MAX.e³POOL

SWIMMING POOL DEHUMIDIFICATION

AHU'S WITH HEAT PUMP

MAX.e³POOL is the subject of continuing improvement and future development! Following its policy of continuous improvement, DamVent reserves the right to make any further changes without the need to inform its customers and partners about it.

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DamVent
quality•innovations•solutions

Every swimming pool should offer optimal micro climate 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 the equipment within. Using DamVent's concept solution which offers precise control of the micro climate found in covered swimming pools, minimizes these negative processes and provides optimal comfort to visitors.

ENERGY EFFICIENCY

Using conventional methods to achieve optimal micro climate 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.

WE KNOW HOW

CONCEPT

MAX.O3POOL *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.O3POOL *is "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, recovering from 65% to 100% the extract heat from the room*

CONSTRUCTION

MAX.O3POOL *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. Size* MAX.O3POOL *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 is 1 or 2 circuits, depending on the type of the unit.
Refrigerant – R407C.

MAXA POOL 03, 06, 09,13.0 use 3 phase "Scroll" Compressors - 1, 2 or 4 pcs. – depending of the type of the unit.

MAXA POOL 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 MAXA POOL 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

MAXA POOL 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.

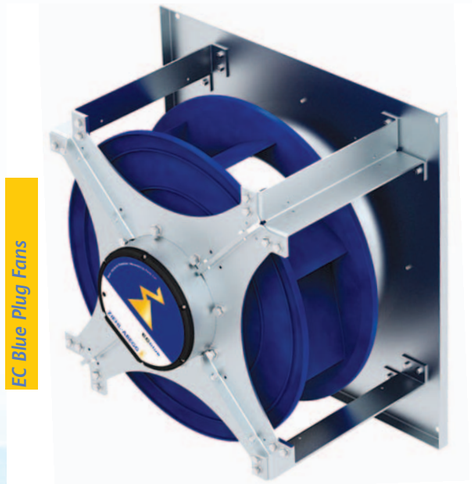
Using EC Blue fans MAXA POOL ensures the highest IE4 Premium Efficiency and ErP conformity- 2015/EC controller integrated. The high-performance composite material Cpro ZAmid®, developed using the latest insights, makes the impeller significantly lighter than those made of steel and offers superior mechanical 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 injection-moulding 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, comparable with steel
- No weld seams - high peripheral velocities up to 70 m/s
- Suitable for operational temperatures from -20°C to +80°C, comparable with steel impellers
- Corrosion-free
- No toxic gas emissions
- Colour-stable

MAXA POOL 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.



EC Blue Plug Fans

Both the fan wheel and the motor are mounted on a common base frame with vibration dampers.

EUROVENT Сертификат: 03.01.242.

Plug Fans

EUROVENT Сертификат: 03.01.242.

PLATE HEAT EXCHANGER

All of the MAXA 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 "free-cooling").

Efficiency (Sensible) – E ≤ 65%-70%. The special cover of the plate heat exchanger extends its useful life and prolongs the best levels of performance.

CONTROLLER AND AUTOMATION SYSTEM

MAXA POOL is fully equipped with all necessary automation as well as with all executive mechanisms.

The "Brain" of MAXA POOL is a CAREL controller, 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. Only the parameters (temperature and relative humidity) of the room need to be input. The controller automatically chooses in which of the 4 processes to work depending on variables input for the outside temperature, the set point temperature, and the supply and room temperatures. The controller even measures the necessary relative humidity within the room.

FILTERS

Filters are installed at the entrance of the unit to ensure normal operation of the air-handling unit and to prevent contamination of the components. Microcell filters are used in the MAXA POOL units 06, 09 and 13.0. These filters are made of plated micro glass paper and spaced with hot-melt adhesive beads which are uniformly positioned to deliver optimum air-flow. The frame is constructed with composite material (plastic) and 130mm Galvanized steel sheets.

The Classes of filtration are F6 (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 filters are unaffected by fan shut down or start up, can resist up to 1000 Pa. of differential pressure, and work perfectly in humid conditions.

EUROVENT №: 09.07.434.

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 so mixed air is heated within the condenser and then supplied to the pool. The plate heat exchanger is used as an economizer, reducing significantly the energy costs.

2. OPERATION IN WINTER - DEHUMIDIFICATION WITH HEAT PUMP

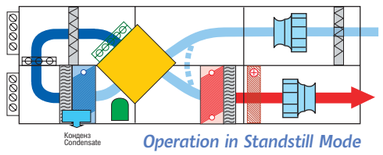
During the winter, water evaporation is much more intensive. Thus a dehumidification process is needed. The exhaust air from the pool is pre-cooled in the plate heat exchanger, then sub-cooled in the evaporator below the dew point temperature. The moisture in the form of condense is taken out. The necessary fresh air is partially mixed with dehumidified, recirculated air. The so 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

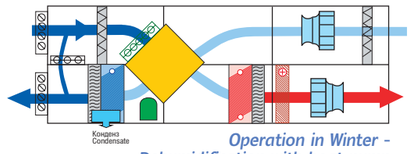
The outside temperatures during the transitional periods are average and relatively high. The MAXPOOL supplies 100% fresh air to the pool. The Heat Pump is switched on only if needed.

4. OPERATION IN SUMMER - VENTILATION WITHOUT HEAT PUMP

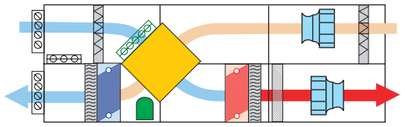
During the summer the heat pump is switched off and only the exhaust and supply fan are operating. The bypass of the plate heat exchanger is open and the unit supplies the maximum quantity of fresh air to the pool. Thus, optimum comfort is achieved.



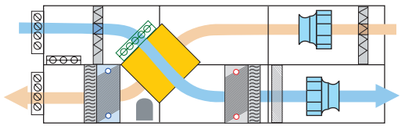
Operation in Standstill Mode



Operation in Winter - Dehumidification with heat pump



Operation in Transitional Periods- Ventilation and heat pump



Operation in Summer - Ventilation without heat pump

GENERAL TECHNICAL DATA

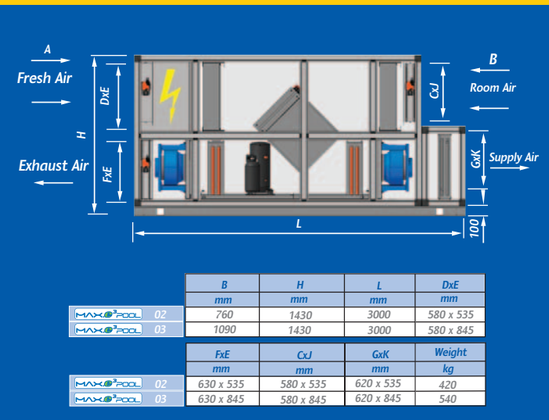
Type AHU		MAXPOOL 02	MAXPOOL 03	MAXPOOL 06	MAXPOOL 09	MAXPOOL 13.0
Min/Max Airflow	m^3/h	1000/2000	2000/3200	4000/7000	5500/10000	9000/14500
Nominal Airflow	m^3/h	1500	2500	6000	9000	13000
Dehumidification Capacity (VDI 2089)	kg/h	11.1	18.9	41.1	60.3	83.2
		Pool Area Surface - m^2				
Private Pool	m^2	56	93	224	336	486
Public Pool	m^2	42	70	168	252	365
Total heating capacity	kW	18.4	31.4	68.5	100.1	140.9
System COP		5.9	5.8	6.1	6.3	6
Filters		Cassette type				
Filtration Class	F	F5	F5	F6	F6	F6
Filtration Efficiency	%	90	90	90	90	90
Total Filtration Area	m^2	4.34	6.4	55.8	74.4	99.2
Fans		Type - EC Plug fan				
Motor Efficiency		% IE4 Premium Efficiency & ErP conformity-2015/EC controller integrated				IE2
Specific Fan Power (SFP)	$W/(m^3/s)$	2184	1944	2130	2216	2166
Supply/Exhaust Static Pressure	Pa	250	250	250	250	250
Installed Motor Power	kW	2.2	3	4	5.5	7.5
Installed Current	A	4.36	5.7	7.96	10.7	15.2
Protection Class	IP	55	55	55	55	55
Plate Heat Exchanger		Aluminum				
Efficiency(1)	%	65	65	67.4	66.8	65
Recovered Heating Capacity(1)	kW	7.9	13.3	30.9	45.2	62.1
Compressor		Rotary	Scroll	Scroll	Scroll	Scroll
Number of compressors		1	1	2	2	4
Winter Mode Power Input(1)	kW	1 x 2.4	1 x 2.55	2 x 2.44	2 x 3.37	4 x 2.25
Max. Full Load Current	A	12.8	1 x 14.1	2 x 14.1	2 x 14.5	4 x 14.1
COP		4.7	4.5	5	5.4	5.2
Total Installed Power (compressors + fans)	kW	7.75	10.95	17.9	22.6	34.8
Total Power Input (compressors + fans)	kW	3.4	5.91	11.8	16.9	25.6
Connection Voltage	V/h/Hz			400 / 3 / 50		
Additional Heating Coil (optional)						
Hot Water 80/60°C	m^3/h	0.27	0.51	1.38	2.16	3.15
Heating Capacity	kW	6.2	11.6	31.5	49	72
Water Pressure Drop	kPa	1	1.6	1	2.8	2.2
Headers in/out	mm	21.3	26.9	33.2	42.2	42.2

Computing Conditions

(1)Exhaust air 28°C/60%, Fresh air -15°C/90%
(2)Quantity of Fresh Air - 30%

DIMENSIONS AND WEIGHTS

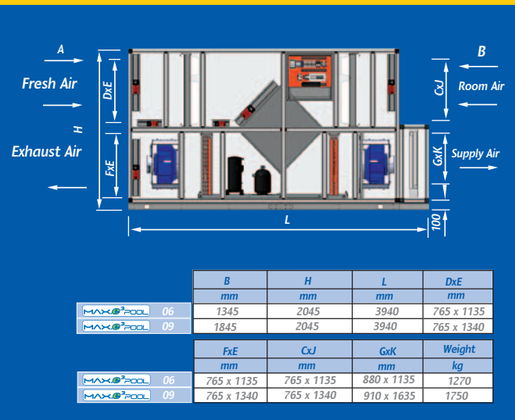
MAXPOOL 02 MAXPOOL 03



	B mm	H mm	L mm	DxE mm
MAXPOOL 02	760	1430	3000	580 x 535
MAXPOOL 03	1090	1430	3000	580 x 845

	FxE mm	CxJ mm	GxK mm	Weight kg
MAXPOOL 02	630 x 535	580 x 535	620 x 535	420
MAXPOOL 03	630 x 845	580 x 845	620 x 845	540

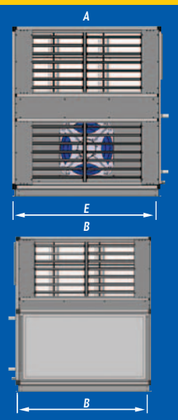
MAXPOOL 06 MAXPOOL 09

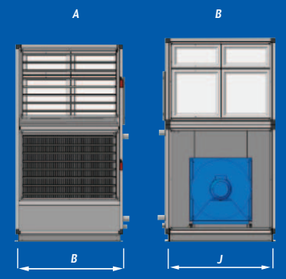


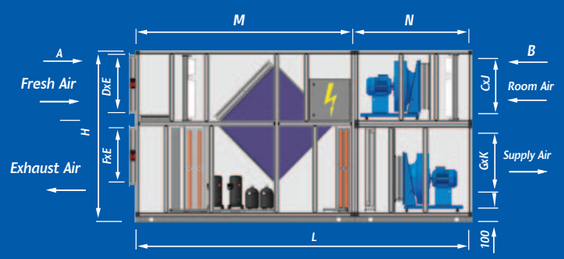
	B mm	H mm	L mm	DxE mm
MAXPOOL 06	1345	2045	3940	765 x 1135
MAXPOOL 09	1845	2045	3940	765 x 1340

	FxE mm	CxJ mm	GxK mm	Weight kg
MAXPOOL 06	765 x 1135	765 x 1135	880 x 1135	1270
MAXPOOL 09	765 x 1340	765 x 1340	910 x 1635	1750

MAXPOOL 13.0







	B mm	H mm	L mm	M mm	N mm	DxE mm	FxE mm	CxJ mm	GxK mm	Weight kg
MAXPOOL 13.0	1345	2470	4920	3200	1720	876 x1265	876 x1265	970x1265	1240x1265	2580