

# **GUÍAS DE DISEÑO DE INSTALACIONES MECÁNICAS Y ELÉCTRICAS EN EDIFICIOS**

INSTALACIONES MECÁNICAS



A diagram showing four rounded square boxes arranged in a 2x2 grid, set against a light gray background with a larger, fainter version of the same grid pattern. The boxes are colored: top-left is blue-gray, top-right is orange, bottom-left is olive green, and bottom-right is brown. Each box contains text in a white, sans-serif font.

Aire  
Acondicionado

Ventilación

Aire  
Comprimido

Gas  
Natural/GLP

## **INSTALACIONES MECÁNICAS**

# AIRE ACONDICIONADO - TEMARIO

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Definicion del Sistema

---

Planta Central

---

Tipos de Compresores

---

Equipos enfriadores de los ambientes

---

Filtros.

---

Refrigerantes

---

Redes de Tuberías

---

La evaluacion economica.

## DEFINICIÓN DEL SISTEMA DEL PROYECTO

Previo cálculo aproximado de las cargas térmicas, preliminarmente se hará una evaluación para definición del sistema

- Agua Helada
- Paquete / Rooftop
- VRF
- Split o Multisplit

## VEAMOS QUE TENEMOS PARA ELEGIR: LOS EQUIPOS CENTRALES PRINCIPALES

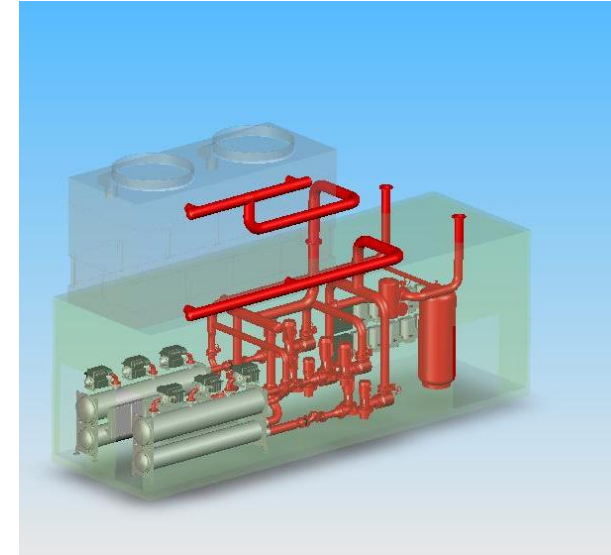
Chiller de Agua Helada enfriado por Aire

Chiller Enfriado por Aire

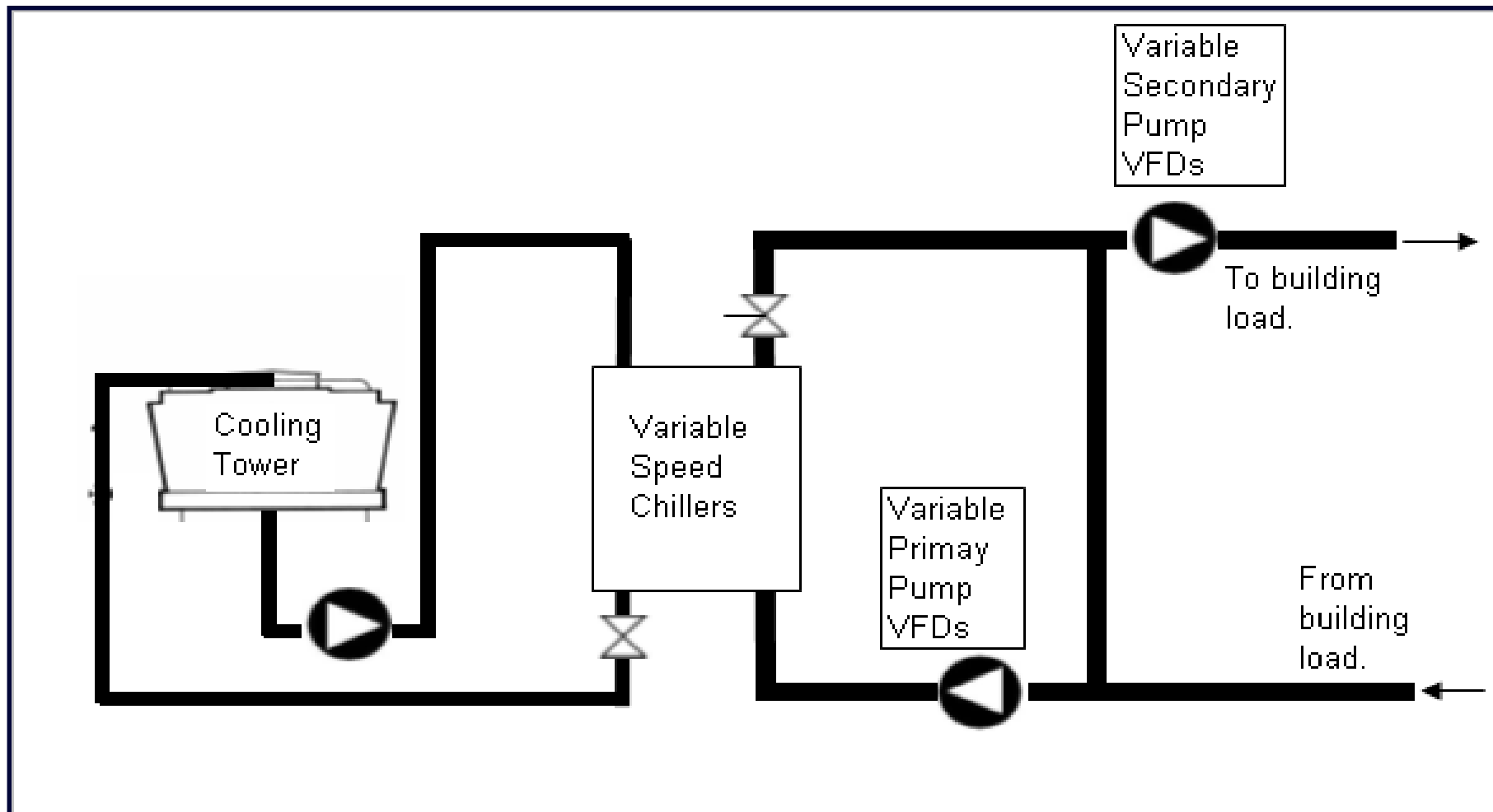
Multisplit VRV o VRF

Rooftop

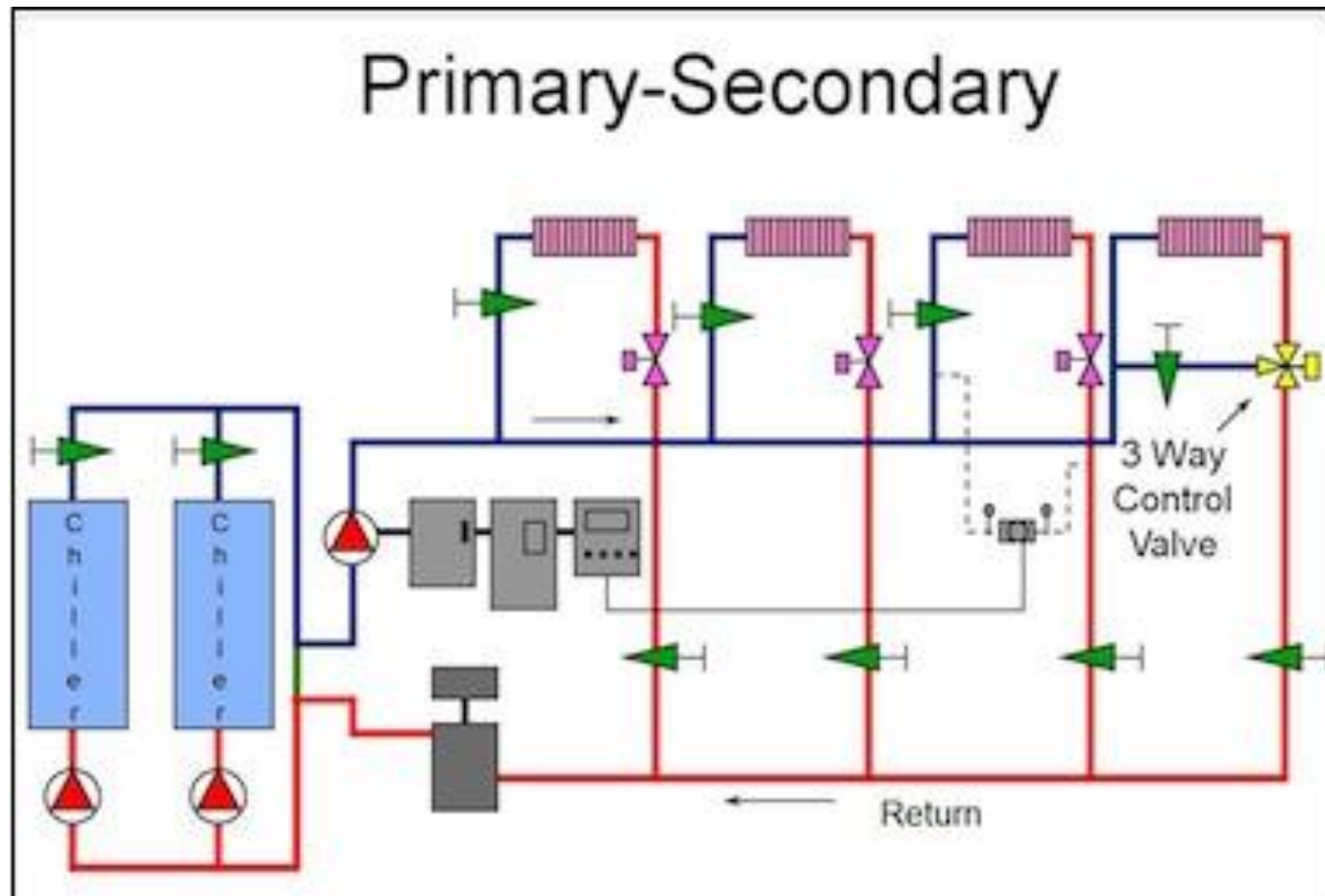
Sistemas de menor capacidad



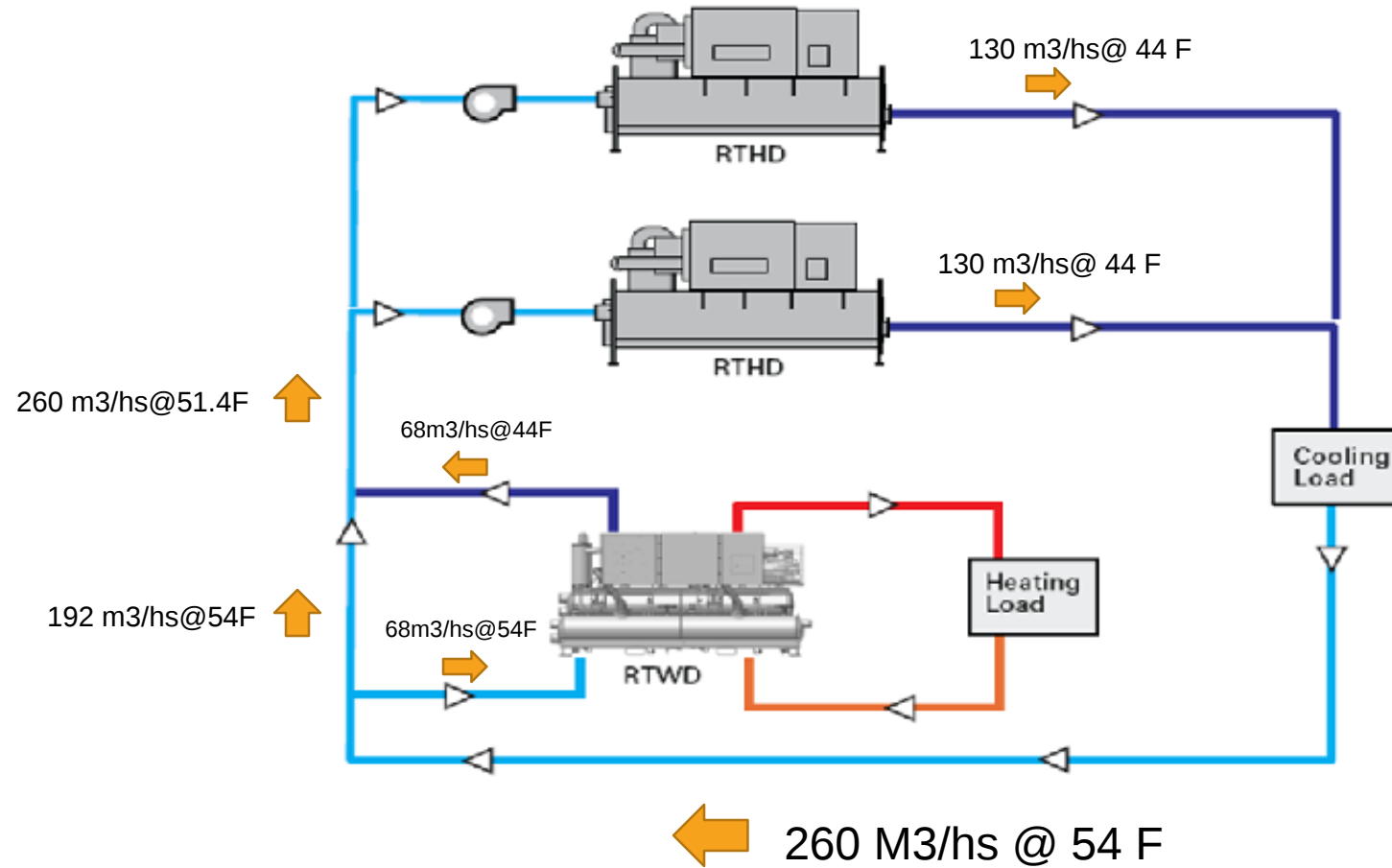
# ESQUEMA DE UN CHILLER CON PRIMARIO VARIABLE Y TORRE DE ENFRIAMIENTO



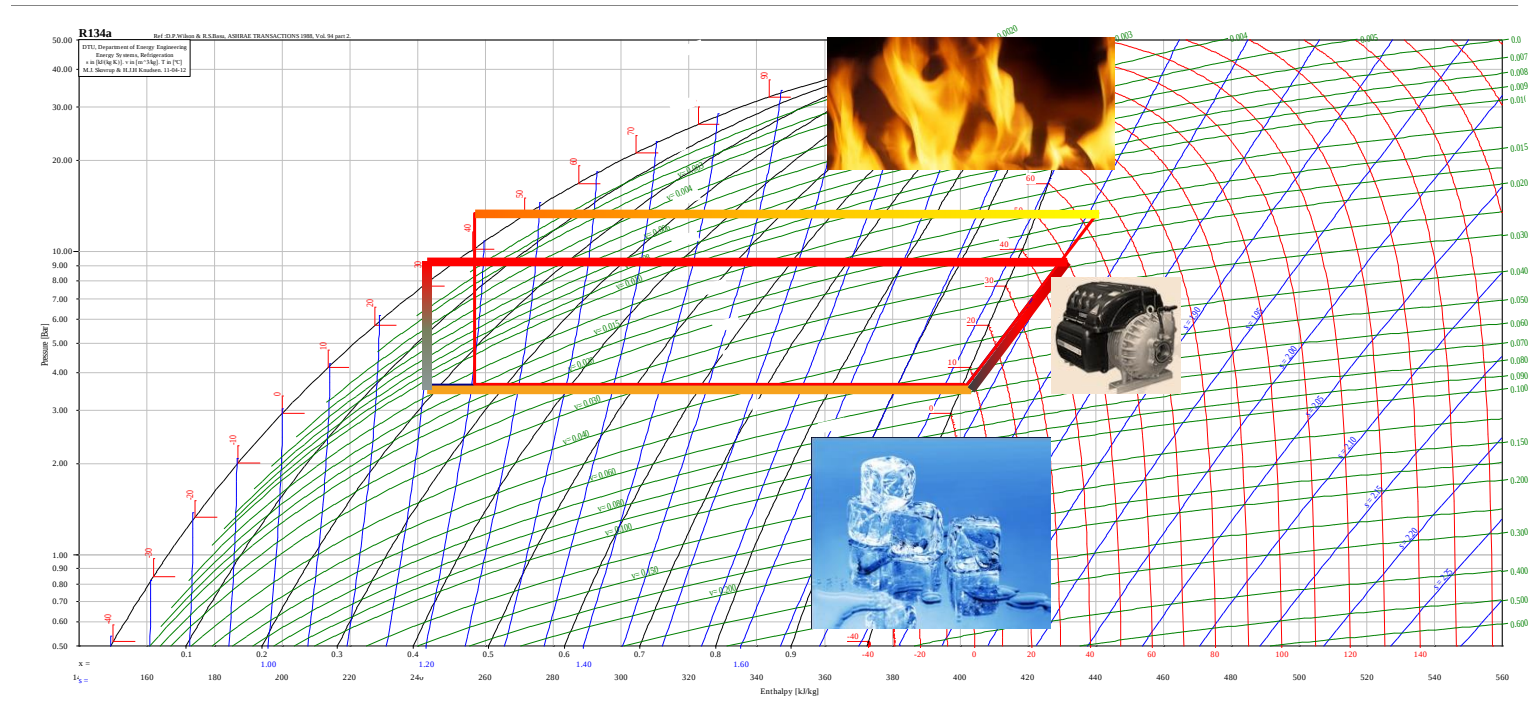
## ESQUEMA DE 2 CHILLERS ENFRIADOS POR AIRE Y PRIMARIO VARIABLE.



# ESQUEMA SOLO DE AGUA HELADA CON 3 CHILLERS, UNO PEQUEÑO LLAMADO PONY QUE GENERA CALOR AL EXTERIOR

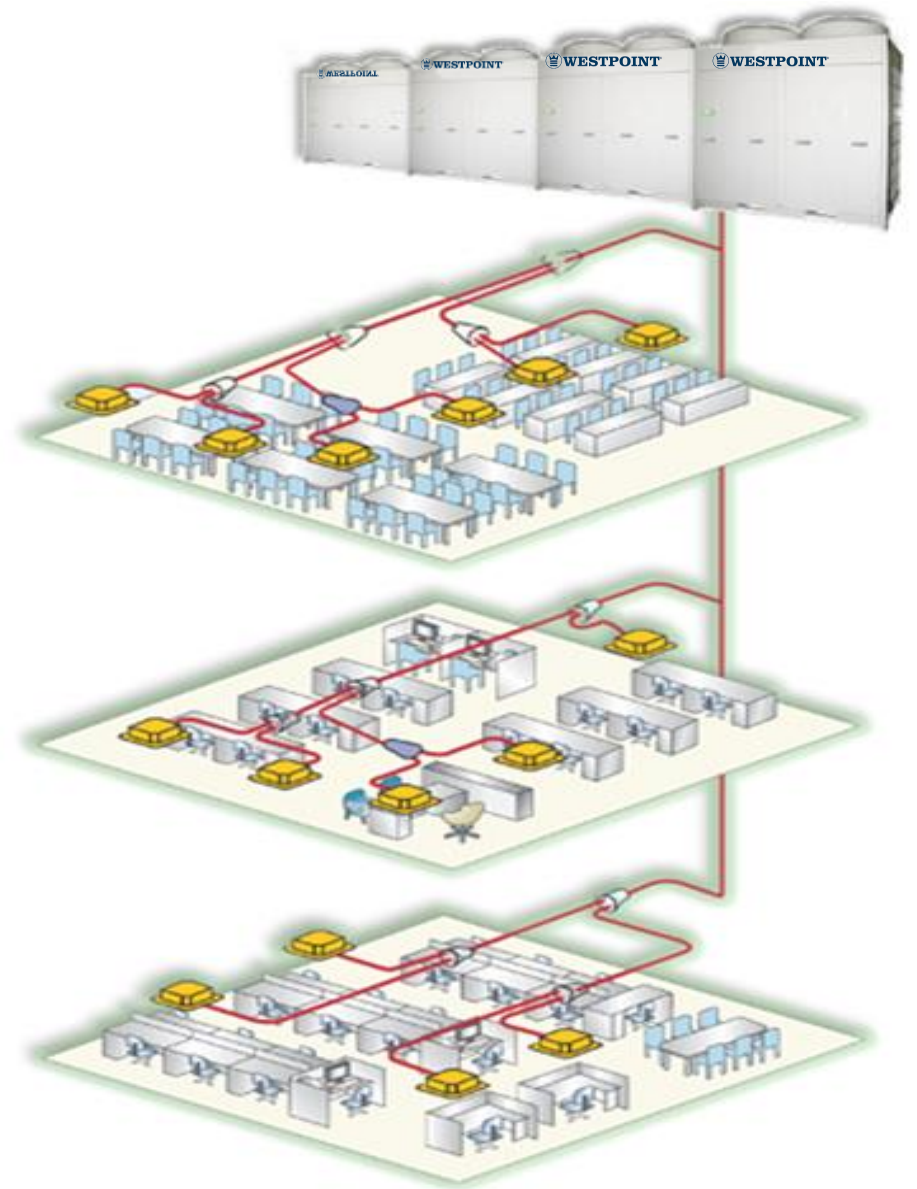
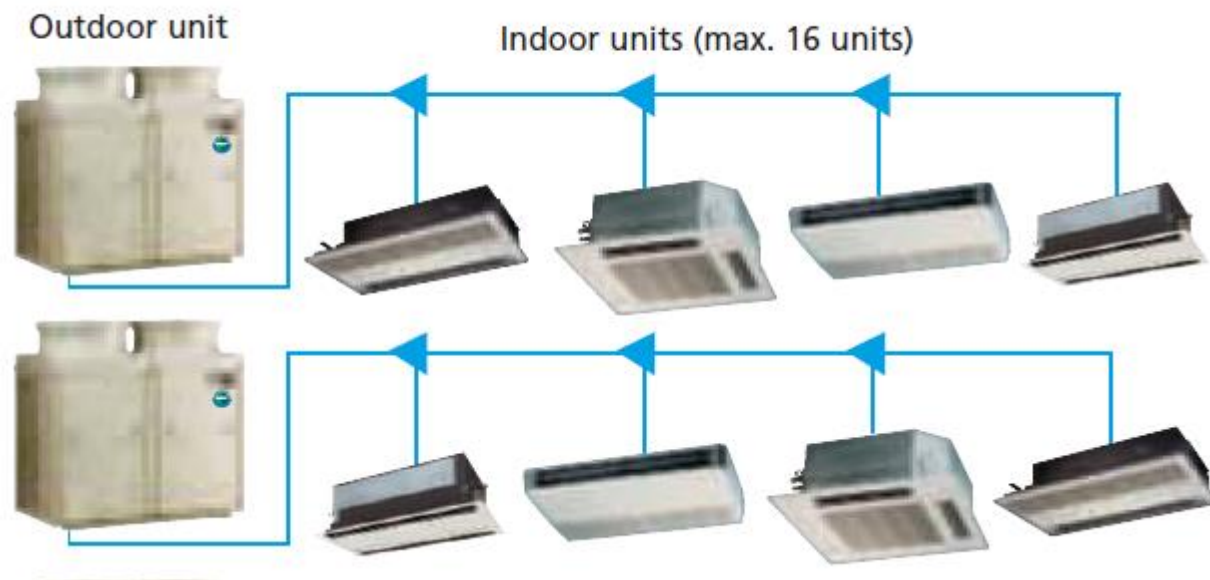


# EL CICLO DE REFRIGERACIÓN EN DIAGRAMA P/H O T/S APROVECHANDO EN CALOR DE LA CONDENSACIÓN.



El calor residual se lleva a una temperatura en la cual puede ser aprovechado

# ESQUEMAS VRV O VRF



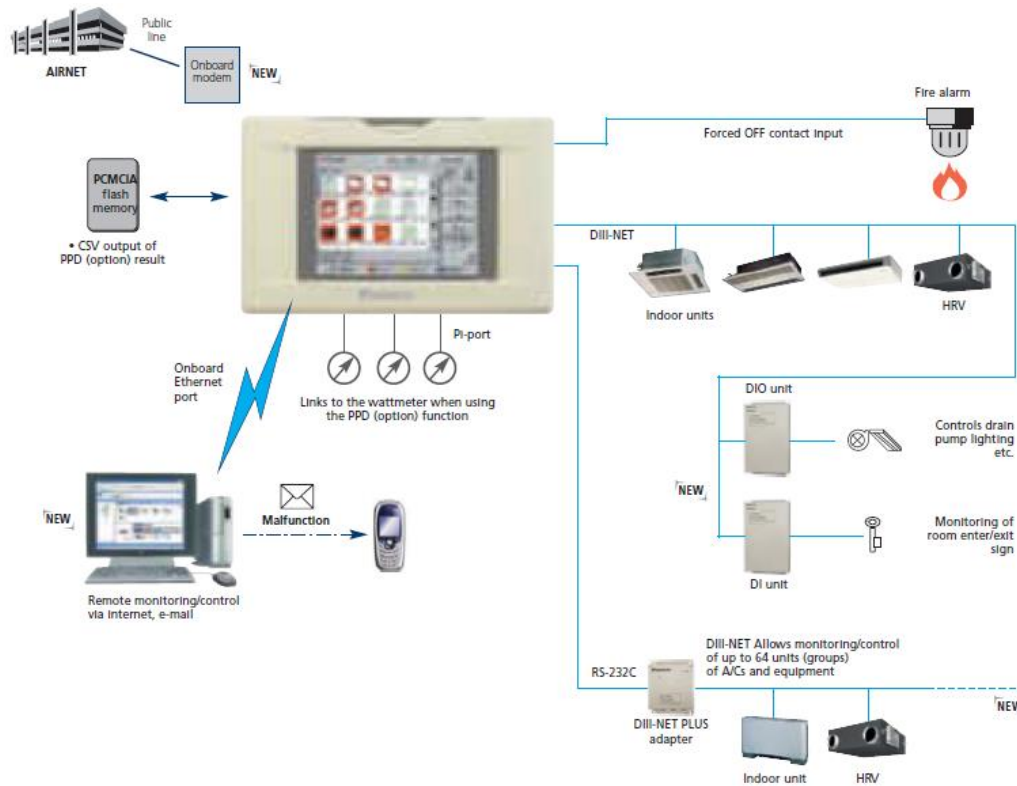
**SITEMA MULTISPLIT  
SIMPLE UN  
CONDENSADOR Y 2  
EVAPORADORES**

- Condensadores en el exterior (piso o techo)
- Evaporadores en cada sala:
  - Cassete.
  - De techo visible.
  - De pared.

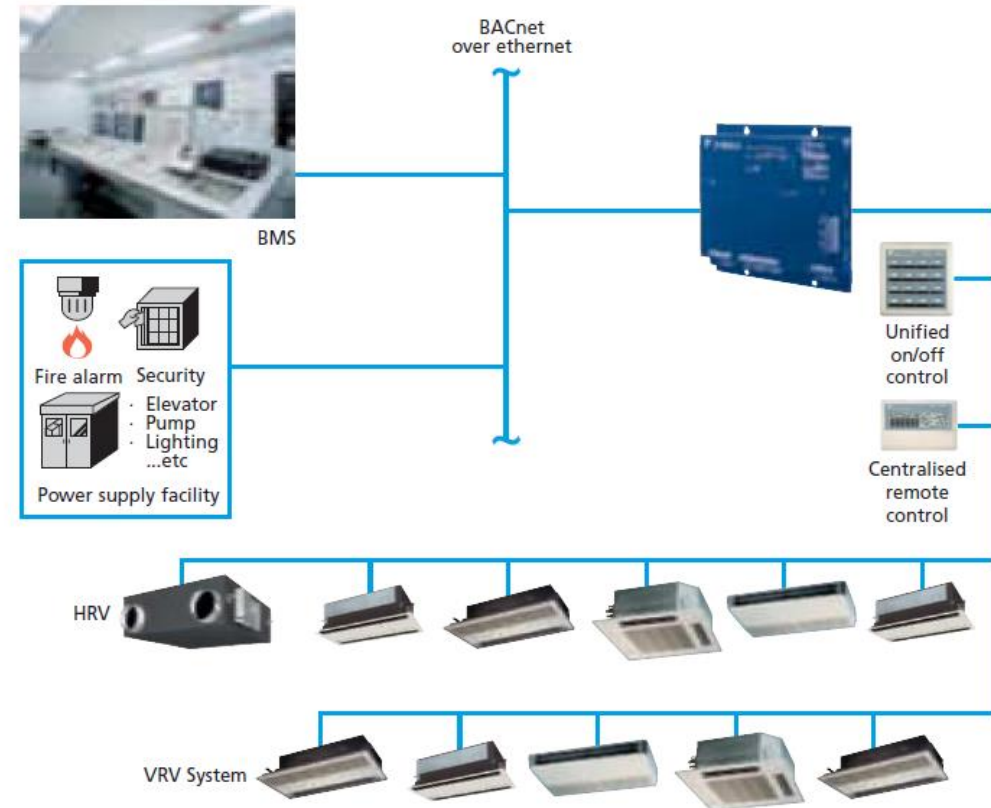


# DIAGRAMAS DE RED DE CONTROL DEL VRV

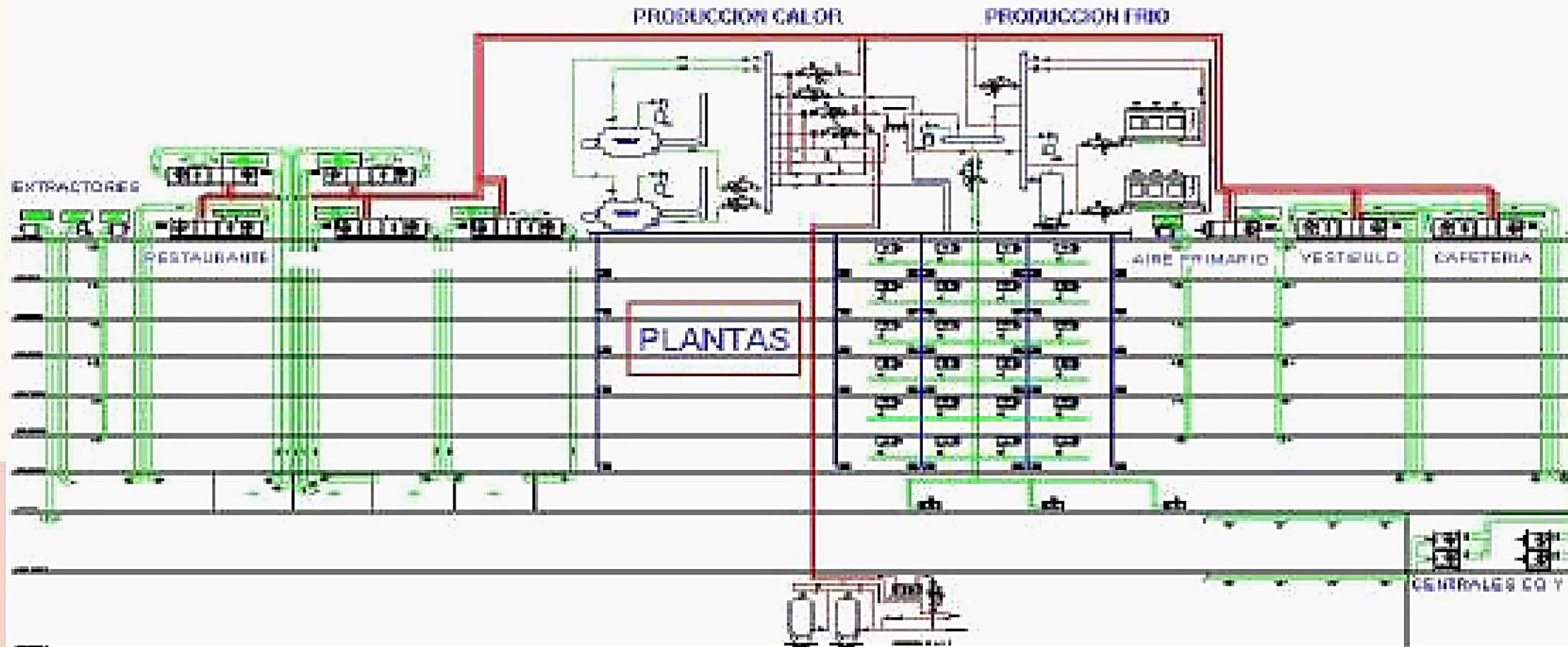
## Con control centralizado (BMS) simple



## CON BMS COMPLETO



# ESQUEMA DE UN EDIFICIO AGUA HELADA Y CALIENTE



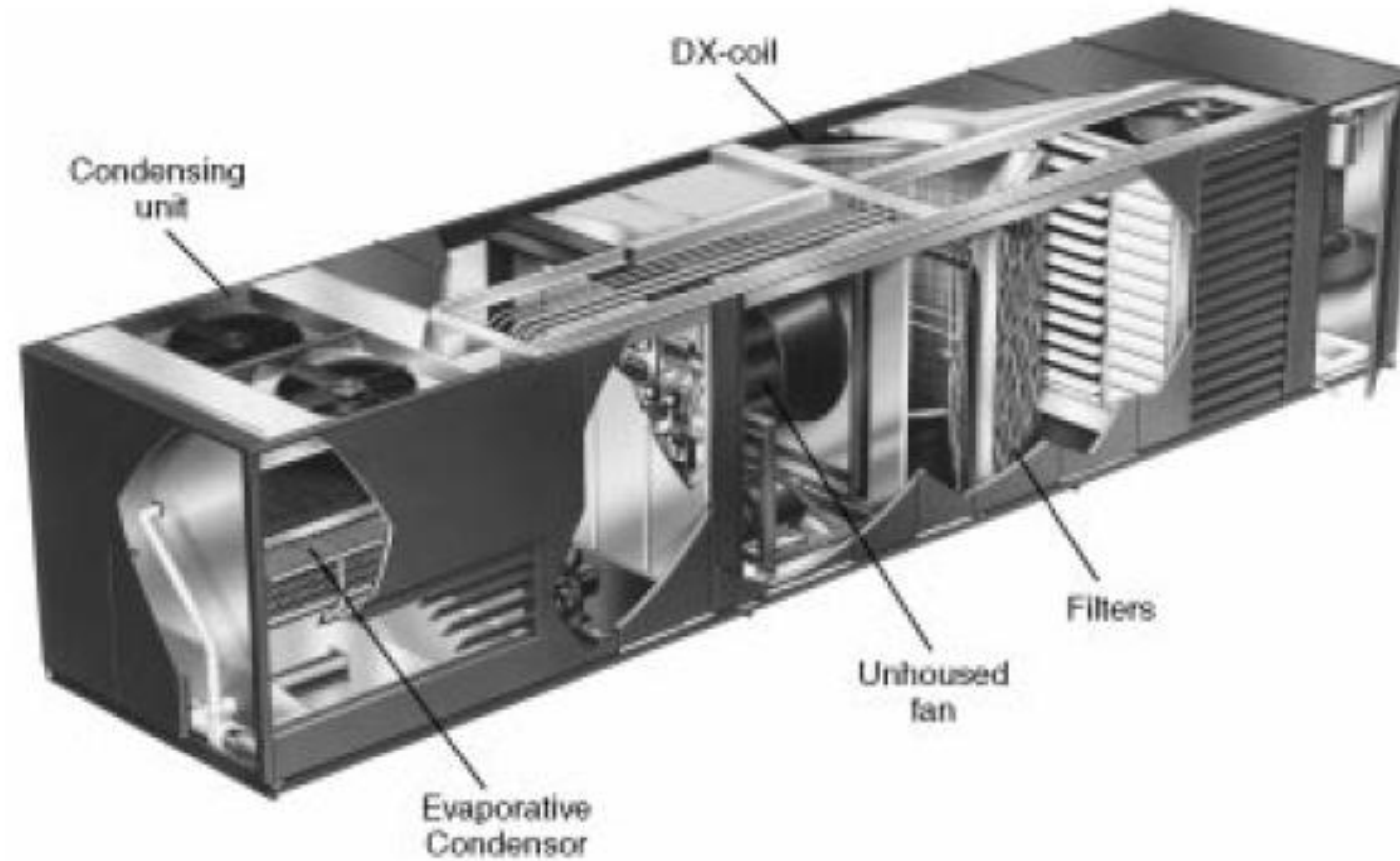


**VEAMOS LOS  
EQUIPOS:**



**EL EQUIPO COMPACTO TODO CONTENIDO EN UN PAQUETE,  
ROOFTOP (EN TECHO) GENERALMENTE.**

**COMPONENTES  
DEL EQUIPO  
COMPACTO**



CHILLER  
ENFRIADO  
POR AIRE





CHILLERS ENFRIADOS POR AIRE, COMPRESOR  
TORNILLO

# CHILLER TURBOCOR MAGNETICO, SIN ACEITE EN RODAMIENTOS, ENFRIADOS POR AIRE Y AGUA



# CHILLERS SCROLL Y TORNILLO ENFRIADOS POR AGUA

**Scroll Water-Cooled Liquid Chillers  
and Compressor Chillers**  
20 to 70 Tons



# CHILLER CENTRIFUGO



## LOS COMPRESORES

- SCROLL (SON TAMBIEN UN TIPO DE TORNILLO)
- TORNILLO (SCREW )
- CENTRIFUGO
- INVERTER
- TURBOCOR (SIN RODAMIENTOS)
- TORNILLO CON RODAMIENTOS ALTA PERFORMANCE

## SCROLL DE CAPACIDAD VARIABLE

### Features and Options

- Split system modulating humidity control is available to provide energy efficient dehumidification, even with low sensible heat loads, without the temperature swings common with on/off reheat systems.
- High density foam compressor sound suppression blanket to reduce radiated noise.
- Polymer e-coated coils are available to extend the life of the coils and protect them in corrosive environments.
- Adjustable fan cycling or modulating head pressure control allow operation down to 35°F for applications that require mechanical cooling at lower ambient temperatures

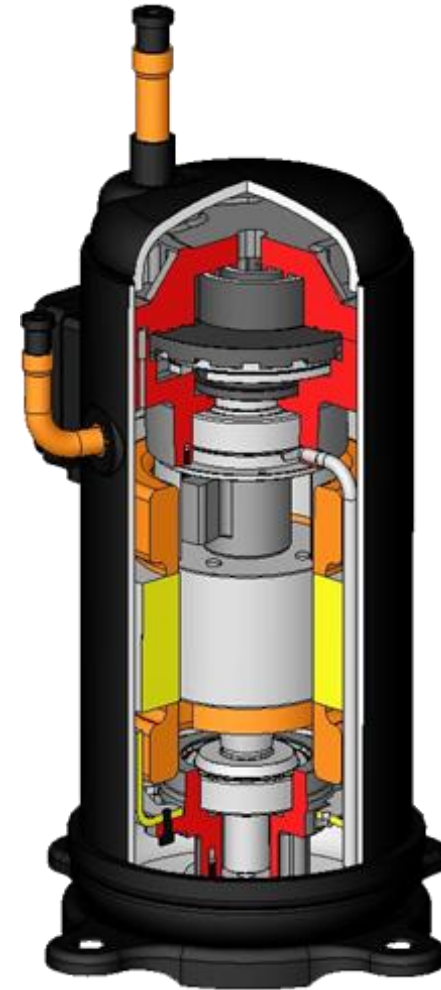


- ▶ Variable capacity scroll compressors provide load matching cooling and improve part load efficiency.

# LOS COMPRESORES DC INVERTER

WESTPOINT DC Inverter VRF powered by  
HITACHI DC Inverter Scroll Compressor

- Variable Speed thanks to permanent magnetic synchronous motor, lower energy loss.
- High Pressure Chamber Design
- New DC motor Design (Centralized Roll)
- WESTPOINT 180 Degree Sine Wave DC Inverter Driving Technology + PWM Capacity Control Technology



ENGINEERING  
TOMORROW



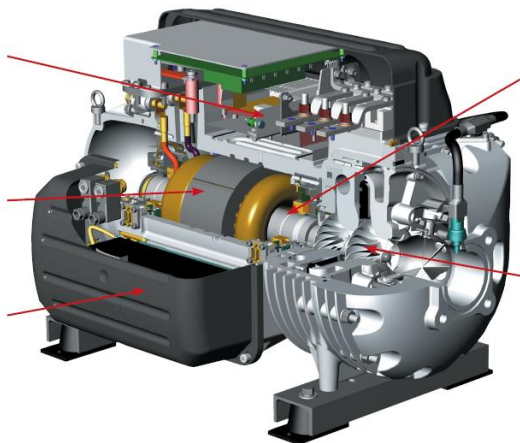
Specification Sheet | Danfoss Turbocor

## The Turbocor Family of Compressors TT300

A VFD (Variable Frequency Drive) built in as a standard providing unmatched part-load efficiency.

A permanent magnet motor which cuts size and weight while increasing efficiency.

A fully functional computer to provide control plus high level monitoring and diagnostics.



Oil-free magnetic bearings provide quiet and reliable operation. No need for oil, reduces maintenance and eliminates the complexity, cost and reliability issues of oil-based designs.

Two Stage, Direct Drive, Hermetic Centrifugal compressor with unshrouded impellers resulting in high efficiency at full load and extraordinarily high efficiency at part load conditions.

A 250 to 320 kW/60-90Tons nominal capacity compressor that is:

## EL COMPRESOR TURBOCOR O CON RODAMIENTOS MAGNETICOS

Es magnético, su polaridad varia, sin aceite en los rodamientos.

Lo inventó Danfoss. Ahora lo tienen otras Marcas.

Alta performance.

Baja vibración.

Muy utilizado desde pocos años.

Pero hay una línea que le hace la competencia en performance denominado con rodamientos cerámicos.



## LAS BOMBAS



## **LAS BOMBAS DE CAJA PARTIDA VERTICALES**



## BOMBAS HORIZONTALES



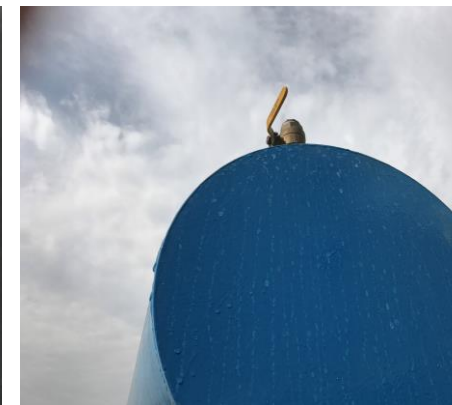
**LAS BOMBAS SE USAN CON BACK UP**

## ACCESORIOS DE BOMBAS

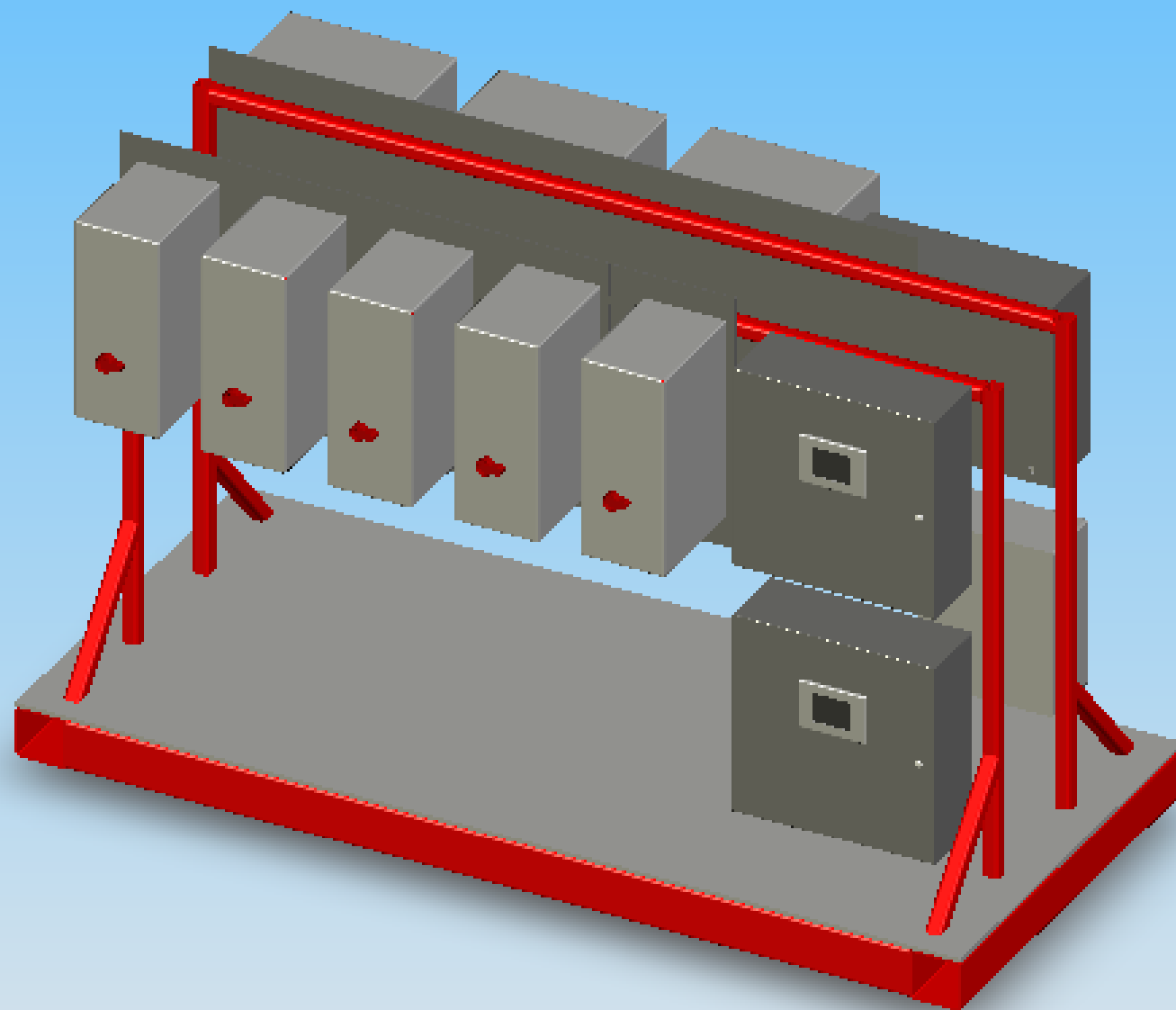
Difusor de succión

Válvula mariposa

Válvula aereadora



**VARIADORES DE  
FRECUENCIA EN TODOS  
LOS EQUIPOS**





**LA TORRE DE  
ENFRIAMIENTO.**

# PANTALLA DE COMPLETA DEL SISTEMA DE AGUA HELADA

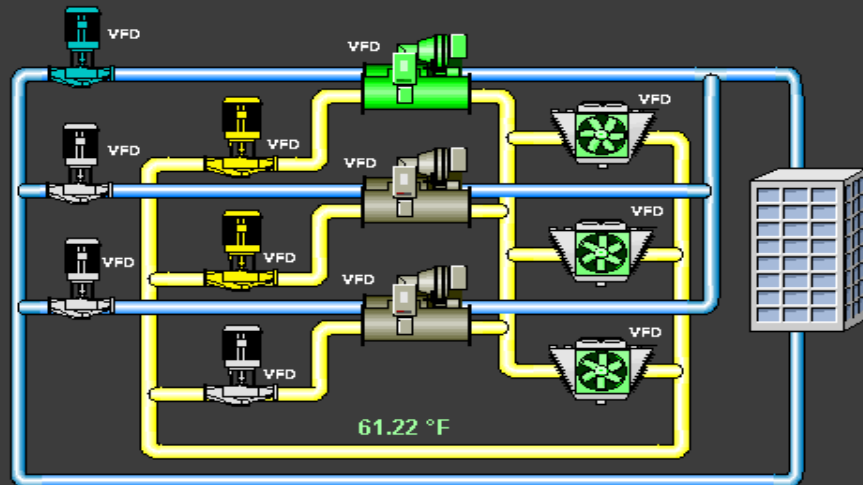


Simulating: Los Angeles February

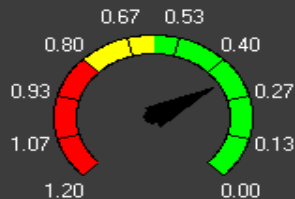


TIME OF THE DAY: 00:00 LOAD: 15.87 %

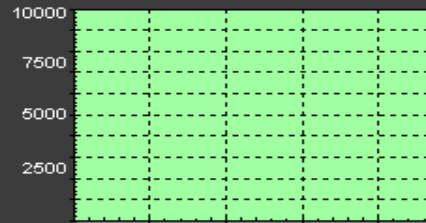
Ultra Efficient All Variable Speed Plant with  
HARTMAN LOOP® Control  
(VS CHW Pump, VS CW Pump, VS Chiller, VS Tower Fan)



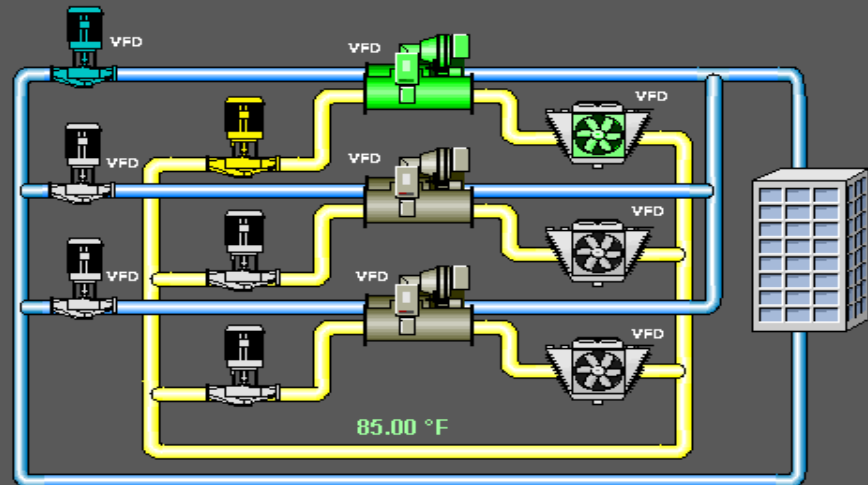
PLANT kW/TON



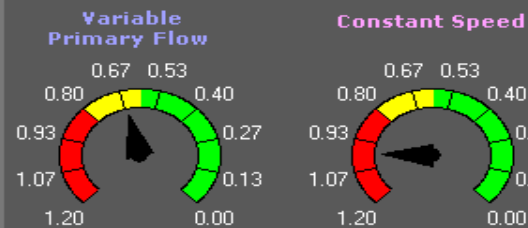
kW-HOUR



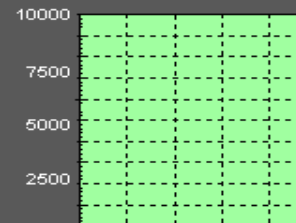
Variable Primary Flow  
(VS CHW Pump, Fixed CW Pump, VS Chiller,  
VS Tower Fan, Fixed LTWT)



PLANT kW/TON



kW-HOUR



## Summary Chart

Cumulative Day \$ Savings  
Cumulative Day % Savings  
Annual Energy Savings

All Variable Speed Plant with HARTMAN LOOP®  
Control over Variable Primary Flow Plant

\$ 1

49 %

47 %

All Variable Speed Plant with HARTMAN LOOP®  
Control over Constant Speed Chiller Plant

\$ 3

66 %

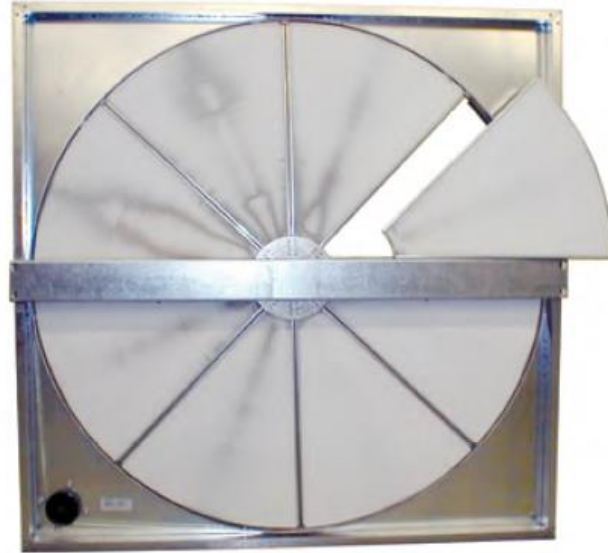
67 %

## UNIDADES MANEJADORAS (UMAS) TOTALMENTE EN PAQUETE





## UNIDAD MANEJADORA Y FANCOILS O EVAPORADORAS



▲ Factory installed AAONAIRE® energy recovery wheel saves heating and cooling energy.



## EVAPORADORA Y RUEDA ENTALPICA

# MANEJADORA PARA AIRE PRIMARIO



# MANEJADORA DE AIRE (UMA) - DIAGRAMA

Se aprecia:

Dámpers con sensor de entalpía en la entrada de aire fresco y de retorno.

Sensor MAT de temperatura de ingreso.

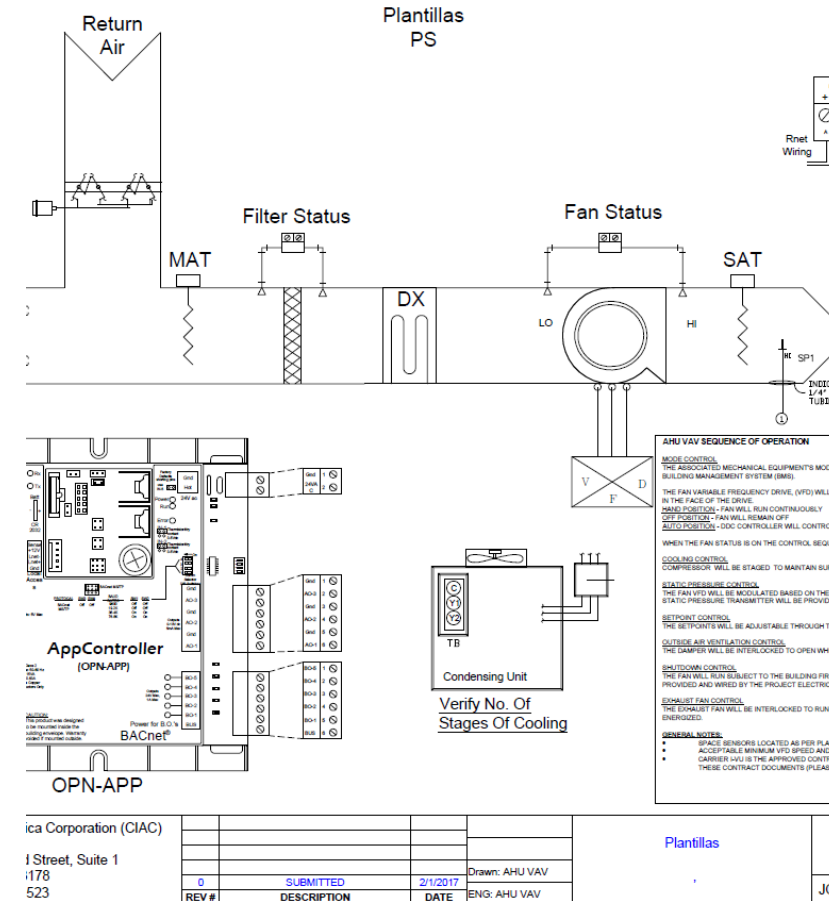
Filtro con sensor diferencial de presión.

El serpentín.

El Ventilador con VFD y sensores de presión.

El sensor de temperatura de salida de aire – SAT

Sensor de presión de salida controla velocidad del Ventilador.





**MANEJADORAS PEQUEÑAS  
HORIZONTALES COLGADAS DE  
TECHO**

# FANCOIL CON DUCTO



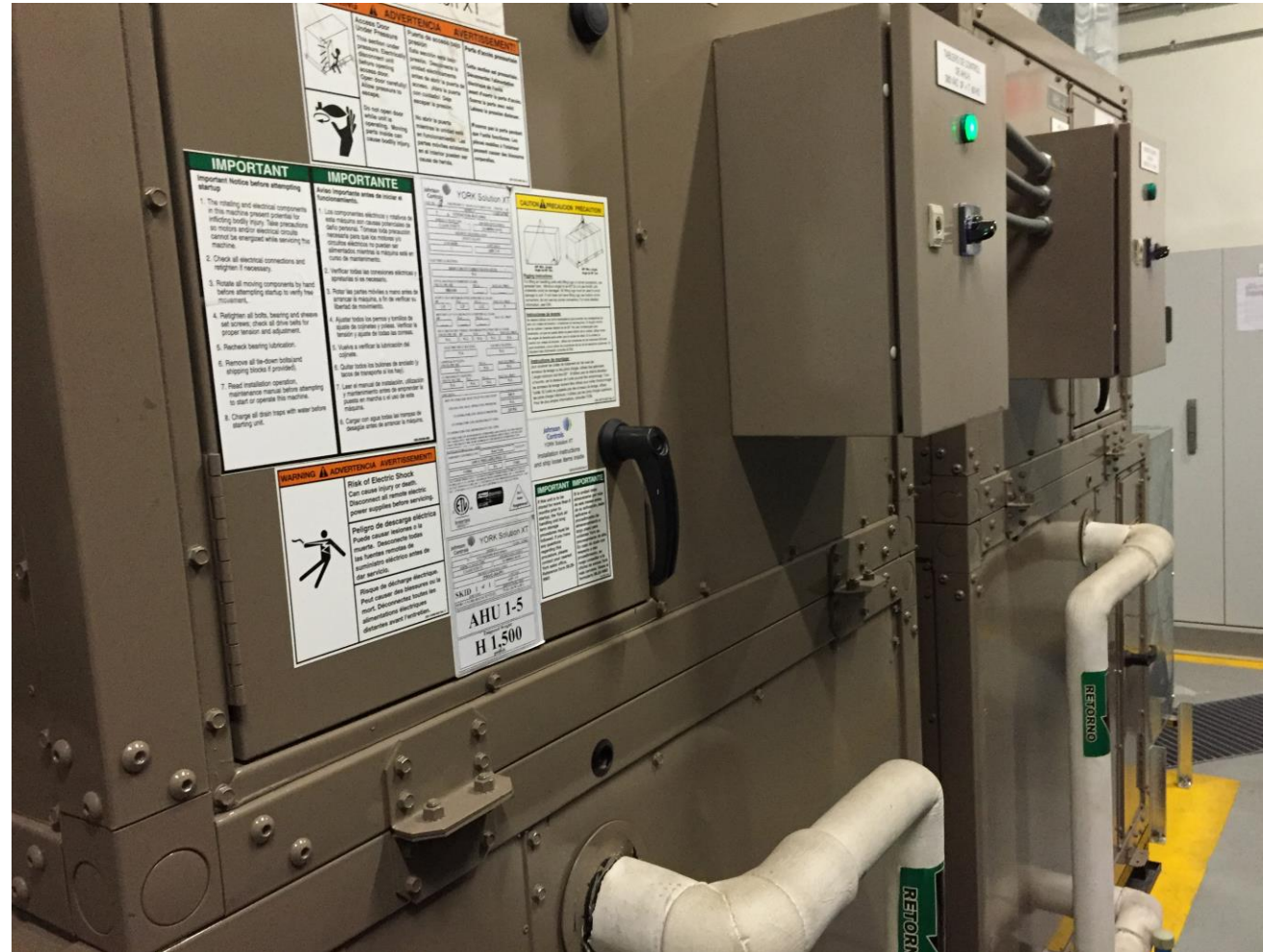


FANCOIL O EVAPORADOR DENTRO  
DE CIELO RASO

## FAN COIL / EVAPORADOR TIPO CASSETTE



# EL EQUIPO DE PRECISIÓN CON AGUA HELADA, TAMBIÉN PUEDE SER CON REFRIGERANTE O DRY COOLER.



# CONDENSADORA CONVENCIONAL Y DE EQUIPO DE PRECISIÓN.



# UNIDADES CONDENSADORAS



- ▲ Copper fins, stainless steel casing, and polymer e-coatings protect the coils from corrosion.



- ▲ Factory Installed AAONAIR® energy recovery wheel saves heating and cooling energy.

# DIFUSORES Y REJILLAS









# NACH ASIEN ÜBER MOSKAU

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DIE BESTE FLUGGESELLSCHAFT  
OSTEUROPAS  
2015



2015 TRAVELLERS'  
CHOICE  
FAVORITES



| Type of area       | Recommended NC or<br>RC range (dB) |
|--------------------|------------------------------------|
| Hotel guest rooms  | 30–35                              |
| Office             |                                    |
| Private            | 30–35                              |
| Conference         | 25–30                              |
| Open               | 30–35                              |
| Computer equipment | 40–45                              |
| Hospital, private  | 25–30                              |
| Churches           | 25–30                              |
| Movie theaters     | 30–35                              |

## NIVELES DE RUIDO RECOMENDADO

# CIUDADES MAS CONTAMINADAS EN EL MUNDO, 2010



## The Most Polluted Places in the World

**5 million**  
people are poisoned  
everyday in the  
developing world

**1**

### Sumgayit, Azerbaijan

- 250,000 potentially affected
- 40 factories manufacturing chemicals
- 120,000 tons of harmful emissions
- Cancer rates 51% higher than average

**6**

### La Oroya, Peru

- Population of 35,000 and a poly-metallic smelter.
- 99% have blood lead levels exceeding acceptable limits
- Very high rates of premature deaths
- Vegetation destroyed by acid rain

**9**

### Chernobyl, Ukraine

- Location of the world's worst nuclear disaster
- 20 years after the disaster the exclusion zone still remains uninhabitable
- 5 million people inhabit the affected area around Chernobyl
- Infertility and birth defects remains high

**7**

### Dzerzhinsk, Russia

- 300,000 tons of chemical waste was disposed here between 1930 and 1998
- In certain places the water has levels of dioxins 17 million times higher than what is deemed safe
- In 2003 the death rate exceeded birth rate by 260%
- Average life expectancy for men is 42

**8**

### Norilsk, Russia

- Contains world's largest heavy metal smelting complex
- 2million tons of sulphur dioxide is released into the air annually
- Life expectancy for factory workers is 10 years less than Russian average
- 15.8% of deaths among children are caused by respiratory diseases

**2**

### Linfen, China

- 3 million affected
- Provides 2/3 of nation's coal energy
- Worst air quality in China, pollutants include arsenic and sulphur dioxide
- High rates of lead poisoning in children

**3**

### Tianying, China

- 140,000 affected
- Largest lead production base in China
- Lead concentrations are 10x higher than national health standards
- 85% of air samples have lead concentrations

**4**

### Sukinda, India

- Contains 97% of India's chromite ore
- 30 million tons of waste rock
- 60% of drinking water contains twice the national standard of hexavalent chromium
- 2.6 million potentially affected

**5**

### Vapi, India

- 400 km belt of industrial estates
- Waste products include heavy metals, cyanides, pesticides and other toxins
- Mercury in the groundwater is 96 times higher than WHO standards
- Very high incidences of respiratory diseases and numerous cancers

**10**

### Kabwe, Zambia

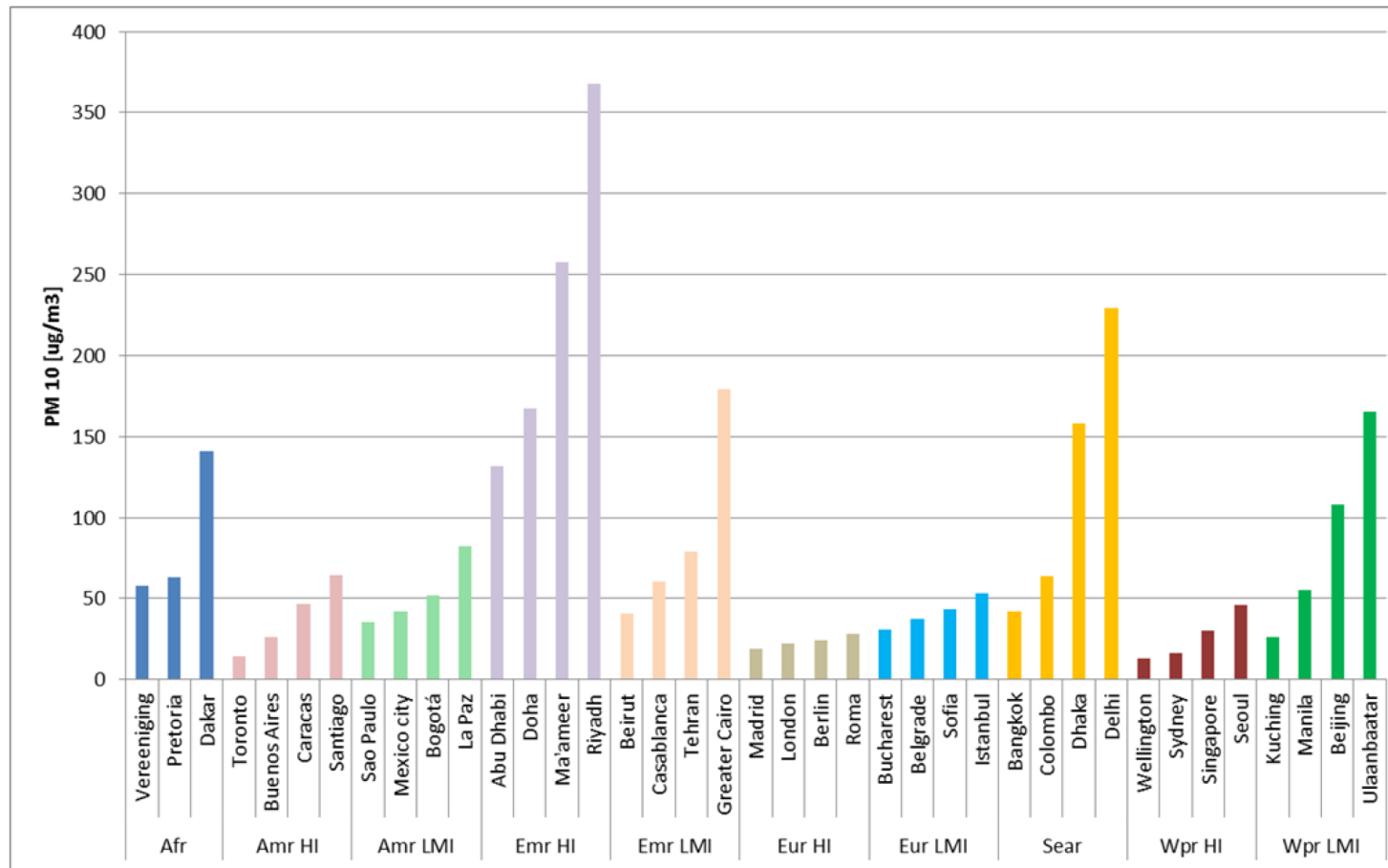
- Mining and smelting of zinc and lead began in 1902 and ran until 1994
- Most workers and residents of the area have been exposed to toxic levels of lead due to a waterway running from the mine to town and the inhalation of dust
- In many cases children's blood lead levels are regarded as potentially fatal

**25%**  
of all deaths in the  
developing world  
are attributable  
to environmental  
factors

Water  
pollution causes  
**14,000**  
deaths a day

# ÍNDICE PM<sub>10</sub> (UG/M<sup>3</sup>) DE CIUDADES EN EL MUNDO 2011-2015

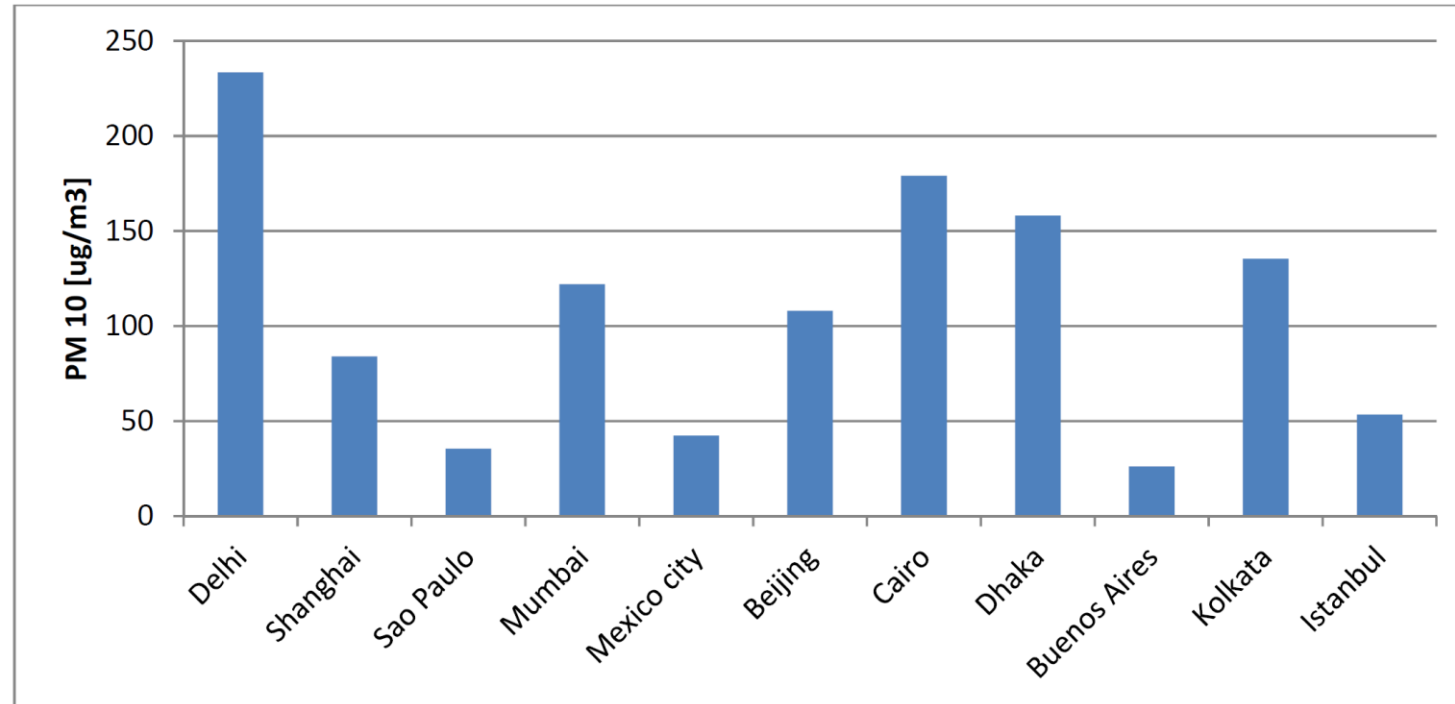
**Figure 3:** *PM<sub>10</sub> levels for selected<sup>2</sup> cities by region, for the last available year in the period 2011-2015.*



PM<sub>10</sub>: Fine particulate matter of 10 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income.

# CONTAMINACIÓN (ÍNDICE PM 10) EN CIUDADES ESPECIFICAS.

**Figure 4:**  $PM_{10}$  levels for available mega-cities of more than 14 million habitants for the last available year in the period 2011-2015.



PM<sub>10</sub>: Fine particulate matter of 10 microns or less.

<sup>2</sup> Selection criteria: for year of measurement 2011 or more recent, the largest city for each country within a region (or two cities for one country if only 2 countries available in the region. City size ranges from 140'000 to 26 million habitants.

# CALIFICACION DE FILTROS SEGÚN ASHRAE COMPARACION 52.2 CON 52.1

Desde MERV 1 hasta MERV 20

| Std. 52.2<br>Minimum<br>Efficiency<br>Reporting Value<br>(MERV) | Approx. Std. 52.1 Results |            | Application Guidelines                                                                                                                                                                                               |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|---------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                 | Dust Spot<br>Efficiency   | Arrestance | Typical Controlled<br>Contaminant                                                                                                                                                                                    | Typical Applications<br>and Limitations                                                                    | Typical Air<br>Filter /Cleaner Type                                                                                                                                                                                                                                                                                       |
| 20                                                              | n/a                       | n/a        | <0.30 <span>µ</span> m Particle Size<br>Virus (unattached)<br>Carbon dust<br>Sea salt<br>All combustion smoke<br>Radon progeny                                                                                       | Cleanrooms<br>Radioactive materials<br>Pharmaceutical mfg.<br>Carcinogenic materials<br>Orthopedic surgery | <b>HEPA/ULPA Filters</b><br>>99.999% efficiency on 0.10-0.20 <span>µ</span> m particles, IEST Type F<br>>99.999% efficiency on 0.30 <span>µ</span> m particles, IEST Type D<br>> 99.99% efficiency on 0.30 <span>µ</span> m particles, IEST Type C<br>> 99.97% efficiency on 0.30 <span>µ</span> m particles, IEST Type A |
| 19                                                              | n/a                       | n/a        |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 18                                                              | n/a                       | n/a        |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 17                                                              | n/a                       | n/a        |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 16                                                              | n/a                       | n/a        | 0.30-1.0 <span>µ</span> m Particle Size<br>All bacteria<br>Most tobacco smoke<br>Droplet nuclei (sneeze)<br>Cooking oil<br>Most smoke<br>Insecticide dust<br>Copier toner<br>Most face powder<br>Most paint pigments | Hospital inpatient care<br>General surgery<br>Smoking lounges<br>Superior commercial buildings             | <b>Bag Filters</b> Nonsupported (flexible) micorfine fiberglass or synthetic media. 300 to 900 mm (12 to 36 inch) deep , 6 to 12 pockets.<br><b>Box Filters</b> Rigid style cartridge filters 150 to 300 mm (6 to 12 inch) deep may be use lofted (air laid) or paper (wet laid) media.                                   |
| 15                                                              | >95%                      | n/a        |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 14                                                              | 90-95%                    | >98%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 13                                                              | 80-90%                    | >98%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 12                                                              | 70-75%                    | >95%       | 1.0-3.0 <span>µ</span> m Particle Size<br>Legionella<br>Humidifier dust<br>Lead dust<br>Milled flour<br>Coal dust<br>Auto emissions<br>Nebulizer drops<br>Welding fumes                                              | Residential<br>Better commercial buildings<br>Hospital laboratories                                        | <b>Bag Filters</b> Nonsupported (flexible) micorfine fiberglass or synthetic media. 300 to 900 mm (12 to 36 inch) deep , 6 to 12 pockets.<br><b>Box Filters</b> Rigid style cartridge filters 150 to 300 mm (6 to 12 inch) deep may be use lofted (air laid) or paper (wet laid) media.                                   |
| 11                                                              | 60-65%                    | >95%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 10                                                              | 50-55%                    | >95%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 9                                                               | 40-45%                    | >90%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 8                                                               | 30-35%                    | >90%       | 3.0-10.0 <span>µ</span> m Particle Size<br>Mold<br>Spores<br>Hair spray<br>Fabric protector<br>Dusting aids<br>Cement dust<br>Pudding mix<br>Powdered milk                                                           | Commercial buildings<br>Better residential<br>Industrial workplaces<br>Paint booth inlet air               | <b>Pleated Filters</b> Disposable, extended surface, 25 to 100 mm (1 to 4 inch) thick with cotton-polyester blend media, cardboard frame.<br><b>Cartridge Filters</b> Graded density viscous coated cube or pocket filters, synthetic media.<br><b>Throwaway</b> Disposable synthetic media panel filter.                 |
| 7                                                               | 25-30%                    | >90%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 6                                                               | <20%                      | 85-90%     |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 5                                                               | <20%                      | 80-85%     |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 4                                                               | <20%                      | 70-80%     | >10. 0 <span>µ</span> m Particle Size<br>Pollen<br>Spanish moss<br>Dust mites<br>Sanding dust<br>Spray paint dust<br>Textile fibers<br>Carpet fibers                                                                 | Minimum filtration<br>Residential<br>Window air conditioners                                               | <b>Throwaway</b> Disposable fiberglass or synthetic panel filters.<br><b>Washable</b> Aluminum mesh, latex coated animal hair, or foam rubber panel filter.<br><b>Electrostatic</b> Self charging (passive) woven polycarbonate panel filter.                                                                             |
| 3                                                               | <20%                      | 70-75%     |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 2                                                               | <20%                      | 65-70%     |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |
| 1                                                               | <20%                      | <65%       |                                                                                                                                                                                                                      |                                                                                                            |                                                                                                                                                                                                                                                                                                                           |

**POR LO TANTO HAY QUE ESPECIFICAR BIEN LOS FILTROS Y LA ACTUAL CARACTERIZACIÓN DE FILTROS DE AIRE ES POR MERV**

| Estándar 52.2<br>Reporte Valor<br>Mínimo de<br>Eficiencia MERV | Composición Promedio del tamaño de<br>partículas y la eficiencia.<br>% en rango de micrones (µm) |                        |                         | Caída de Presión |       |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------|-------------------------|------------------|-------|
|                                                                | Rango 1<br>( 0.3-1.0 )                                                                           | Rango 2<br>( 1.0-3.0 ) | Rango 3<br>( 3.0-10.0 ) | PA               | IN.CA |
| 1                                                              | n/a                                                                                              | n/a                    | E3=20                   | 75               | 3     |
| 2                                                              | n/a                                                                                              | n/a                    | E3=20                   | 75               | 3     |
| 3                                                              | n/a                                                                                              | n/a                    | E3=20                   | 75               | 3     |
| 4                                                              | n/a                                                                                              | n/a                    | E3=20                   | 75               | 3     |
| 5                                                              | n/a                                                                                              | n/a                    | 20=E3=35                | 150              | 6     |
| 6                                                              | n/a                                                                                              | n/a                    | 35=E3=50                | 150              | 6     |
| 7                                                              | n/a                                                                                              | n/a                    | 50=E3=70                | 150              | 6     |
| 8                                                              | n/a                                                                                              | n/a                    | 70=E3                   | 150              | 6     |
| 9                                                              | n/a                                                                                              | E2=50                  | 85=E3                   | 250              | 1.0   |
| 10                                                             | n/a                                                                                              | 50=E2=65               | 85=E3                   | 250              | 1.0   |
| 11                                                             | n/a                                                                                              | 65=E2=80               | 85=E3                   | 250              | 1.0   |
| 12                                                             | n/a                                                                                              | 80=E2                  | 90=E3                   | 250              | 1.0   |
| 13                                                             | e1<75                                                                                            | 90=E2                  | 90=E3                   | 350              | 1.4   |
| 14                                                             | 75=E1=85                                                                                         | 90=E2                  | 90=E3                   | 350              | 1.4   |
| 15                                                             | 85=E1=95                                                                                         | 90=E2                  | 90=E3                   | 350              | 1.4   |
| 16                                                             | 95=E1                                                                                            | 95=E2                  | 95=E3                   | 350              | 1.4   |

*Tabulador de la Asociación Nacional de Filtración de EU extraída de la prueba ANSI/ASHRAE 52.2-2007. Titulada como "Método para Probar la Eficiencia de Dispositivos de Ventilación Limpiadores Aire agrupados por tamaño de partículas.*

**PARA APLICACIÓN  
SE RECOMIENDA:**

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Fancoil Merv 4

---

Prefiltro, Merv 4 a Merv 8.

---

Filtros de alta performance de Merv 8  
a Merv 14

---

Hospitales de Merv. 15 a Merv 18 (20);  
los mayores en Salas de Operaciones.

## FILTRO CLASIFICADO POR NORMA EN NO INDICA MERV

### AIROPAC TRADITIONAL

Compact Pleated Filter



#### ADVANTAGES

- Large surface area
- Rigid design concept
- High dust holding capacity
- Low pressure drop
- Robust metal header frame

|                                        |                                                                                 |
|----------------------------------------|---------------------------------------------------------------------------------|
| Application                            | Air conditioning applications and preparatory filtration in clean-rooms         |
| Type                                   | Compact Pleated Filter                                                          |
| Frame                                  | Galvanised steel                                                                |
| Gasket                                 | Polyurethane                                                                    |
| Media                                  | Glass fiber                                                                     |
| Separator                              | Aluminium                                                                       |
| Sealant                                | Polyurethane                                                                    |
| Dimensions                             | Filter front dimensions according EN 15805                                      |
| Rec. final pressure drop acc. EN 13053 | Initial pressure drop + 100 Pa or initial pressure drop x3 (whichever is lower) |
| Max airflow                            | 1,15 x nominal flow                                                             |
| Temperature max                        | 110°C                                                                           |
| RH. max                                | 100%                                                                            |
| Mounting/Frames                        | Front and side access housings and frames are available                         |



ASTRO-GUARD™



Also Available  
Anti-Microbial



Also Available  
Activated Carbon

## Attic Replacement Filters

### Astro-Guard™ Whole House Replacement Attic Filters

Astro-Guard™ offers a full line of OEM (Original Equipment Manufacturer) replacements for **Honeywell™**, **Air Bear™**, **Aprilaire™** / **Spaceguard™** and **White Rodgers™** whole house attic filters.

Utilizing 100% synthetic fibers or cotton poly with high initial efficiency **Astro-Guard™** attic filters will not promote the growth of bacteria, mold, mildew, or fungi in normal operating environments.

**Astro-Guard™** extends the life of your air conditioning / furnace system by allowing the system to work more efficiently and economically and are specifically designed to last up to 12 months depending on environmental conditions.



SYNTHETIC

#### Filtered Contaminants

MERV8

MERV11

MERV13



#### Typical Applications



# FLO-PAK<sup>TM</sup> FILTERS



## Flo-Pak<sup>TM</sup> Extended Surface Pocket Filters

Engineered to withstand demanding applications, Flo-Pak<sup>TM</sup> MERV 11, MERV 13, MERV14 and MERV16 synthetic pocket filters now utilize an ultra sonic welded design.

Years of development and the highest quality raw materials available are combined to create a pocket filter that is unmatched in performance and value.

Flo-Pak<sup>TM</sup> extended surface pocket filter was developed to provide dependable performance in commercial and industrial applications.

### Standard Filter Sizes

#### 3 & 4 Pocket (H x W)

24 x 12    24 x 12    24 x 12

#### 5 & 7 Pocket (H x W)

20 x 20    20 x 20    20 x 20  
24 x 20    24 x 20    24 x 20

#### 6 & 8 Pocket (H x W)

12 x 24    12 x 24    12 x 24  
20 x 24    20 x 24    20 x 24  
24 x 24    24 x 24    24 x 24

12-Inch Width Only 3 & 4 Pockets Available  
20-Inch Width Only 5 & 7 Pockets Available  
24-Inch Width Only 6, 8, 10 & 12 Pockets Available



## Pocket Filters



### Filtered Contaminants

| MERV11      | MERV13      | MERV14      | MERV16      |
|-------------|-------------|-------------|-------------|
| MERV11 PLUS | MERV13 PLUS | MERV14 PLUS | MERV16 PLUS |
|             |             |             |             |
|             |             |             |             |
|             |             |             |             |
|             |             |             |             |

### Typical Applications



Disinfectant Pocket Filters

# EL FILTRO HEPA

- PUEDE LLAGAR DESDE 95% HASTA 99.7% en 0,30 MICROMETROS.
- IDEAL EN HOSPITALES Y LABORATORIOS, PRINCIPALMENTE.

## HEPA FILTERS

Each Alpha Cell HEPA Filter has a minimum efficiency of 99.97% on 0.30 micrometer size particles when tested at rated capacity on a Q-107 Penetrometer. Filters rated for 1000 cfm or less are challenged with an approved nearly monodis-

## Higher Efficiency ULPA Filters

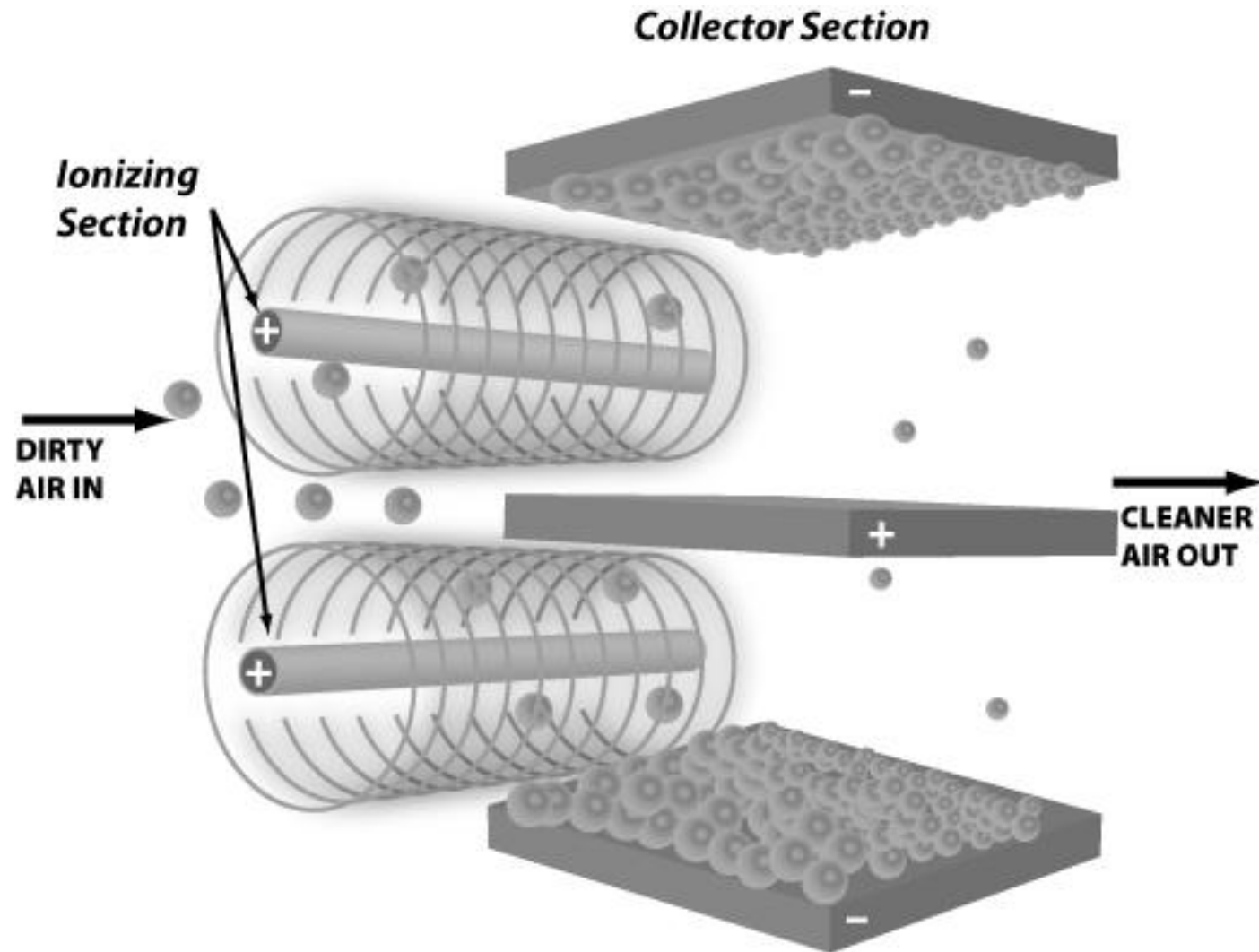
Flanders can provide Pureform® and Separator Style ULPA Filters with efficiencies up to 99.9995% on 0.12 micrometer size particles. Please contact the factory for more information.

### Typical applications for Alpha Cell Filters include:

- Hospitals
- Biomedical
- Pharmaceutical
- Biotechnology
- Genetic Research
- Universities
- Laboratories
- Food Processing
- Photo Processing
- Semiconductor Fabrication
- Industrial Processing Systems



# FILTRACIÓN ESTÁTICA.

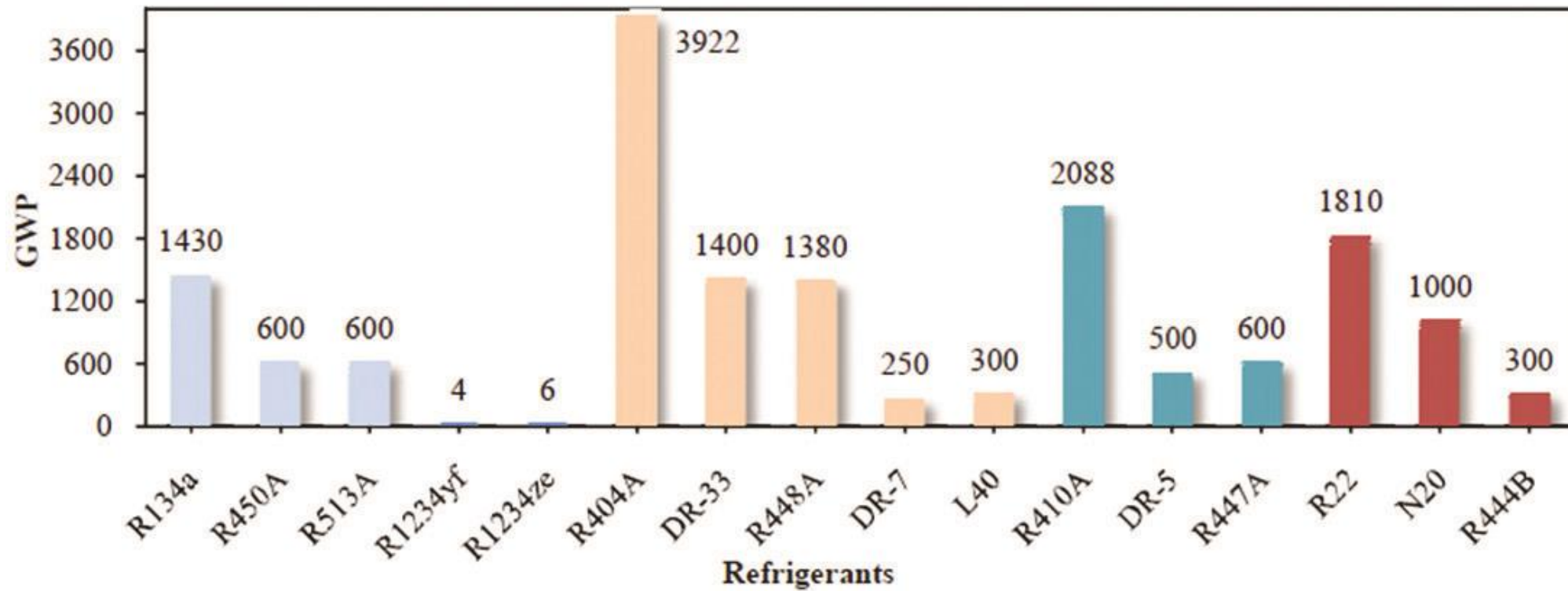


# LOS REFRIGERANTES ECOLÓGICOS DE ESTA GENERACIÓN

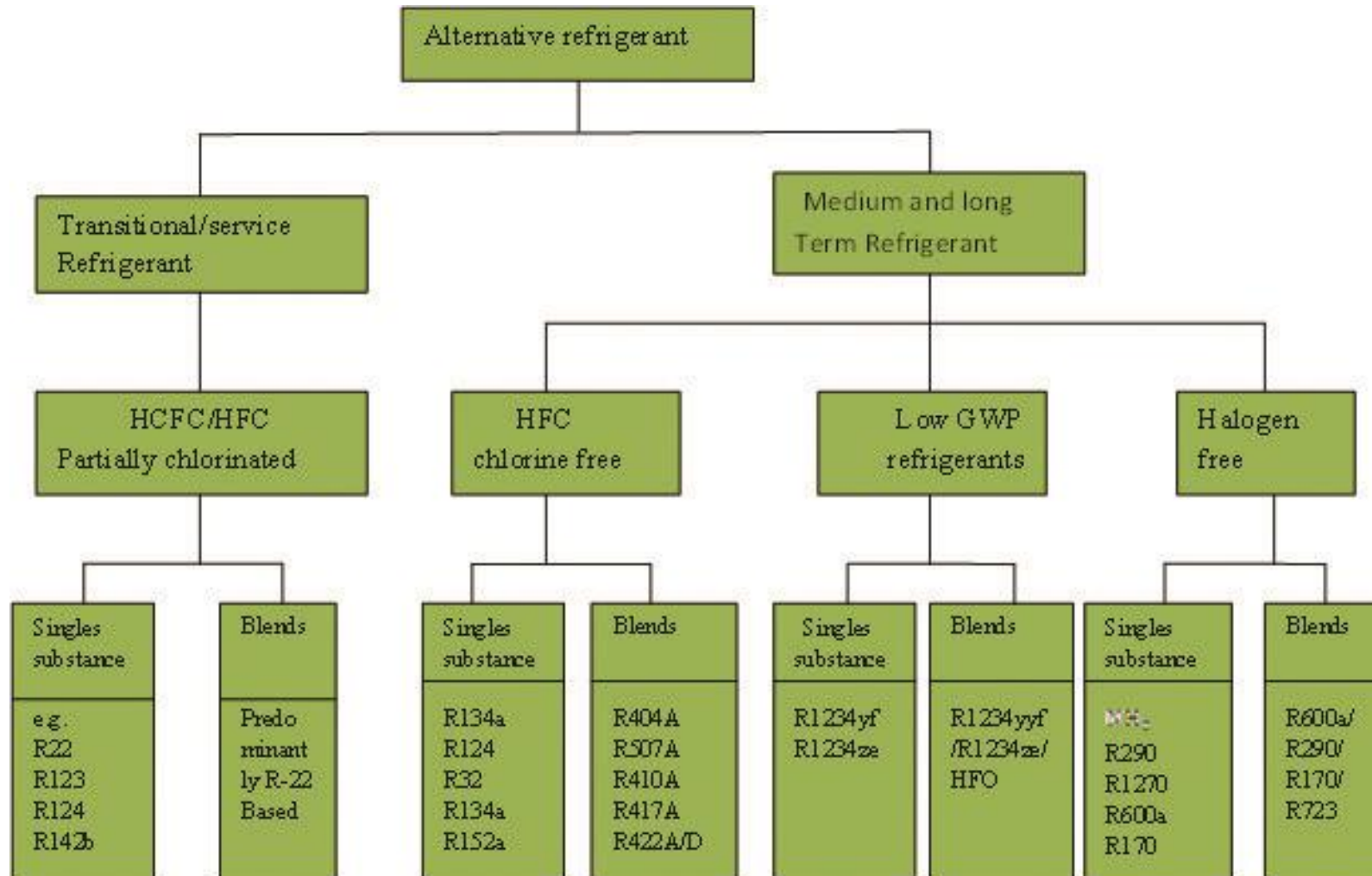
**Table 3: Properties of third generation refrigerants**

| R number | M Kg/kmol | NBP (°C) | GT (°C) | CP Bar | Temp. glide (°C) | Safety Group | GWP   |
|----------|-----------|----------|---------|--------|------------------|--------------|-------|
| R-32     | -52.02    | -51.65   | 78.11   | 57.8   | 0                | A2L1         | 580   |
| R-134A   | 102.03    | -26.07   | 101.06  | 40.6   | 0                | A1           | 1300  |
| R-404A   | 97.6      | -46.6    | 72.14   | 37.4   | 0.46             | A1           | 3800  |
| R-407C   | 86.2      | -43.8    | 86.05   | 46.3   | 5.59             | A1           | 1600  |
| R-410A   | 72.59     | -51.6    | 70.17   | 47.7   | 0.1              | A1           | 1900  |
| R-507    | 98.86     | -47.1    | 70.75   | 37.2   | 0                | A1           | 4000  |
| R-508A   | 100.1     | -87.4    | 11.01   | 37.0   | 0                | A1           | 13000 |

## LOS ACTUALES E INMEDIATOS



# LA ALTERNATIVA DE REFRIGERANTE ECOLÓGICOS



## INFORMACION DE LOS REFRIGERANTES EN EUROPA

|              | <i>CARACTERISTICAS</i> |      |             |             |                    |              |                             |
|--------------|------------------------|------|-------------|-------------|--------------------|--------------|-----------------------------|
| <i>GASES</i> | ODP                    | PCA  | Precio €/kg | Impuesto/kg | Deslizamiento (°C) | Cargas (Kgs) | TEWI (Kgs CO <sub>2</sub> ) |
| R134A        | 0                      | 1300 | 6,06        | 26          | 0                  | 1,3          | 18857,961                   |
| R450A        | 0                      | 547  | 16,11       | 10,94       | 0,79               | 1,73         | 19398,011                   |
| R1234ze      | 0                      | 7    | 29,33       | 0           | 0                  | 0,89         | 17880,629                   |
| R1234yf      | 0                      | 4    | 155,56      | 0           | 0                  | 1            | 17934,869                   |
| R422D        | 0                      | 2623 | 13,79       | 52,46       | 4,5                | 1,3          | 26555,847                   |
| R434A (M T°) | 0                      | 3131 | 15,01       | 62,62       | 1,5                | 1,52         | 28378,535                   |
| R513A        | 0                      | 572  | 24,8        | 11,44       | 0                  | 1,005        | 17666,265                   |
| R404A (M T°) | 0                      | 3784 | 7,69        | 75,68       | 0,7                | 1,5          | 39212,729                   |
| R407F        | 0                      | 1705 | 8,61        | 34,1        | 6,4                | 1,2          | 33581,666                   |
| R438A        | 0                      | 2151 | 13,5        | 43,03       | 4                  | 1,205        | 34811,964                   |
| R442A (M T°) | 0                      | 1793 | 9,94        | 35,86       | 4,6                | 1,2          | 35453,577                   |
| R404A (B T°) | 0                      | 3784 | 7,69        | 75,68       | 0,7                | 1,5          | 31572,9                     |
| R442A (B T°) | 0                      | 1793 | 9,94        | 35,86       | 4,6                | 1,2          | 27531,033                   |
| R448A        | 0                      | 1300 | 17,24       | 26          | 6                  | 1,25         | 24158,583                   |
| R449A        | 0                      | 1307 | 16,25       | 26,15       | 6                  | 1,02         | 22613,79                    |
| R434A (B T°) | 0                      | 3131 | 15,01       | 62,62       | 1,5                | 1,52         | 29304,84                    |
| R452A        | 0                      | 2067 | 23,90       | 41,34       | 3                  | 1,12         | 23434,583                   |
| R453A        | 0                      | 1664 | 13,835      | 33,28       | 4,2                | 1,13         | 23598,714                   |

# LAS TUBERÍAS



## TUBERÍAS PARA UNA OFICINA ALQUILER/VENTA





**TUBERÍAS DE AGUA HELADA, DIÁMETRO CONSIDERABLE, CON CHAQUETA**



**TAMBIÉN DE POLIPROPILENO PPR  
CERTIFICACIÓN ASTM/EN**

**CONTROLES  
EJEMPLOS  
SIMPLES Y  
ESPECIALES  
EL MANÓMETRO  
INDICADOR.**





**EL TERMOSTATO  
INDICADOR**

## EL TRANSMISOR DE CO<sub>2</sub> DE PARED

Requerido en Proyectos Leed, para controlar el Aire Fresco.

Muy conveniente en Aulas, Auditorios, Foyer, etc.

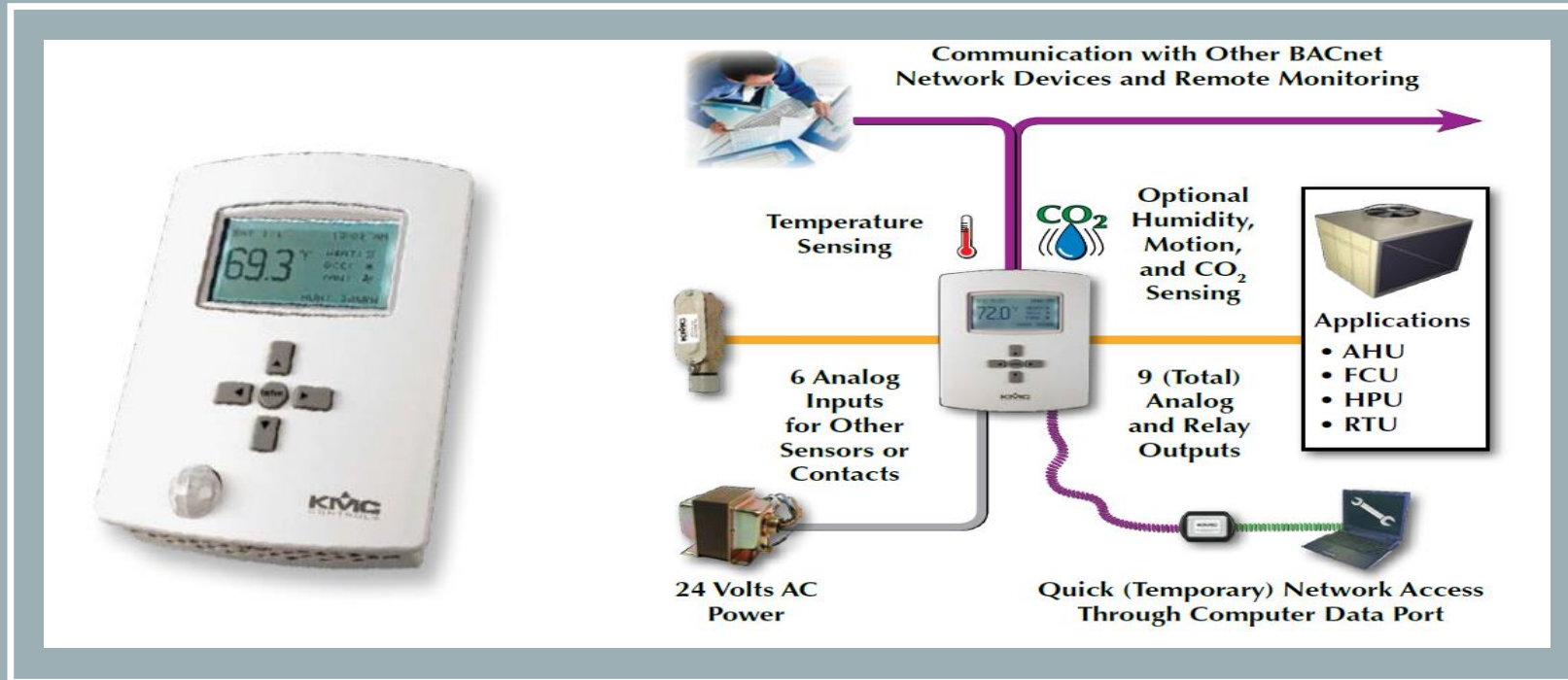


**Figure 1: Wall Mount CO<sub>2</sub> Transmitter with Logo**

**EL TRANSMISOR  
DIFERENCIAL DE  
PRESION, MUY  
USADO EN  
FILTROS.**



**DPT-2015 Differential Pressure  
Transmitter**



**SENSOR DE MOVIMIENTO**

## MEDIDOR Y TRANSMISOR DE FLUJO DE AIRE



Code No. LIT-1900559  
Issued July 15, 2013

### AD-1250 Airflow Measuring Station

#### Description

The AD-1250 Airflow Measuring Stations are accurate, economical solutions for measuring, reporting, and controlling airflow from 300 to 5,000 Feet Per Minute (FPM) (91 to 1,524 Meters per Minute [MPM]) within  $\pm 5\%$  accuracy.

The factory-assembled AD-1250 Airflow Measuring Station incorporates the following items in one 15 inch (38 mm) deep assembly:

- an ultra-low-leak, high-performance, aluminum airfoil blade/aluminum frame control damper
- an aluminum air straightener
- multiple AD-1251 Airflow Sensing Probes
- a DMPR-RA001 Differential Pressure Transducer (DPT)
- galvanized steel sleeve
- M9220-GGC-3 Electric Spring Return Actuators (optional)

Refer to the *M9220-xxx-3 Electric Spring Return Actuators Product Bulletin (LIT-12011057)* for necessary information on operating and performance specifications for the actuator.

#### Features

- Air Movement and Control Association International, Inc. (AMCA) Class IA Damper
- Flanged or Slip Fit Mounting Available
- Vertical Anodized Aluminum Sensing Blades
- Factory-Piped DPT with Display
- Factory-Installed Actuator

#### Repair Information

If the AD-1250 Airflow Measuring Station fails to operate within its specifications, replace the unit. For a replacement AD-1250 Airflow Measuring Station, contact the nearest Johnson Controls® representative.

All AD-1250 Airflow Measuring Stations are built to order and cannot be returned due to ordering errors. Airflow measuring stations are backed by a 1-year warranty, which covers defects in materials or workmanship. Refer to terms and conditions of sale for specifics.



AD-1250 Airflow Measuring Station

## ACCESORIOS SOPORTES DE RESORTES



Conceptos para la comparación de la Performance el kW/Ton es expresado  
como COP o EER, También EERS  
Ratios de eficiencia

Full Load units kW/Ton

$$\frac{\text{Electrical Power Input}}{\text{Refrigeration Capacity}} = \frac{\text{kW}}{\text{Ton}} \xrightarrow{\text{@ ARI STD}} 0.576 \text{ kW/Ton}$$

Coefficient of Performance (COP)\*<sub>cooling</sub>

$$\frac{\text{Refrigeration Capacity}}{\text{Electrical Power Input}} = \frac{\text{kW}}{\text{kW}} \xrightarrow{\text{@ ARI STD}} 6.1 \text{ (unitless)}$$

Coefficient of Performance (COP)<sub>heating</sub>

$$\frac{\text{Heating Capacity}}{\text{Electrical Power Input}} = \frac{\text{kW}}{\text{kW}} \xrightarrow{\text{}} 3.4 \text{ (unitless)}$$

Coefficient of Performance (COP)<sub>heating & cooling</sub>

$$\frac{(\text{Heating} + \text{Refrigeration}) \text{ Capacity}}{\text{Electrical Power Input}} = \frac{\text{kW}}{\text{kW}} \xrightarrow{\text{}} 7.4 \text{ (unitless)}$$

\*90.1 specifies performance in COP  
To convert from kW/Ton: COP = 1 / (kW/Ton X 0.284)

## CONCEPTOS PARA LA COMPARACIÓN DE LA PERFORMANCE, IPLV ES EL PROMEDIO PONDERADO DE UN EQUIPO, APLICANDO AHRI.

$$\text{IPLV (or NPLV)} = 0.01A + 0.42B + 0.45C + 0.12D$$

Where:

A = COP or EER @ 100% Load

B = COP or EER @ 75% Load

C = COP or EER @ 50% Load

D = COP or EER @ 25% Load

For the purpose of chiller equipment, the operational conditions are shown in Table 3 of AHRI Standard 550/590-2003. A water cooled chiller, for example, is required to run

## EL CASO DEL COP DEL VRF CON CALEFACCIÓN.

VRF-HR mixed mode operation leads to energy savings as both ends of the thermodynamic cycle are delivering useful heat exchange. If a system has a cooling COP (Coefficient of Performance) of 3, and a heating COP of 4, then heat recovery operation could yield a COP as high as 7. It should be noted that this perfect balance of heating and cooling demand is unlikely to occur for many hours each year, but whenever mixed mode is used energy is saved. Units are now available to deliver the heat removed from space cooling into hot water for space heating, domestic hot water or leisure applications, so that mixed mode is utilized for more of the year.

# CUAL ES LA EFICIENCIA EN CHILLERS CONVENCIONALES, SIN VFD EN GENERAL.

## Efficiency Recommendations ARI Standard 550/590

### Air Cooled Chillers

| Compressor Type & Capacity    | <i>Part Load Optimized</i> |                              | <i>Full Load Optimized</i>     |                                   |
|-------------------------------|----------------------------|------------------------------|--------------------------------|-----------------------------------|
|                               | Recommended IPLV (kw/ton)  | Best Available IPLV (kw/ton) | Recommended Full Load (kw/ton) | Best Available Full load (kw/ton) |
| Scroll (30 - 60 tons)         | 0.86 or less               | 0.83                         | 1.23 or less                   | 1.10                              |
| Reciprocating (30 - 150 tons) | 0.90 or less               | 0.80                         | 1.23 or less                   | 1.00                              |
| Screw (70 - 200 tons)         | 0.98 or less               | 0.83                         | 1.23 or less                   | 0.94                              |

### Water Cooled Chillers

| Compressor Type & Capacity     | <i>Part Load Optimized</i> |                              | <i>Full Load Optimized</i>     |                                   |
|--------------------------------|----------------------------|------------------------------|--------------------------------|-----------------------------------|
|                                | Recommended IPLV (kw/ton)  | Best Available IPLV (kw/ton) | Recommended Full Load (kw/ton) | Best Available Full load (kw/ton) |
| Centrifugal (150 - 299 tons)   | 0.52 or less               | 0.47                         | 0.59 or less                   | 0.50                              |
| Centrifugal (300 - 2,000 tons) | 0.45 or less               | 0.38                         | 0.56 or less                   | 0.47                              |
| Rotary Screw greater 150 tons  | 0.49 or less               | 0.46                         | 0.64 or less                   | 0.58                              |

# CALCULO DE UN CASO CON 2 CHILLERS ENFRIADOS POR AGUA DE ALTA EFICIENCIA, MODERNOS.

| PERFOMANCE DE CADA CHILLER                                                              |                 |            |            |          |             | DATOS CHILLER 2             |            |            |                  |            |       |      |  |  |  |
|-----------------------------------------------------------------------------------------|-----------------|------------|------------|----------|-------------|-----------------------------|------------|------------|------------------|------------|-------|------|--|--|--|
|                                                                                         | DATOS CHILLER 1 |            |            |          |             | 100%                        | 75%        | 50%        | 25%              |            |       |      |  |  |  |
| INFO FABRICANTE/AHRI                                                                    | 100%            | 75%        | 50%        | 25%      |             | 0.5579                      | 0.4305     | 0.3168     | 0.3171           |            |       |      |  |  |  |
| PERFORMANCE A % CARGA KW/TON                                                            | 0.5723          | 0.4187     | 0.2859     | 0.2604   |             | 0.01                        | 0.42       | 0.45       | 0.12             |            |       |      |  |  |  |
| TIEMPO OPERACIÓN A % CARGA                                                              | 0.01            | 0.42       | 0.45       | 0.12     |             |                             |            |            |                  |            |       |      |  |  |  |
|                                                                                         |                 |            |            |          |             |                             |            |            |                  |            |       |      |  |  |  |
| CALCULOS                                                                                |                 |            |            |          |             | 10                          | 10         | 10         | 10               |            |       |      |  |  |  |
| Horas/dia                                                                               | 10              | 10         | 10         | 10       |             | 2480                        | 2480       | 2480       | 2480             |            |       |      |  |  |  |
| Dias/ano                                                                                | 248             | 248        | 248        | 248      |             |                             |            |            |                  |            |       |      |  |  |  |
|                                                                                         |                 |            |            |          |             | 248                         | 248        | 248        | 248              |            |       |      |  |  |  |
| Total Horas                                                                             | 2480            | 2480       | 2480       | 2480     |             | 0.01                        | 0.42       | 0.45       | 0.12             |            |       |      |  |  |  |
| Porcentaje operación                                                                    | 0.01            | 0.42       | 0.45       | 0.12     |             | 24.8                        | 1041.6     | 1116       | 297.6            |            |       |      |  |  |  |
| Tiempo de operación                                                                     | 24.8            | 1041.6     | 1116       | 297.6    |             | 350                         | 262.5      | 175        | 87.5             |            |       |      |  |  |  |
| Fraccion TONS                                                                           | 350             | 262.5      | 175        | 87.5     |             | 195.265                     | 113.00625  | 55.44      | 27.72            |            |       |      |  |  |  |
| KW en cada fraccion                                                                     | 200.305         | 109.90875  | 50.0325    | 25.01625 |             | 4,842.57                    | 117,707.31 | 61,871.04  | 8,249.47         | 192,670.39 |       |      |  |  |  |
| KW x Horas                                                                              | 4,967.56        | 114,480.95 | 55,836.27  | 7,444.84 | 182,729.62  | 9,685.14                    | 235,414.62 | 123,742.08 | 8,249.47         | 377,091.32 |       |      |  |  |  |
| Total 2 Chillers (kwh)                                                                  | 9,935.13        | 228,961.91 | 111,672.54 | 7,444.84 | 358,014.41  |                             |            |            |                  | 19,076.90  |       |      |  |  |  |
|                                                                                         |                 |            |            |          |             |                             | HAY = US\$ | 1,907.69   | ANUAL EN ENERGIA |            |       |      |  |  |  |
| SI LA DIFERENCIA CH1-CH2 DEL COSTO INICIAL                                              |                 |            |            |          | US\$ 32,000 | Y CADA kwh costara US \$ 0. |            |            |                  |            | 16.77 | ANOS |  |  |  |
| CONCLUSION EL CHILLER 1 CON MAYOR COSTO INICIAL, RECUPERARIA LA INVERSION INICIAL EN    |                 |            |            |          |             |                             |            |            |                  |            |       |      |  |  |  |
|                                                                                         |                 |            |            |          |             |                             |            |            |                  |            |       |      |  |  |  |
| No considera aspectos de Mantenimiento, no depreciacion, agua y otros temas de finanzas |                 |            |            |          |             |                             |            |            |                  |            |       |      |  |  |  |

# VENTILACIÓN

## VENTILACIÓN

- Estacionamientos
- Aire Fresco.
- Extracción de SSHH – Ambientes contaminados
- Escaleras Presurizadas.

## VENTILACIÓN: INYECCIÓN O EXTRACCIÓN

- Un objetivo es renovar el aire para eliminar elementos tóxicos. Ejemplo: Se requiere mínimo de 5 renovaciones por hora en un sótano de estacionamiento para eliminar el CO. Para SSHH 15 ren/h
- Inyectar aire fresco. Mínimo 15 cfm por persona en ambientes con aire acondicionado.
- En Laboratorios y hospitales, se requiere mantener presión positiva en los ambientes más limpios.
- En Escaleras de escape presurizadas, la presión de la escalera debe ser de 0.05 a 0.45" de c.a.
- El ASHRAE 62.1 tiene indicaciones amplias.



INYECTOR CENTRIFUGO

## EL MISMO INYECTOR, CON MALLA; NO FILTRO



# INYECTOR CENTRIFUGO EN GABINETE, EN ENSAMBLE





**¿LA TRANSICIÓN DE DUCTO ES LA CORRECTA?**



**¿ESTÁ BIEN SOPORTADO EL DUCTO?**

## INYECTOR CENTRÍFUGO EN GABINETE, DE ALMACÉN



## EXTRACTORES TIPO HONGO





## EXTRACTORES AXIALES O HELICOIDALES LIVIANOS



## DUCTO DE VENTILACIÓN CON BRIDAS



## CODO DEL DUCTO Y SUS SOPORTES

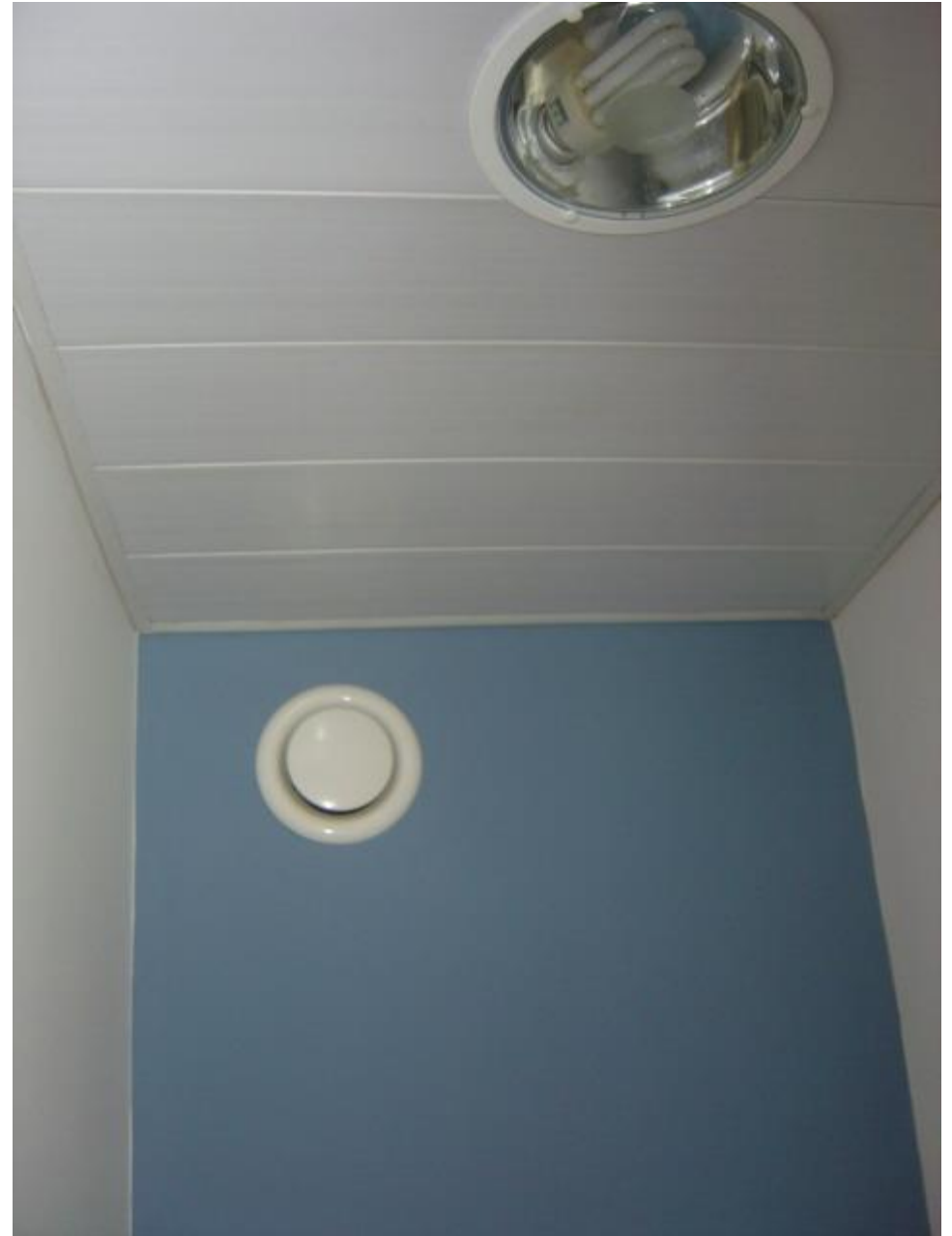


# JUNTAS FLEXIBLES DE DUCTO



## UN MODELO DE REJILLA EXTRACTORA DE PVC EN BAÑO

Funciona como d  mper de graduaci  n.  
Pero por experiencia estaba a la mano  
de las personas.



# DUCTOS EN SÓTANO DE ESTACIONAMIENTO



## EL JET FAN

Sustituye los ductos del sótano de estacionamientos.

Hay versiones resistentes al humo de alta temperatura.

Hay versiones rectangulares, denominados de perfil bajo.



## QUE DICE LA ULTIMA NORMA DEL RNE

### 7.1.6.1 Estacionamientos en sótanos.

La ventilación de estacionamiento en sótanos, deberá ser permanente y se efectuará por un sistema mecánico de impulsión y extracción que suministre un mínimo de doce metros cúbicos de aire exterior, por hora y por metro cuadrado de área de piso, incluyendo el área de circulación, pero manteniendo el mínimo de renovación de aire cada doce minutos. A partir del tercer sótano o más, deberá ser cumplimiento obligatorio.

El sistema mecánico de impulsión de aire se instalará en la parte superior lo más cercano al techo; la ubicación de la extracción será definida por el Profesional Responsable.

La altura de descarga mínima será de +1,50 m encima del nivel de último techo para el caso de sótanos de estacionamientos en edificaciones con pisos superiores, siempre y cuando no afecte las edificaciones colindantes en cuyo caso se usarán filtros.

Para el caso de sótanos de estacionamientos sin edificaciones en pisos superiores (estacionamientos públicos), la altura de descarga mínima será de 3,00 m por encima del nivel del techo o el sistema de extracción deberá contar con ductos de salida de gases

Mounting Flange Standards

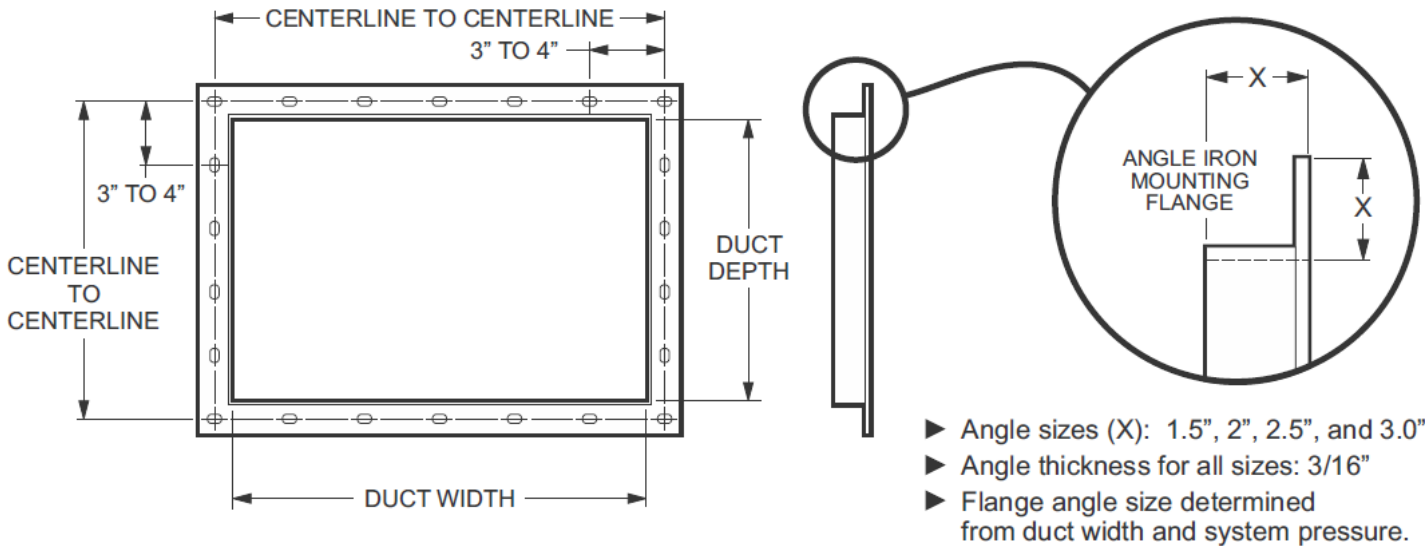


TABLE BELOW IS FOR STANDARD DUCT LENGTH OF 48-1/4"  
S = STIFFENER ADDED

| DUCT WIDTH | -6" W.G.   |            | -10" W.G.  |            | -14" W.G.  |            | -18" W.G.  |            |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|
|            | DUCT GAUGE | ANGLE SIZE | DUCT GAUGE | ANGLE SIZE | DUCT GAUGE | ANGLE SIZE | DUCT GAUGE | ANGLE SIZE |
| 12" - 24"  | 16         | 1.5"       | 12         | 1.5"       | 12         | 1.5"       | 10         | 2"         |
| 26" - 36"  | 16         | 1.5"       | 12         | 2"         | 12         | 2"         | 10         | 2"         |
| 38" - 48"  | 16         | 2"         | 12         | 2"         | 12         | 2"         | 10         | 3.0"       |
| 50" - 60"  | 16 - S     | 2"         | 12 - S     | 2"         | 12 - S     | 2"         | 10 - S     | 2"         |
| 62" - 72"  | 16 - S     | 2"         | 12 - S     | 2"         | 12 - S     | 2"         | 10 - S     | 2"         |
| 74" - 84"  | 16 - S     | 2"         | 12 - S     | 2"         | 12 - S     | 2"         | 10 - S     | 2.5"       |
| 86" - 96"  | 16 - S     | 2"         | 12 - S     | 2"         | 12 - S     | 2.5"       | 10 - S     | 3.0"       |

# DAMPER GRAVITACIONAL EN ESCALERA PRESURIZADA



# DISEÑO DE DAMPERS

Instalación en Muro cortina, ladrillo o muro de concreto.

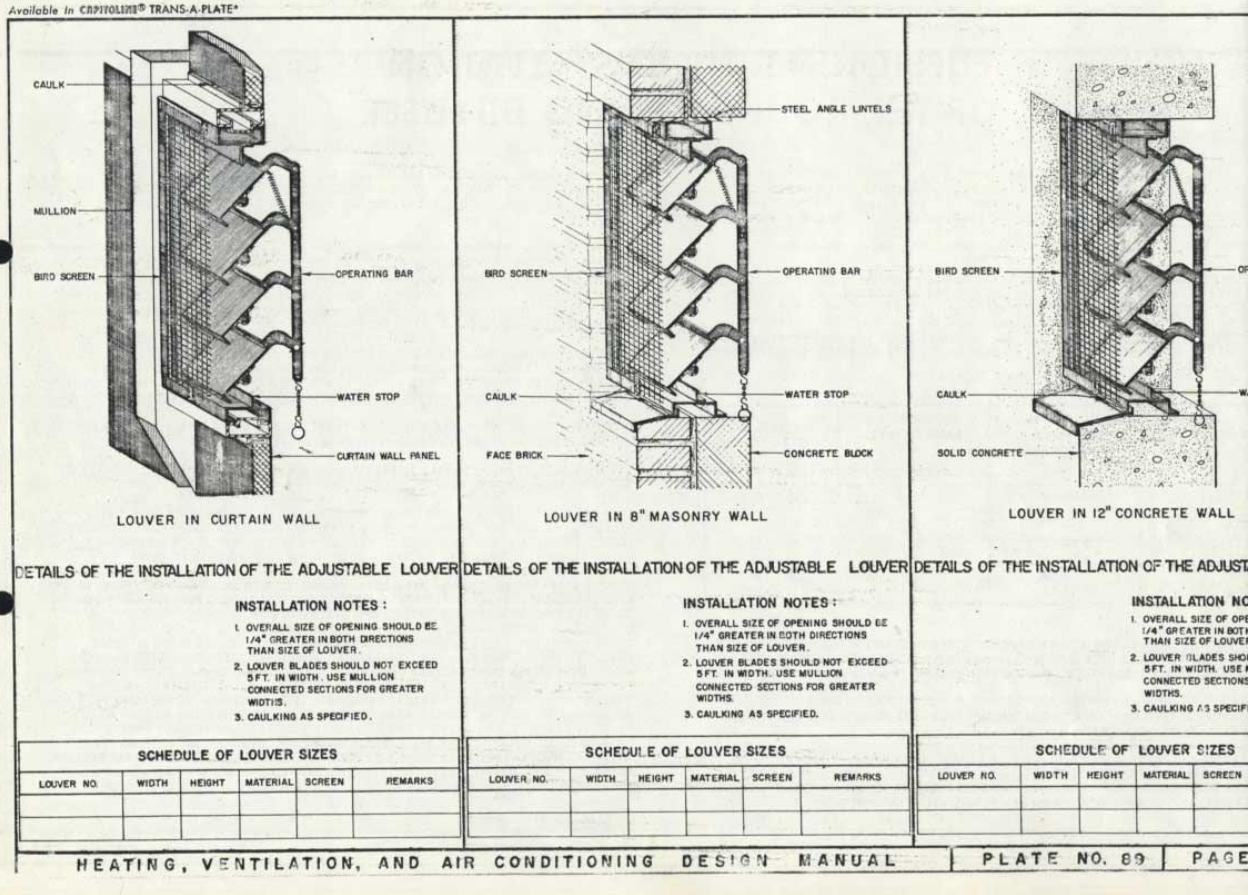
Tipo manual por medio de la barra.

Se precisan holguras.

Normalmente son de acero pintadas electrostáticamente, pero el metal y acabado puede cambiarse.

Se puede incorporar un servo motor para monitoreo.

Pero no es el ideal para el regulación de flujo.



## REJILLA PARA EXTRACCIÓN DE HUMOS EN UNA TIENDA.



## INYECTOR DE ESCALERA PRESURIZADA

- Instalada sobre la escalera
- Se aprecia ductos de expulsión de aire a distancia y dirección apropiada.





**DUCTOS Y TUBERÍAS  
DISTRIBUIDOS SOBRE EL  
TECHO.**

## DUCTOS EN RACK TÉCNICO DEBIDAMENTE ORDENADOS.



**SOLUCIÓN DE DUCTOS  
PARA UN LABORATORIO  
NUEVO EN UNA  
EDIFICACIÓN ANTIGUA SIN  
ALTURA EN FCR NI  
DUCTOS DE  
MAMPOSTERÍA.**





**FIN DE LA  
PRESENTACION**

Aire Acondicionado y Ventilación

MUCHAS GRACIAS