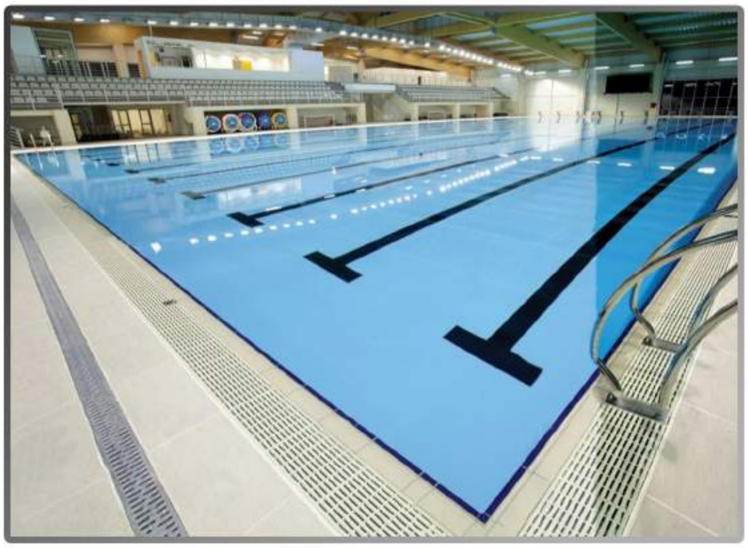


MAX.e³POOL

SWIMMING POOL DEHUMIDIFICATION

AHU's WITH HEAT PUMP

Damvent
to reach... and exceed Benelux

*Every swimming pool should offer optimal microclimate conditions to its visitors. The high relative humidity and condensation in this environment (especially within covered swimming pools) significantly reduces comfort and also leads to damage of the building structure and nearby equipment. Using **Damvent**'s concept solution, which offers precise control of the microclimate found in covered swimming pools, minimizes these negative processes and provides optimal comfort to visitors.*

ENERGY EFFICIENCY

Using conventional methods to achieve optimal microclimate conditions and reduce the negative effects of high humidity is an expensive process which uses a lot of energy. Swimming pools disproportionately consume larger amounts of energy compared to dry buildings. This energy, contained in the water vapour is lost from the building through ventilation. Unlike dry buildings, swimming pools behave more like boilers due to the evaporation of water which occurs naturally during the use of energy. Water evaporation requires the supply of Latent Heat of Vaporisation (the energy required to evaporate water). This use of energy is about 540 times more than what is needed to raise the temperature of water by one degree Celsius (the "Sensible Heat"), and much more than what is required to heat the air.

The problem with indoor pools is that they need to be heated to about 30°C to provide a comfortable bathing environment. Even small deviations from this temperature lead to discomfort and complaints. Unfortunately, the level of evaporation at this temperature is quite high. Most of the heat used to warm the water ends up in the hot, wet, energy-rich air above the pool. In the absence of ventilation, this air will become saturated with water and condensation appears on all surfaces which are at a lower temperature than the air. Therefore, ventilation systems are installed in order to dilute the concentration of water vapour in the air and minimize condensation on exposed surfaces.

The net effect is that the ventilation drives out the energy which has been used to maintain the water at 30°C. In addition, the cold inlet air has to be heated to maintain an air temperature near to the water temperature. Clearly, less ventilation means less energy loss but creates a higher risk of condensation and damage to the building.

The level of activity in swimming pools affects the rate of evaporation since the surface area exposed to the air increases due to splashing, etc. The level of needed ventilation varies significantly as activities vary widely during the day and cease altogether overnight.

A variety of measures can be taken to reduce energy consumption. Such as the use of: pool covers which can be rolled out overnight;
variable speed fan motors;
dehumidification systems;
heat recovery units;
improved insulation;
etc.

CONCEPT

MAX.e3POOL is a concept solution designed to maintain the indoor climate parameters (Temperature and Relative Humidity) within covered swimming pool environments, according to the latest requirements for energy efficiency!

MAX.e3POOL is an "e-conomizer" with 2 stage thermodynamic heat recovery technology - recovering up to 100% of the extract heat, achieved in two consecutive stages:

- 1st – "passive recovery"
  air-to-air plate exchanger, 65% to 70% from the room
- 2nd – "active heat recovery"
  evaporator of the air-to-air heat pump recovers between 65% to 100% of the extract heat from the room

CONSTRUCTION

MAX.e3POOL is a single "1 piece" (standalone) unit. The construction is manufactured from high quality profiles made of extruded aluminum characterized by high strength and resistance to adverse weather conditions. Unit size 13.0 consists of two blocks. The connection between the two blocks is carried out by aluminum connection plates. Unit enclosure panels are double skinned and shall comprise of a 1mm inner skin manufactured from galvanized sheet steel, 50mm mineral wool insulation having a density of 75kg/m3, and a 1mm outer skin manufactured from galvanized sheet steel. Both the inner and outer skins have a powder polymer coating color RAL9006. The insulation material is thermal and sound absorbing, fire and high temperature resistant, mineral wool having CE certificate in accordance with EN14303.

Gaskets - Closed cell structure gaskets, made of Ethylene Propylene Diene Monomer (EPDM) are used for internal insulation and separation between the air flow sides- supply and exhaust, as well as on all doors and panels to protect the unit from internal and external leakages. The components wherein condensation may occur (such as, direct expansion coils and plate heat exchanger) are equipped with a condensate drain pan. The condensate is removed via drain outlets connected to siphons (detailed schematics are provided with the documentation of the unit). The condensate drain pans are a welded steel structure made from 1.2mm thick galvanized steel sheets with a powder coating.

REFRIGERANT CIRCUIT

The Refrigerant circuit contains 1 or 2 circuits, depending on the type of the unit. Type of Refrigerant is ***R407C****.*

MAX.@3POOL units 03, 06, 09,13.0 use 3 phase "Scroll" Compressors (1, 2 or 4 pcs., respectively, depending on the type of unit. MAX.@3POOL unit 02 uses a 1 phase "Rotary" compressor.

The main components of the refrigerant circuit are: electronic expansion valves; filter dryer; receiver; suction line accumulator; thermostats (high/low pressure); and differential pressure transmitter (high/low pressure).

All of the MAX.@3POOL units contain high efficiency direct expansion coils which are made from copper tubes and aluminum fins that are "epoxy" coated, and condensate drain pans.

The refrigerant circuit is intended for use only in "Heating" mode and is non-reversible. If the situation calls for "Cooling" mode, this is an optional feature that must be coordinated in advance with the manufacturer.

FANS

MAX.@3POOL models 02, 03, 06, 09 use ***"EC (Electronically Commutated) Blue Plug Fans"*** *– with a* ***Cpro*** *frequency inverter manufactured by* ***Ziehl-Abegg****. The fan wheel is statically and dynamically balanced on the axis of the direct-driven motor. Both the fan wheel and the motor are mounted on a common base frame with vibration dampers. Using* ***EC Blue*** *fans ensures the highest* ***IE4 Premium Efficiency*** *and* ***ErP*** *conformity-* ***2015/EC*** *controller integrated. The high-performance composite material* ***Cpro ZAmid®****, developed using the latest insights, makes the impeller significantly lighter than those made of steel and offers superior mechanical properties.* ***Cpro ZAmid®*** *provides new opportunities for system runtimes, enables lower power consumption and leads to a drastic reduction in noise.* ***Cpro ZAmid®*** *is manufactured using a one-shot injection-moulding process in a highly complex injectionmoulding machine, resulting in no welded joints. This highly technical process ensures the highest system reliability.*

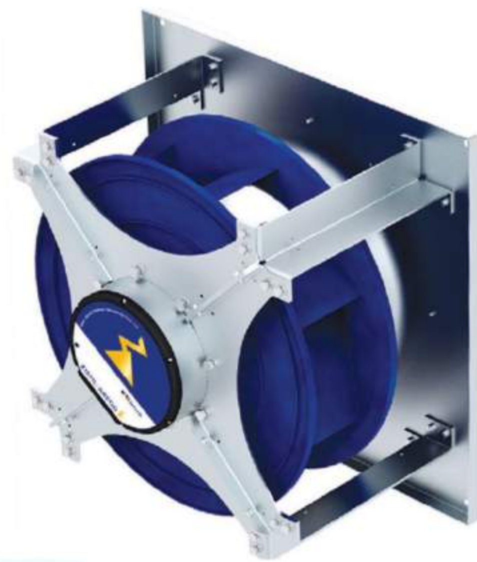
Innovation at a glance:

- *Significant weight reduction, which reduces motor bearing loads and increases the system service life.*
- *Drastic reduction in noise generation. leads to tonal noise reduction up to 5 dB.*
- *Significant increase of the impeller efficiency,which reduces the absorbed power.*
- *Reduced power consumption - up to 15% energy savings during operation.*
- *Significant CO_2 reduction - improved mechanical properties, in comparison with steel.*
- *No weld seams - high peripheral velocities up to 70 m/s.*
- *Suitable for operational temperatures from -20°C to +80°C, in comparison to steel impellers.*
- *Corrosion-free.*
- *No toxic gas emissions.*
- *Colour-stable.*

Plug Ventilatoren

MAX.@3POOL unit 13.0 uses Plug Fans complete with an ***IE2*** *efficiency motor and a separate frequency inverter mounted within the unit.*

The fan wheel is statically and dynamically balanced on the axis of the direct-driven motor. Both the fan wheel and the motor are mounted on a common base frame with vibration dampers.



EC Blue Plug Fans

EUROVENT PLATENWARMTEWISSELAAR 03.01.242.

PLATE HEAT EXCHANGER

All of the MAX-S3-POOL units contain air-to-air plate heat exchangers made from aluminum fins that are "epoxy" coated; condensate drain pans; and mounted motorized dampers (bypass and "freecooling").

Efficiency (Sensible) – E ≤ 65%-70%.

The special cover of the plate heat exchanger extends its useful life and prolongs the best levels of performance.

The air-to-air heat exchanger used in this unit is ***EUROVENT*** *Certified*

EUROVENT PLATENWARMTEWISSELAAR 03.01.242.

CONTROLLER AND AUTOMATION SYSTEM

MAX-S3-POOL is fully equipped with all necessary automation and all executive mechanisms. The electric switchboard is integrated into the unit and located on the operation (access) side.

The "Brain" of the MAX-S3-POOL is its controller (specially designed by Damvent) which controls and manages all processes and protects the unit from eventual cut-offs. The software is developed with a high level of know-how and it automates all processes.

All you need to do is set the desired supply temperature. The controller automatically selects in which of the 2 working modes (heating or ventilation) to work, depending on variables input for the outside temperature, the set point temperature, and the supply and room (return) temperatures.

EUROVENT Nr. 09.07.434.

FILTERS

Filters are installed at the entrance of the unit to ensure normal operation of the AHU and to prevent contamination of the components.

Microcell filters are used in the MAX-S3-POOL units. These filters are made of plated micro glass paper and spaced with hotmelt adhesive beads which are uniformly positioned to deliver optimum airflow. The frame is constructed with composite material (plastic) and 130mm Galvanized steel sheets.

The Classes of filtration are M6 (standard), F7, F8 and F9 (optional).

One of the benefits of using this type of filter is that despite the turbulence, variable air volume, and vibration found in the system, it performs perfectly. Since the air passes equally through Microcell filters, a maximum service life is achieved. Microcell filter s are unaffected by fan shut down or start up, can resist up to 1000 Pa. of differential pressure, and work perfectly in humid conditions

WORKING MODES

1. Operation in Standstill Mode (Without Swimmers)

The exhaust air from the pool is pre-cooled in the plate heat exchanger, then sub-cooled in the evaporator below the dew point temperature. The moisture in the form of condense is taken out. The dehumidified air is partially mixed with recirculation air. The mixed air is heated within the condenser and then supplied to the pool. The plate heat exchanger is used as an economizer, significantly reducing the energy costs.

2. Operation in Winter - Dehumidification with Heat Pump

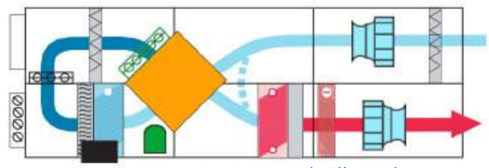
During the winter, water evaporation is much more intense. Thus dehumidification is needed. The exhaust air from the pool is pre-cooled in the plate heat exchanger, then sub-cooled in the evaporator below the dew point temperature. The moisture in the form of condense is taken out.
The necessary fresh air is partially mixed with dehumidified, recirculation air. The mixed air is first pre-heated in the plate heat exchanger, then re-heated within the condenser and then supplied to the pool.

3. Operation in Transitional Periods - Ventilation and Heat Pump

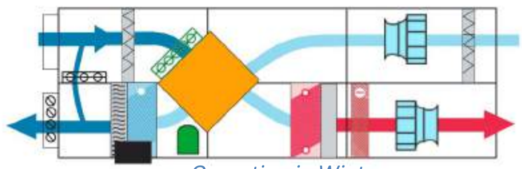
The outside temperatures during the transitional periods are average and relatively high, MAX@3POOL supplies to the pool 100% fresh air. Thus maximum comfort is achieved with minimum energy costs. The Heat Pump is switched on only if needed.

4. Operation in Summer - 100% Ventilation Without Heat Pump

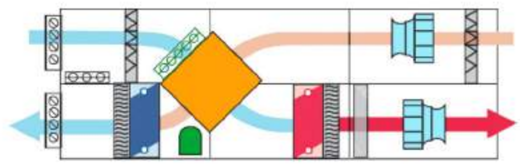
During the summer the heat pump is switched off and only the exhaust and supply fan are operating. The bypass of the plate heat exchanger is open and the unit supplies to the pool the maximum quantity of fresh air, achieving an optimum comfort.



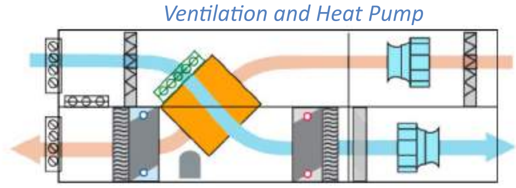
Operation in Standstill Mode



Operation in Winter - Dehumidification with Heat Pump

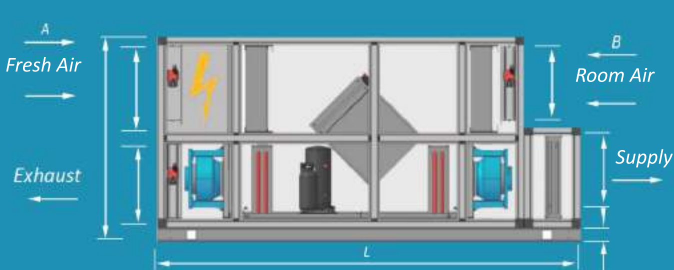


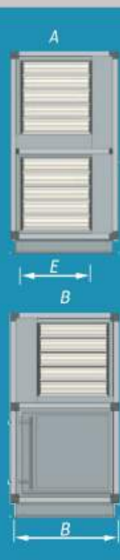
Operation in Transitional Periods - Ventilation and Heat Pump



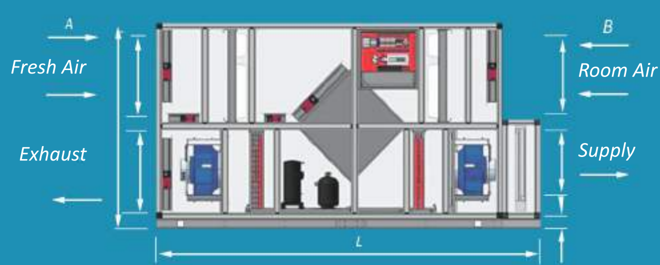
Operation in Summer - Ventilation with Heat Pump

MAX@3POOL 02 MAX@3POOL 03





MAX@3POOL 06 MAX@3POOL 09



	B	H	L	DxE
	mm	mm	mm	mm
MAX@3POOL 02	760	1430	3000	580 x 535
MAX@3POOL 03	1090	1430	3000	580 x 845

	FxE	CxJ	GxX	Weight
	mm	mm	mm	kg
MAX@3POOL 02	630 x 535	580 x 535	620 x 535	420
MAX@3POOL 03	630 x 845	580 x 845	620 x 845	540

	B	H	L	DxE
	mm	mm	mm	mm
MAX@3POOL 06	1345	2045	3550	765 x 1135
MAX@3POOL 09	1845	2045	3550	765 x 1340

	FxE	CxJ	GxK	Weight
	mm	mm	mm	kg
MAX@3POOL 06	765 x 1135	765 x 1135	880 x 1135	1270
MAX@3POOL 09	765 x 1340	765 x 1340	910 x 1635	1750

GENERAL TECHNICAL DATA

AHU Type		MAX.O^{3}POOL 02	MAX.O^{3}POOL 03	MAX.O^{3}POOL 06	MAX.O^{3}POOL 09	MAX.O^{3}POOL 13
		General Technical Data				
Min/Max Airflow	m^3/h	1000 / 2000	2000 / 3200	4000 / 7000	5500 / 10000	9000 / 14500
Nominal Airflow	m^3/h	1500	2500	6000	9000	13000
Dehumidification capacity (VDI 2089)	kg/h	10.6	17.2	38.3	51.5	79.6
General Data		**Pool Area Surface – m^2**				
Private Pool	m^2	56	93	224	336	486
Public Pool	m^2	42	70	168	252	365
Total Heating Capacity	kW	18.7	31.4	68.0	91.5	141.6
Total Installed Power (comp + fans)	kW	7.7	10.0	16.9	18.4	34.8
Total Power Input (comp + fans) Winter Mode	kW	3.39	5.88	11.95	14.57	26.51
Full Load Current	A	20.8	22.1	39.4	39.8	85.4
Connection Voltage	V/Ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Weight (options will change kg)	Kg			1270	1750	2580
System COP		5.9	5.8	6.1	6.3	6
Filters		**Polyester**				
Classification (EN779:2012)	M	M5	M5	M5	M5	M5
Filtration Efficiency	%	50	50	50	50	50
Total Filtration Area	m^2	2.70	4.06	3.04	4.18	3.04
Fans						
Motor Efficiency	IE4 Premium Efficiency					
Installed Motor Power	kW	2.5	2.5	3.5	5.4	6.0
Installed Current	A	4.0	4.0	5.6	8.6	9.4
Protection Class	IP	55	55	55	55	55
Plate Heat Exchanger		**Aluminum**				
Temperature Efficiency	%	68	68	67	66	63
Recovered Heating Capacity (Winter)	kW	7.9	13.0	29.6	42.3	60.0
Condensation Rate (Winter)	l/h	3.5	5.8	12.6	17.0	24.1
Compressor		**Rotary**	**Scroll**			
Number of Compressors		1	1	2	2	4
Number of Circuits		1	1	1	1	2
Power Input (Winter Mode)	kW	1 x 2.62	1 x 4.79	2 x 4.38	2 x 4.73	4 x 4.26
Max. Full Load Current	A	1 x 12.8	1 x 14.1	2 x 14.1	2 x 14.5	4 x 14.1
COP (Winter Mode)		4.13	3.78	4.38	5.20	4.79
Water Heater (optional)						
Hot water 80 / 60°C	m^3/h	0.12	0.22	0.42	0.64	1.10
Heating Capacity	kW	5.9	9.8	23.4	35.4	53.7
Water Pressure Drop	kPa	0.3	0.2	0.7	0.6	0.9
Headers in/out	mm	21.3	26.9	33.2	42.2	42.2

Condities voor berekening
(1) Afvoerlucht 28°C / 60%, verse l lucht -15°C / 90%
(2) Hoeveelheid verse lucht – 30%

** These figures are representative and may vary based on customer specifications, components used, and/or factory improvements.*

Damvent
to reach...and exceed Benelux

De Star 27 J
1601MH Enkhuizen
The Netherlands
Tel.: +31(0)85 130 0983

info@damventbenelux.eu
www.damventbenelux.eu