ENSTO

Saves Your Energy

Enervent solutions

for ventilation and dehumidification

enervent®

Energy efficient ventilation

Why pay attention to indoor environment?

The environment closest to us is the air indoors. Today we spend almost 90 % of our lives indoors. Therefore, we should pay just as much attention to the air quality indoors as we do to the outdoor air quality. Everyday we require approximately 1 Kg of food, 3 Kg of water and over 20 Kg or 17,000 ltr of air to breathe! We all want good quality food and clean fresh water to drink but what about the quality of the air we breathe at home?

Indoor air quality is important for our health and comfort

The outdoor air, especially in big cities but also in rural areas, contains a large number of particles. We don't normally see the polluting particles because most are very small. The air around us gets polluted by traffic, industrial processes and other contaminant sources like plants, forest fires, volcanoes, sand etc. Winds can take particles hundreds of miles away from their sources.

The quality of the indoor air is important to our health and comfort. Although we can smell the indoor air when we come in from outdoors, we can not necessarily see or smell all the impurities contained within it.

With mechanical ventilation systems, which also include mechanical air supply, a vast majority of particles can be removed from the air with filtration. Ensto Enervent use fine filtration to remove very small particles from the incoming airflow reducing the risk to health.

Air temperature determines how we feel and what level of comfort cooling we desire. Indoor air quality directly affects our performance in both the workplace and indeed in our education facilities. We know that poor air quality leads to early onset fatigue and temperature extremes lead to issues in productivity. All this leads to a need and desire to improve both temperature and air quality in our built environments.

Buildings must also consume less

The contribution of buildings to global climate change is estimated to be about 30 % of the total emission of greenhouse gases. Ventilation in general consumes one third of the overall energy consumption in buildings. But can we really maintain a good air quality with less energy? Looks impossible – but to use energy in a smart way and only when we need it makes this possible! The quality of the indoor air should not be jeopardized as a consequence of reduced energy consumption. Ventilation should never be switched off because even when we do not occupy a building VOC´s are emitted by the contents of the space such as paint, furniture and general building materials.

Energy recovery and demand-control

The air which is "used" indoors and discharged outdoors can, in the heat recovery equipment, warm up or cool down the incoming supply air. Up to 90% of the warmth or coolness in the outgoing air can be recovered this way. Even when effective energy recovery is used, it makes sense to ventilate according to the real demand. When the indoor spaces are not occupied (houses during workdays, offices at night and during weekends etc.), only minimum ventilation is required. Ventilation needs only to be boosted during times of moisture generation such as bathing or cooking and only for short periods as the background ventilation rate is assisting also. It is important to remember the amount of energy used to ventilate a space when considering maximum ventilation periods. Correct and considered design of the ventilation system is critical to ensure the system works effectively, fan sizing and accessory selection is an important part of this process at Ensto Enervent. It is also important for the end user to feel the benefits and understand how the system works in their property by providing clear and concise instructions and maintenance

An example of a mechanical ventilation system. The blue ducts show the path of the fresh, filtered and cooled/ dehumidified or warmed incoming replacement air. The red ducts show the path of the stale extract air.

Energy recovery and cooling

Is it possible to cool the building using less energy?

Comfortable indoor conditions are a combination of temperature and humidity. In order to achieve a comfortable indoor climate it is not enough to focus just on the temperature.

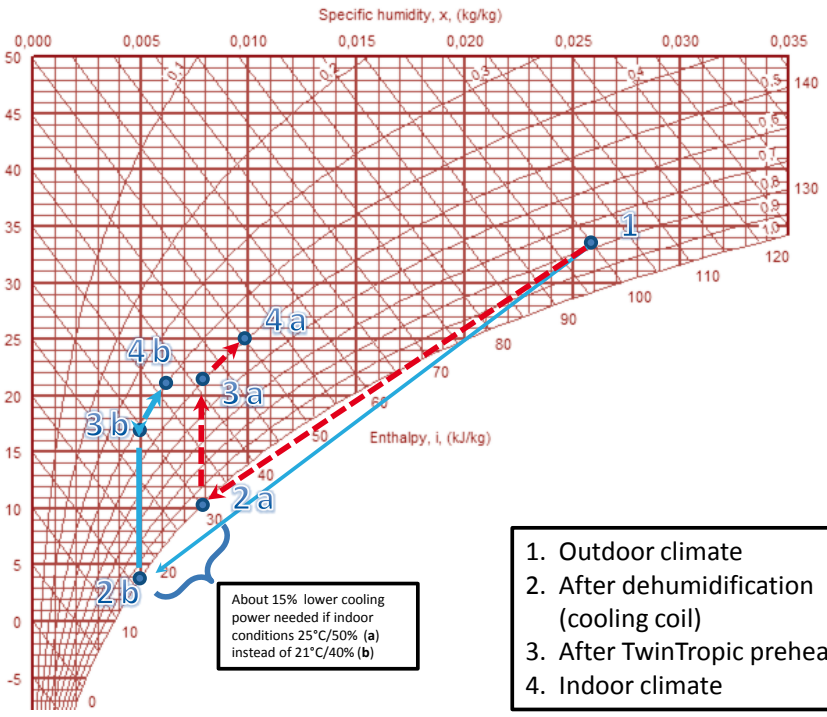
Cooling of the outdoor air

Refrigeration air conditioning equipment usually reduces the humidity of the air processed by the system. The relatively cold (below the dewpoint) evaporator coil condenses water vapor from the processed air (much like an ice-cold drink will condense water on the outside of a glass), sending the water to a drain and removing water vapor from the cooled space and lowering the humidity. Since we perspire to provide natural cooling by the evaporation of perspiration from the skin, drier air (up to a point) improves the comfort provided. The comfort air conditioner in the TwinTropic is designed to provide an RH of between 40% and 60%.

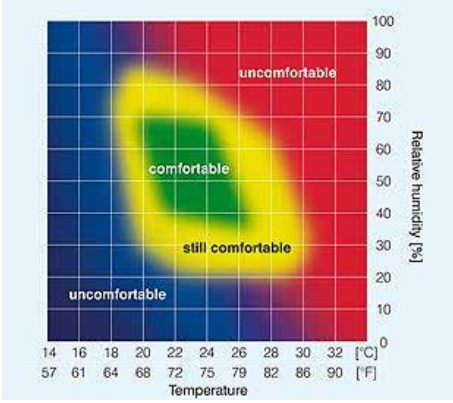
Energy consumption in condensation prior to cooling

Dry air contains much less energy than humid air, as energy is accumulated in the moisture (steam). There are two different energy terms; the sensible cooling energy, which can be calculated from the temperature difference, and the latent cooling energy, which is the energy needed for condensation of excess humidity (the energy of the air humidity in the form of steam). It is vital to distinguish the difference between the two terms: sensible + latent = TOTAL.

Without condensation of the excess humidity that the warm air outside contains, it is not possible to cool the air below the dew point. A lot of energy is needed just for condensation. Thus the solution for cost effective cooling lies in effective dehumidification.
The picture below shows the area of temperature and relative humidity which people would classify as comfortable or uncomfortable. As the picture shows, the higher the relative humidity the lower the indoor temperature must be in order to feel comfortable.



1. Outdoor climate
2. After dehumidification (cooling coil)
3. After TwinTropic preheat
4. Indoor climate



Mollier diagrams (Enthalpy-entropy chart) are routinely used in the design work associated with power compressors, refrigeration systems and air conditioning equipment to visualize the working cycles of thermodynamic systems. The diagram shows moist air versus its water vapor content.

Solution 1: Enervent Pegasos TwinTropic

The way to control supply air humidity, indoor climate, air purification and absolute humidity

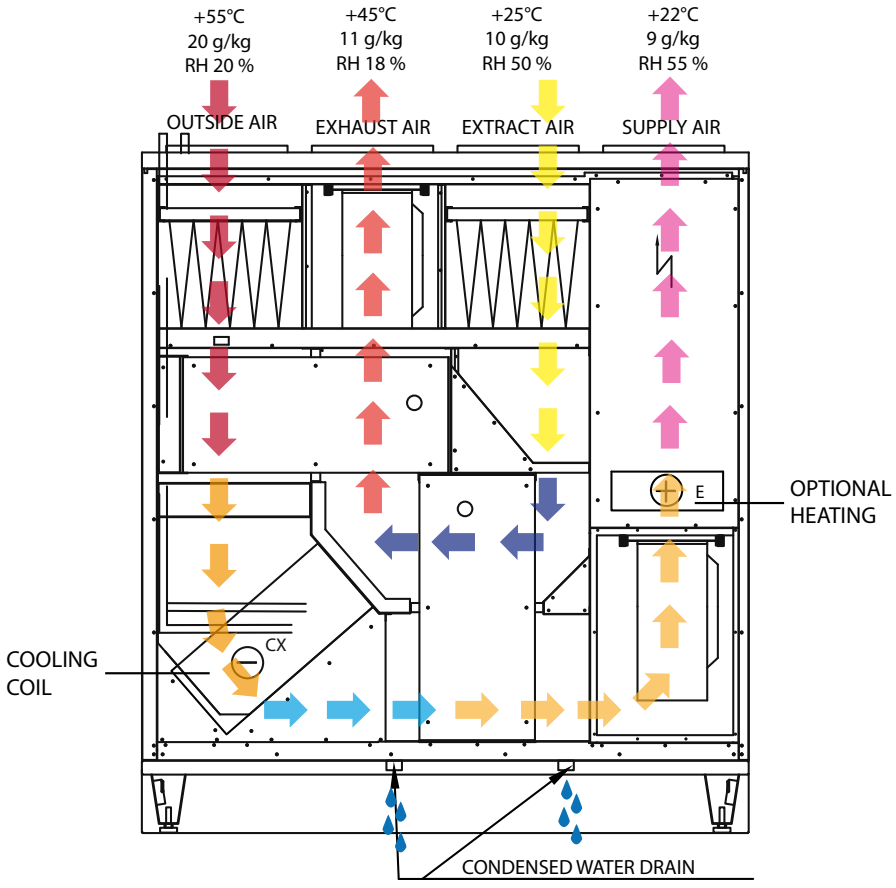
Pegasos TwinTropic is an air handling unit with two heat recovery wheels and highly efficient dehumidification for controlling supply air temperature, humidity and quality.

Cooling recovery with double recovery wheels

The outside air is pushed through the first recovery wheel, meeting the precooled exhaust air. The excess heat and some humidity is transferred with the wheel to the outgoing waste air. This will heat up the exhaust air and load it with humidity from the wheel, prior to being pushed out from the building. The dryer and cooler fresh supply air continues to the cooling coil. The supply air is cooled, thus dehumidified, at the cooling coil.

The fresh supply air is preheated at the second heat recovery wheel before entering the ventilation duct. The stale extract air is cooled down before entering the first heat recovery wheel.

Studies show that double energy recovery units have a better humidity control with a constant fresh air supply temperature and RH year-round. Although costs are higher, they are recommended for use when constant supply temperature and humidity are critical.



Enervent Pegasos TwinTropic principle of operation

TwinTropic advantages

- Air purification
  Air purification to as low as 0,18 microns. The mechanical ventilation system ensures that the indoor air is fresh, clean and at a desired temperature.
- Much lower energy consumption than conventional dehumidification
  Conventional dehumidification only cools air to a desired dewpoint and requires additional preheating of the supply air to prevent draughts being felt by the user.
  Enervent TwinTropic utilizes HRW technology and free preheating by utilising the second HRW improving the performance of the first HRW as part of the process.

  The exceptional efficiency ratio in energy recovery of the heat exchanger is due to silver halide coating which is polarized with power electronics in order to achieve outstanding retention performance of both energy and humidity.
- Possible condensed water recovery/usage
  Enervent Twin Tropic can harness the expelled condensate as grey water harvesting.
- Indoor air moisture content control
  By keeping the RH of the air under control on the incoming airflow the TwinTropic unit can serve to reduce interstitial condensation and protect the ducts and building fabric from moisture build up. This can significantly impact on the longevity of the built environment whilst maintaining a clean and fresh air quality.

Many different solutions with Twin Tropic at the core

The TwinTropic produces about 200 litres of condensed water per day. If the condensed water (grey water) is harvested into a tank it can be used for toilets, showers and irrigation systems.
In addition to controlling the indoor climate, the TwinTropic can also, in combination with a water chiller, be used to heat the domestic hot water (Aqua). The TwinTropic Aqua system saves a lot of energy whilst creating an enjoyable living environment.

Example:

Normal house

No ventilation	0 kW
Cooling power 45 kW	22 kW
Hot water	10 kW
Dehumidification/after heating	4 kW
Total consumption	36 kW

TwinTropic house:

TwinTropic ventilation unit 5 kW	3.9 kW
Cooling water pump	1 kW
Cooling power 20 kW	7 kW
Hot water	10 kW
Dehumidification/after heating	0 kW
Total consumption	21.9 kW

TwinTropic Aqua house:

TwinTropic ventilation unit 5 kW	3.9 kW
Cooling water pump	1 kW
Cooling power 16 kW	5.9 kW
Shade of solar panels	-1.5 kW
Hot water	0 kW
Dehumidification/after heating	0 kW
Total consumption	10.5 kW
Total consumption with solar panels	9 kW

1. *Enervent Twintropic unit*
2. *Sandfilter*
3. *Water chiller (hot water) i.e. York*
4. *Supply air duct*
5. *Extract air duct*
6. *Outside air intake*
7. *Exhaust air*
8. *Kitchen exhaust*
9. *Cooling pipes*
10. *Condense water drain pipe*
11. *Fan coil unit and supply air grille i.e. Chiller/FI*
12. *Extract air grille*

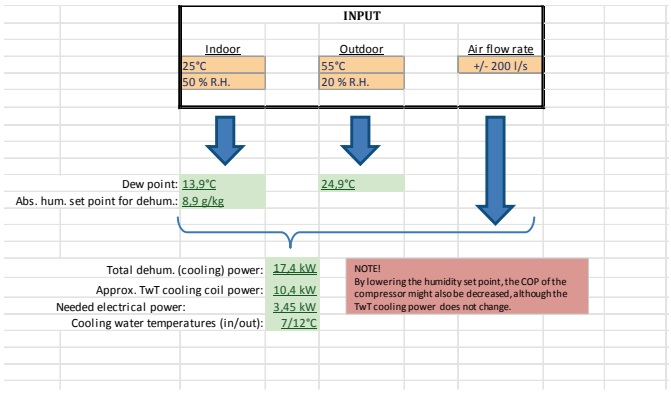
Repayment period calculation Case Hong Kong

	CONVENTIONAL	SORPTION HRW	PEGASOS TwinTropic
Runnig energy (kW)			
Cooling (COP = 3.21x4, 3.52x8)	8.4	3.0	2.2
Dehumidification	3.3	4.95	0
Fans	0.3	0.3	0.15
Total	**12.0**	**8.3**	**2.4**
Running cost per year (0.145 €/kWh)	15 034	10 377	2 944
Savings € (compared to conventional)	-	4 656	12 090
Capital cost €			
AHU	12 000	6 000	52 000
Additional DX cooling	-	12 000	2 540
Additional fans	3 500	3 500	-
Dehumidifiers	**4 500**	**6 750**	**-**
Total	**15 500**	**21 500**	**54 540**
Difference € (compared to conventional)	-	6 000	39 040
Repayment period (years)	-	1.29	3.23
Earnings € (compared to conventional)			
Earnings 3 years		7 969	-2 722
Earnings 5 years		17 281	21 407
Earnings 10 years		40 562	81 855

The unit runs on 60 % fan speed.
The unit produces 30 m^3/a condensed water. If the condensed water (grey water) is harvested into a tank it can be used for toilets, showers and irrigation systems.

Dehumidification calculations for TwinTropic

Example (orange fields are input values):



Your local reseller can provide you with the calculation sheet.

Versatile unit series

Our team of dedicated and experienced engineers at Enervent have designed a range of TwinTropic units to accommodate all climatic conditions.

The unit always comprises two energy recovery wheels. The TT X-E unit is equipped with a direct expansion coil and electric heater element whilst the W model has an integral water coil in addition to the ERW's.

The unit is supplied with Enervents own control module.

Technical data

Enervent Pegasos TwinTropic

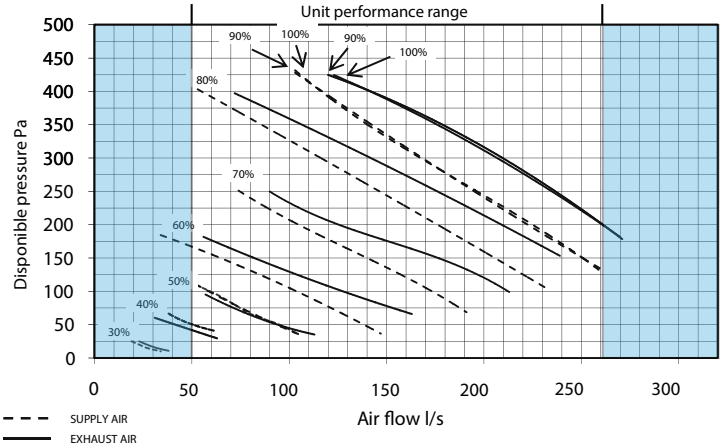
PEGASOS TwinTropic	
Technical specifications	
Air amount	+572/-572 CFM / +270/-270 l/s (125 Pa)
Fans	520 / 520 W
Current X-E models	400 V3~/50 Hz
Current CW models	230 V~/50 Hz
Fuse X-E models	3x16 A
Fuse CW-models	10 A
Measurements	
Duct connections	Ø 250 mm
Weight	230 kg
Width	1 250 mm
Depth	677 mm
Hight	1 400 mm
Equipment	
Standard filters	Class F7/F5 (supply/exhaust)

Models:
Pegasos TwinTropic CW: unit with water chiller
Pegasos TwinTropic CW-E: unit with water chiller and electrical heater
Pegasos TwinTropic X: unit with direct expansion
Pegasos TwinTropic X-E: unit with direct expansion and electrical heater

The TwinTropic design team made it their goal to design a unit as compact and stylish as possible. Almost good enough to display, the unit should be located in a suitable position to service the property correctly.

Specific curves

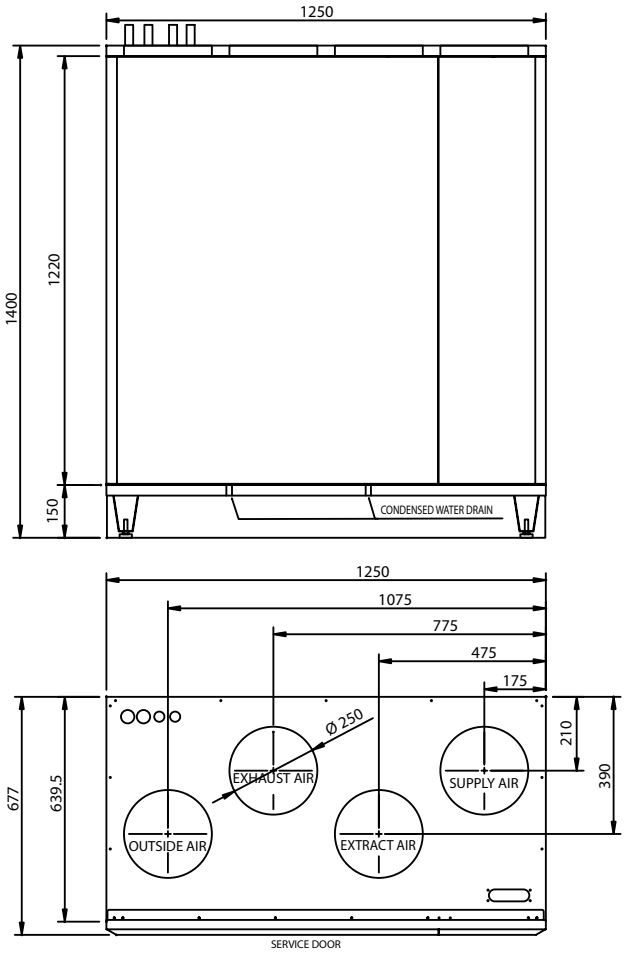
Pegasos TwinTropic CW
SUPPLY AND EXTRACT AIR
Specific curves with F7/F5 bag filter



1 l/s = 2.12 CFM

NOTE! If the unit is equipped with F7/F7 filters the extract air flow is 10-30 % smaller than presented in the curve above.

Measurements



Solution 2: Enervent Twincoil units

Another way to control supply air humidity, indoor climate, air purification and absolute humidity

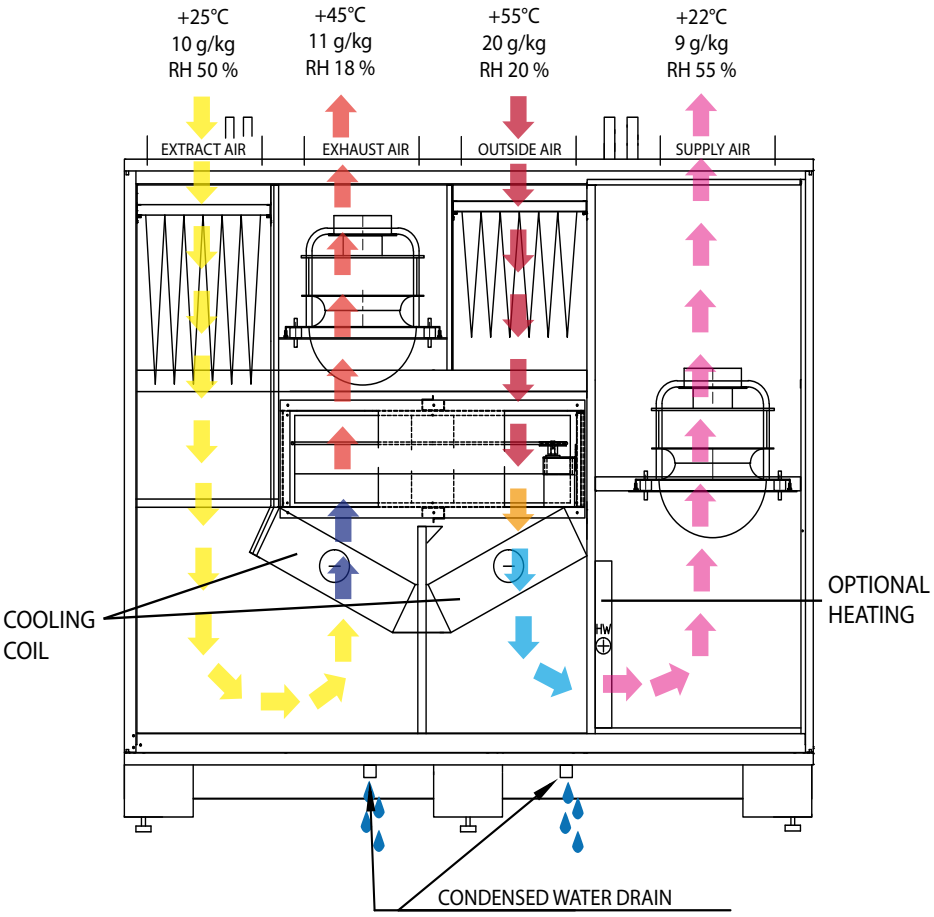
Enervent Pandion and Pallas Twincoil are air handling units with rotating heat recovery wheel and highly efficient dehumidification for controlling supply air temperature, humidity and quality.

Cooling recovery with rotating recovery wheel

The outside air is pushed through the recovery wheel, meeting the precooled exhaust air. The excess heat and most humidity is transferred with the wheel to the outgoing waste air. This will heat up the exhaust air and load it with humidity from the wheel, prior to being pushed out from the building. The dryer and cooler fresh supply air continues to the cooling coil. The supply air is cooled, thus dehumidified, at the cooling coil.

The fresh supply air is preheated at the heating coil if needed before entering the ventilation duct. The stale extract air is cooled down before entering the heat recovery wheel.

Studies show that energy recovery units have a better humidity control with a constant fresh air supply temperature and RH year-round. Although costs are higher, they are recommended for use when constant supply temperature and humidity are critical.



Enervent Pallas Twincoil principle of operation

Twincoil advantages

- Air purification
  Air purification to as low as 0,18 microns. The mechanical ventilation system ensures that the indoor air is fresh, clean and at a desired temperature.
- Much lower energy consumption than conventional dehumidification
  Conventional dehumidification only cools air to a desired dewpoint and requires additional preheating of the supply air to prevent draughts being felt by the user.
  Enervent Twincoil utilizes HRW technology as of the process.

  The exceptional efficiency ratio in energy recovery of the heat exchanger is due to silver halide coating which is polarized with power electronics in order to achieve outstanding retention performance of both energy and humidity.
- Possible condensed water recovery/usage. *Enervent Twincoil can harness the expelled condensate as grey water harvesting.*
- Indoor air moisture content control
  By keeping the RH of the air under control on the incoming airflow the Twincoil unit can serve to reduce interstitial condensation and protect the ducts and building fabric from moisture build up. This can significantly impact on the longevity of the built environment whilst maintaining a clean and fresh air quality.

Technical data

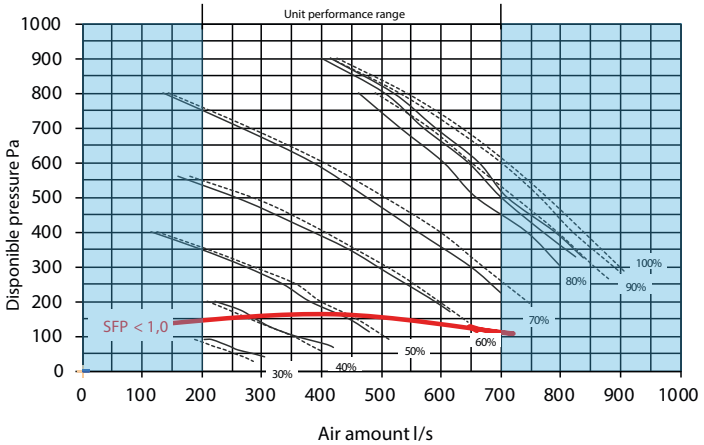
Enervent Pallas Twincoil

PALLAS Twincoil	
Technical specifications	
Air amount	+1271/ -1271 CFM / +600/-600 l/s (300 Pa)
Fans	1000 / 1000 W
Current	400 V3~/50 Hz
Fuse	3x16 A
Measurements	
Duct connections	300x600 mm
Weight	450 kg
Width	1 800 mm
Depth	890 mm
Hight	1 610 mm
Equipment	
Standard filters	Class F7/F5 (supply/extract)

Models:
Pallas TCG-W Dehum: unit with twin cooling coils, hydronic heater and dehumidification function

Specific curves

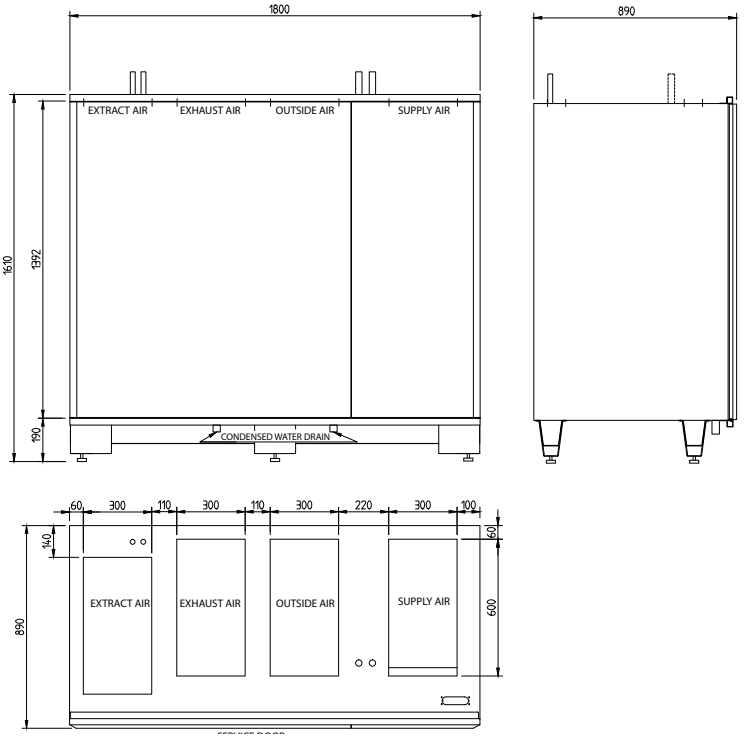
Pallas Twincoil supply and extract air characteristic curves with F7/F5 filters



1 l/s = 2.12 CFM

NOTE! If the unit is equipped with F7/F7 filters the extract air flow is 10-30 % smaller than presented in the curve above.

Measurements



Technical data

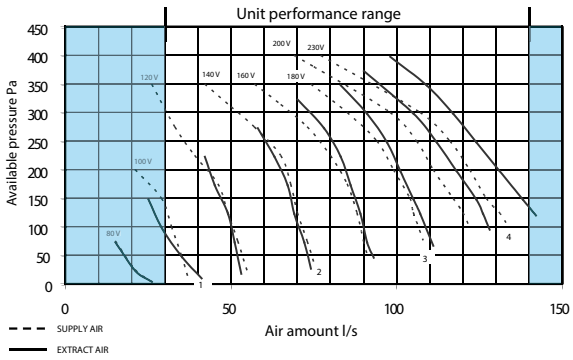
Enervent Pandion Twincoil

PANDION Twincoil	
Technical specifications	
Air amount	+297/-297 CFM / +140/-140 l/s (125 Pa)
Fans	230 / 230 W
Current	230 V~/50 Hz
Fuse	10 A
Measurements	
Duct connections	Ø 200 mm
Weight	90 kg
Width	785 mm
Depth	548 mm
Hight	1 045 mm
Equipment	
Standard filters	Class F7/F5 (supply/extract)

Models:
Pandion TCG: unit with twin cooling coils
Pandion TCG-E: unit with twin cooling coils and electrical heater
Pandion TCG-W: unit with twin cooling coils and hydronic heater

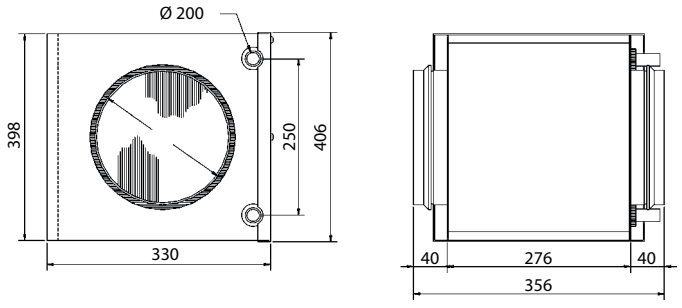
Specific curves

Pandion Twincoil supply and extract air characteristic curves with F7/F5 filters



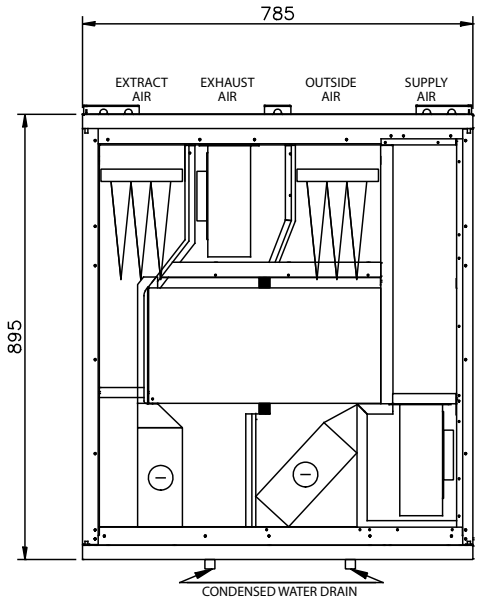
1 l/s = 2.12 CFM

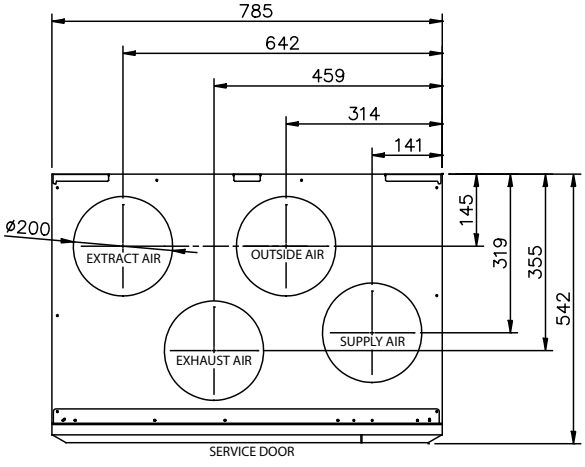
NOTE! If the unit is equipped with F7/F7 filters the extract air flow is 10-30 % smaller than presented in the curve above.



The optional hydronic heating for Pandion twincoil is realized with a duct coil

Measurements





Higher energy efficiency with Enervent Energy BUS

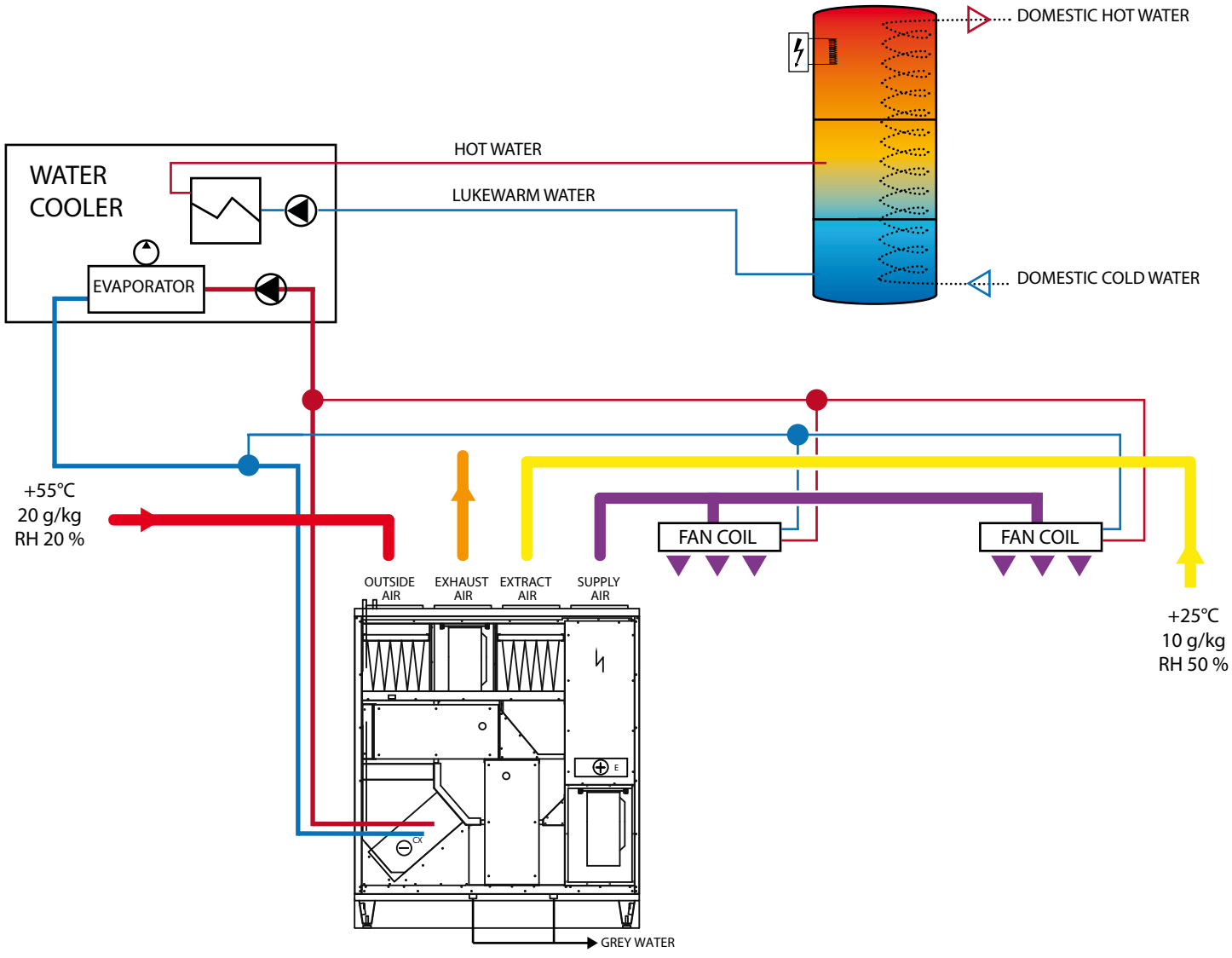
Extreme energy efficiency in addition to air purification

With Enervent Energy BUS energy can be moved inside the building from spaces with excess energy to spaces with demand for energy. Thus energy existing in the building will be used before external energy is bought.
The energy recovered with Energy BUS is mostly excess energy from the cooling process which is normally blown out. The recovered energy is stored in an energy bank (energy tank) from where it can be used to heat or cool the building via ventilation when needed. The energy can also be used for hydronic heating system, hydronic floor heating or domestic hot water. The recovered energy is automatically stored for later use or distributed to spaces with demand for heating/cooling.
Control of the buildings heating/cooling load and energy consumption can be done with one system. Enervent units with Energy BUS have been developed to take complete care and control of the buildings indoor climate, energy recovery, hot water production and water cooling.

Energy BUS can be installed and implemented in all kinds of buildings; new as well as old and small as well as big buildings.

With Energy BUS you get fresh, filtered indoor air which is dehumidified, cooled or heated according to your whishes. In addition you get excess energy from the process stored in a tank. This "free" energy can be used for heating the building or water. The warm water can be used for hydronic heating systems or for domestic hot water production.

Energy BUS



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Saves Your Energy

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