusers must not exceed 6 m from the floor.



COLD AIR coolers installed on ROOF



COLD AIR coolers installed on WALL

MODEL SELECTION

The ideal solution is to install the COLDAIR coolers on the roof of the building and enter with the ducts through the skylights.

In presence of a roof with low weight bearing capacity or other obstacles, installing COLDAIR coolers on the wall can represent a valid solution.



Do you need help? Talk with the Experts!

Expert engineers of the IMPRESIND Design Dept. are at your complete disposal to advise you and to propose solution that best suits the specific situation.

This service is "free of charge" and without any commitment !!



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