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EVAPORATIVE COOLING



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INTRODUCTION TO THE EVAPORATIVE COOLING SYSTEM

FOR EASILY UNDERSTANDING THE EVAPORATIVE COOLING PROCESS YOU SHALL KNOW THE FOLLOWING BASIC CONCEPTS.

AIR

The air we daily breathe is composed of different gases:

Oxygen 21%

Nitrogen 78%

Different gases 0,9%

Carbonic gas 0,03%

Water vapour 0,05 – 1,50%

PSYCHOMETRICS

It is the science that studies properties and thermodynamic processes of the damp air.

HYGROMETRIC STATE

For evaluating a thermodynamic state of the damp air, we need to know three data:

1. Atmospheric pressure.
2. Dry temperature.
3. Relative humidity.

DRY TEMPERATURE

It is the temperature taken with an ordinary thermometer.

HUMID TEMPERATURE

It is the temperature with a thermometer whose bulb has been wrapped in a piece of gauze softened with distilled water and ventilated with a determined air speed.

PSYCHOMETER

It has two thermometers that give us dry temperature and humid temperature.

DEW TEMPERATURE

It is the temperature from which water vapour condenses in a damp air.

CONDENSATION

To pass from a gaseous state to a liquid one.

RELATIVE HUMIDITY

It is the amount of vapour-shaped water that contains a certain state of damp air.

It is the value from 0 to 100%, which indicates the saturation degree.

Fog appears when humidity is bigger than 100%.

VAPOUR CONCENTRATION

It is the amount of water vapour contained in a damp air environment referred to 1 kg of dry air.

SPECIFIC HEAT

It is the necessary heat for raising a centigrade degree 1 kilogram of air.

FRIGORIES

It is the amount of heat that shall be removed from one litre of water in order to bring down its temperature one centigrade degree.

Frigories are just one kilocalorie. So when we speak about a cooler of 10,000 frigories/h, this means it is able to extract 10,000 Kcal/h from any building.

ENTHALPY

Enthalpy in damp air describes the thermodynamic state from its energetic content. It is the sum of the two elements, dry air and water vapour, so that:

ENTHALPY = PERCEPTIBLE HEAT + LATENT HEAT

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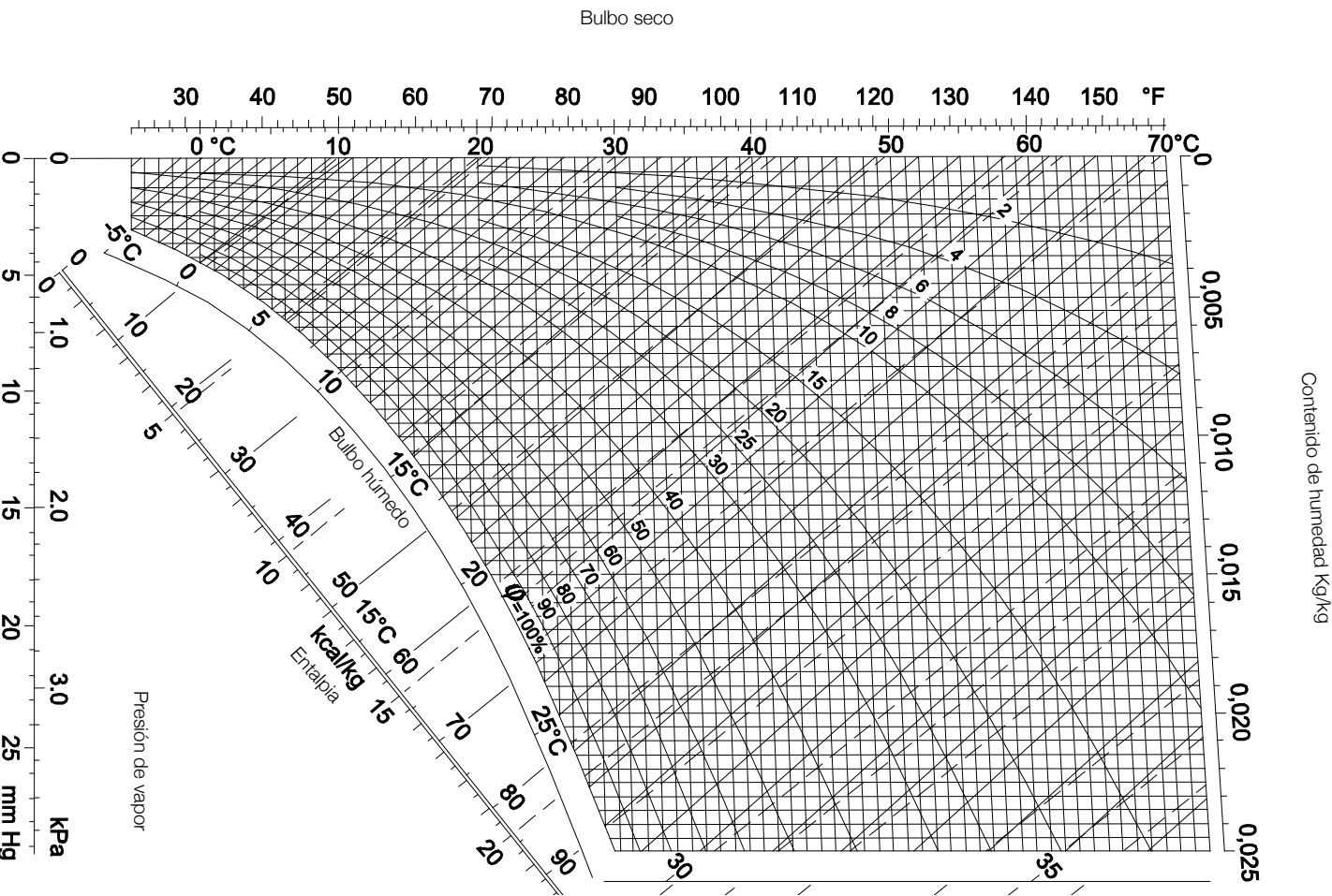
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PSYCHOMETRIC DIAGRAM

IN ORDER TO KNOW AIR CONDITIONS, THERE IS A PSYCHOMETRIC DIAGRAM THAT INFORMS US ABOUT DRY TEMPERATURE, VAPOUR CONCENTRATION RELATIVE HUMIDITY, SPECIFIC VOLUME, ENTHALPY, DEW TEMPERATURE, VAPOUR PRESSURE.

Temp. -5°C +7°C → Humid air to 760mm de Hg



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EVAPORATIVE COOLING

MET MANN EVAPORATIVE COOLERS

MET MANN evaporative coolers use successfully the simple technology of the evaporative cooling. This technology is set by water evaporation when a certain air volume passes through cooling panels that cause a temperature decrease, as well as an increasing of the humidity degree.

Nowadays, due to rapid technological advances,

industrial products are daily perfected. Air condition follows this tendency.

There is a necessity to control temperature during the whole year and to control humidity in order to make high technology equipment work properly.

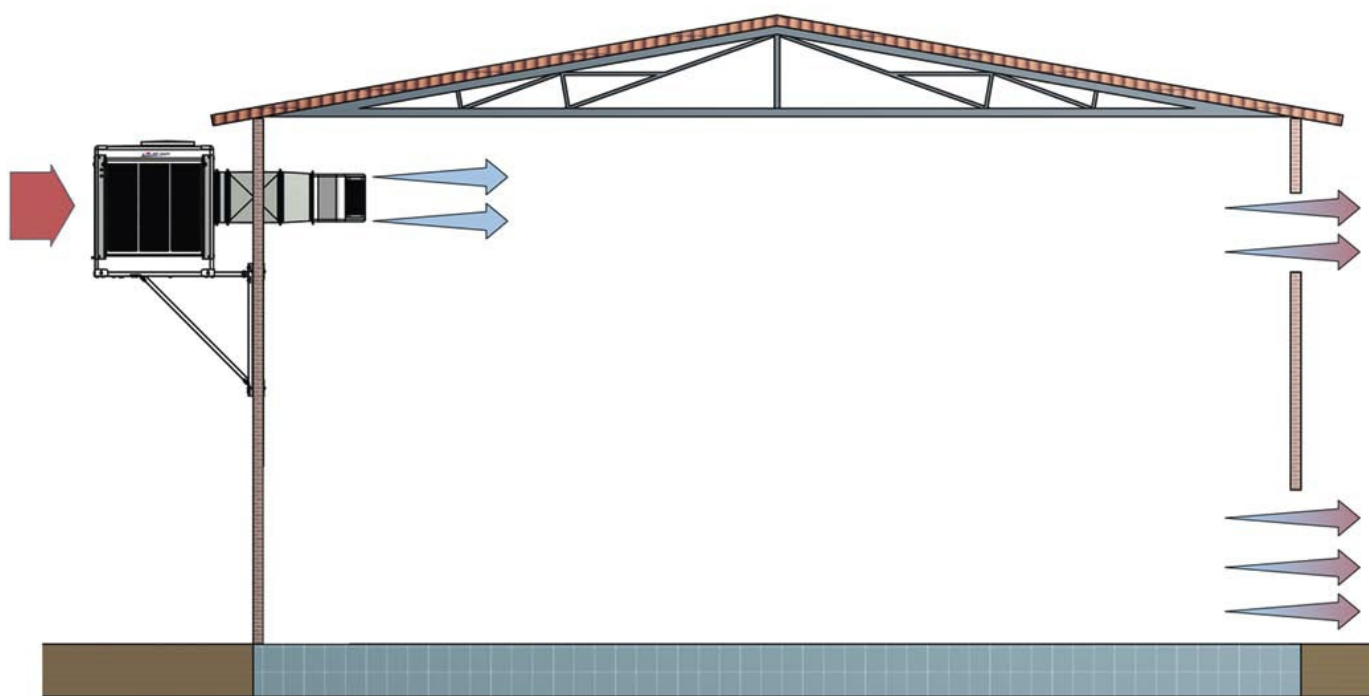
The evaporative cooling system is at present

appreciated and requested by industrial plants, cattle breeding sector, greenhouses, and any space that needs a certain level of humidification.

This system is totally ecological, since it does not use any kind of refrigerating gas. Its electric consumption is minimum, when compared to the traditional system of air-conditioning.

It only needs water from the main water supply to work.

In this scheme we explain the system in an easy way using a theoretical example.



WARNING: THIS IS AN INDICATIVE EXAMPLE THAT REFERS TO PROPERLY CALCULATED EQUIPMENT WITHOUT HEAT INFLOWS INSIDE THE PRECINCTS AND WITH THE NUMBER OF RENEWALS AND AIR EXTRACTION OUTLETS SUITABLE FOR THE KIND OF INSTALLATION.

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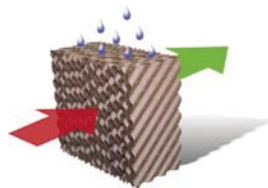
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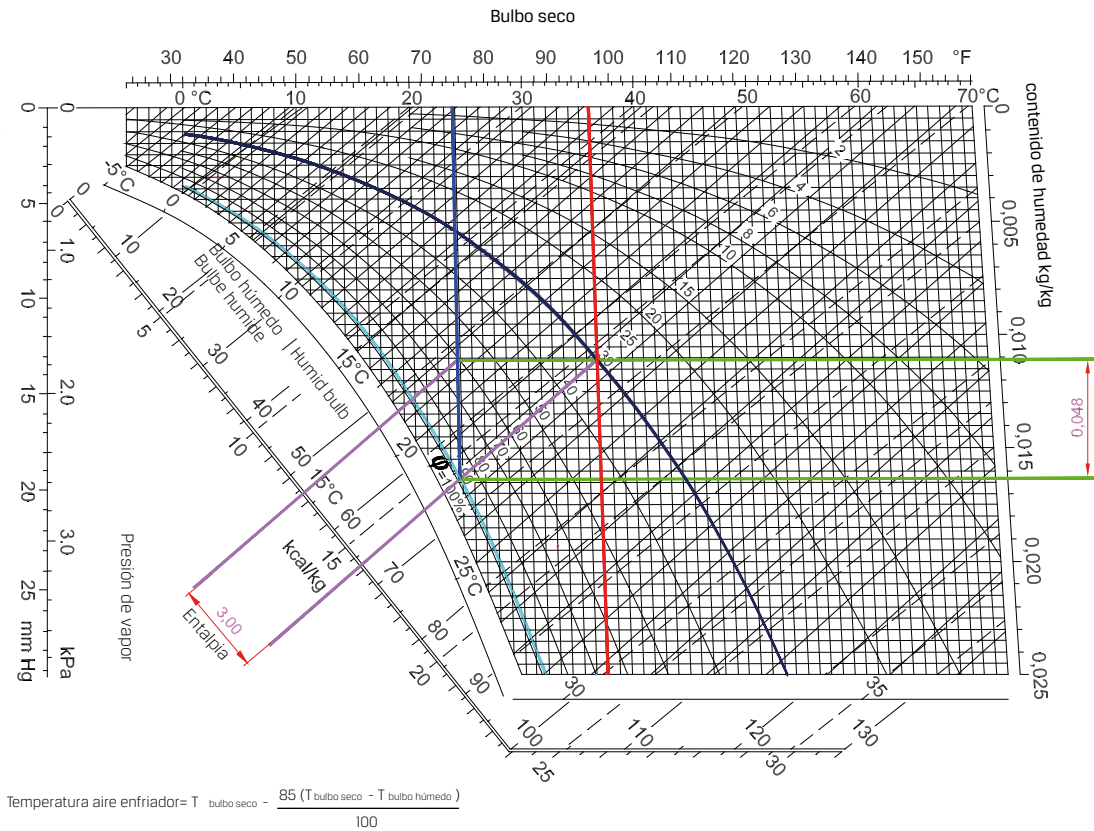
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Panel enfriador
5090 100mm 1,5 m/s
Cooling panel
5090 100mm 1,5 m/s
Panneau rafraichisseur
5090 100mm 1,5 m/s



- Temperatura exterior seca (36°C)
- Grado de humedad exterior (30%)
- Temperatura del bulbo húmedo (22, 0°C)
- Temperatura del aire impulsado (26, 5°C) Aplicar formula
- Grado de humedad del aire impulsado (70% - 50mm)
- Grado de humedad del aire impulsado (87% - 100mm)

COOLING PANEL 5090 OF 50MM THICKNESS

Air temperature at the cooling outflow (1, 5 m/s suction speed)

HUMIDITY	EXTERIOR TEMPERATURE															
%	30 °C	31 °C	32 °C	33 °C	34 °C	35 °C	36 °C	37 °C	38 °C	39 °C	40 °C	41 °C	42 °C	43 °C	44 °C	45 °C
20	20,4	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7
25	21,2	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7
30	21,9	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7
40	23,3	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7
50	24,6	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7
60	25,9	21,2	21,9	22,7	23,4	24,2	25,0	25,7	26,5	27,2	28,0	28,7	29,5	30,2	31,0	31,7

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EXAMPLES OF APPLICATIONS AND ADVANTAGES

STORAGE OF VOLATILE PRODUCTS

Stored products will not become volatile, reducing the risk of fires and eliminating fumes and odours.

STORAGE OF PHARMACEUTICAL PRODUCTS

Medications can be properly preserved.

PAINTING

With proper levels of humidity, when applying spray paint or painting by use of electrostatic processes, static electricity is eliminated and airborne dust is reduced. This avoids costly repainting and provides a superior finish along with reduction of the amount of paint used.

GRAPHIC ARTS

Proper temperature and humidity content maintains paper's strength, making it less easily torn.

Paper that is too dry is easily charged by static electricity which makes it difficult to handle. Ensuring a proper humidity level during the printing process maintains the properties of the paper, reducing the risk of errors and saving on printing ink.

BINGO ROOMS AND CASINOS

Maintains comfortable temperatures and eliminates contaminated air and odours.

WINE STORAGE

Winemaking is not disturbed. The flor always remains on top. Wine does not evaporate or become spoiled. The storage area remains fully oxygenated.

In the fermentation tanks, the

yeast always remains at the surface. Lowering the fermentation temperature for wine prevents volatilization and eliminates the production of gasses.

SHOPPING CENTRES

Provides a comfortable atmosphere for customers and employees.

Fruits, vegetables, and other foods stay well preserved.

Odours and insects are eliminated.

Wood furniture will not be altered in any way.

COMPUTERS AND ELECTRONIC EQUIPMENT

Static electricity represents a hazard for modern electronic circuitry. A controlled level of humidity will keep working areas free from harmful discharges of static electricity.

DISCOS AND NIGHTCLUBS

Comfortable temperatures can be maintained with rapid elimination of contaminated air and odours.

FACTORIES

Allows comfortable temperatures to be maintained and rapid, continuous elimination of fumes and odours.

MANUFACTURING PLANTS FOR PLASTICS AND CONTAINERS

Eliminates dust, particulates, and insects that could become affixed to the products, while providing a very comfortable ambient temperature for the personnel.

FLOUR MILLS

Grinding of grains relies upon the use of air. This air, from the local surroundings, makes milling difficult when it is too dry. Also, paper bags can tear when they lack moisture. Both of these problems can be eliminated by adding humidity to the air.

PAPER MILLS

Damage to packaging can be avoided by maintaining appropriate relative humidity. Agreeable temperatures for personnel are also created.

WOOD INDUSTRY

Maintaining the moisture content of wood at particular levels preserves its stability and promotes consistency in the process of handling, thereby minimizing costs.

Increased levels of humidity bring the added benefits of reducing static electricity and dust, and also create a more comfortable working environment.

FOOD INDUSTRY

Fruits and vegetables maintain their freshness as well as their value, since higher humidity levels reduce loss of weight.

FOUNDRIES

Excessive heat and smoke in mills can be eliminated.

MUSEUMS AND CHURCHES

Maintaining constant humidity levels prevents possible damage to valuable objects such as paintings or furniture, which may otherwise occur because of volumetric shrinking.

METALLURGICAL FACILITIES

The heat produced by machinery and furnaces, as well as fumes and gasses are eliminated, increasing productivity and providing more comfortable temperatures. Machining tools work with greater precision when proper environmental temperatures are maintained.

AGRICULTURE AND ANIMAL RAISING

Losses due to excessive heat are avoided.

Animal raising takes place in an ideal atmosphere without odours or insects, and production can be increased.

MACHINERY OR GENERATOR ROOMS

Solves the problems created by excessive heat and improves performance of turbines and combustion engines.

AUTO SHOPS

Creates comfortable temperatures for customers and mechanics.

Eliminates exhaust gasses.

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INSTALLATION SIZING

CALCULATION OF THE FRIGORIFIC POWER OF A COOLER

To calculate the negative kilocalories of an evaporative cooler, we follow these steps:

Once the psychometrics graphs completed,
we extract the following data:

(supply of kcal/kg of air)

(1 kcal = 1 frigorie)

In the previous sketch

(Cooling panel 5090 50mm) = 2, 5 kcal/kg air

2,5 kcal/kg air x 1,2 air density = 3 kcal/m³

An evaporative cooler model AD-20-V impulses an airflow of 16,000 m³/h, so the power negative kilocalorie of this model is of

(3 kcal/m³ x 16,000 m³/h) = 48,000 kcal/h.

According to this kind of activity in the building to cool, it is necessary a certain number of renovations

(see enclosed table).

Let's take the example of a textile industry:

48,000 kcal/h / 25 renovation =

1.920 negative kilocalories / renovations.

So we renew and we cool the air of the building every

2 minutes and 40 seconds.

INSTALLATION SIZING BY N° OF BUILDING AIR RENOVATIONS

Let's suppose that we have to cool a textile factory of 200m² x 8 height.

We calculate a maximum height of 4 meters (*),
this means 200m²x4 = 800m³.

Necessary flow = 800m³ x 25 = 20000 m³/h.

Of all "MET MANN" series range, we chose AD-30 model.

According to the experience acquired during many years, we recommend this renovations number by sector.

(*) Height advised for air diffusion

ENTERPRISE ACTIVITY	NUMBER OF RENEWALS COOLING PANEL 5090 50MM	COOLING PANEL 5090 100MM
Textile industries	25-29	22-26
Rag workshops	22-25	20-22
Machine rooms	18-22	16-20
Manufacturing trade	18-22	16-20
Foundries	25-30	22-27
Painting workshops	25-30	22-27
Plastic manufactures	30-35	27-31
Bakeries	20-25	18-22
Restaurants	18-22	16-20
Cafes and bars	18-22	16-20
Canteens	18-22	16-20
Salas de fiesta	25-29	22-26
Wine cellars	30-40	27-36
Discotheques and pubs	25-29	22-26
Cinemas and theatres	14-18	13-16

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