SXV/HE

SWIMMING POOL AIR HANDLING UNITS

INTRODUCTION

Indoor swimming pools are generally characterised by an air temperature between 28 °C and 33 °C, in order to offer bathers a comfortable environment. In principle, the air temperature in the pool rooms is almost always warmer than the outside air.

These rooms are also characterised by a high degree of water evaporation which leads to a high level of humidity and an unpleasant feeling of oppressive heat. If humidity is not controlled, not only is the time spent in an indoor pool perceived as unpleasant, but the climate that forms in the environment can also cause real discomfort to the users and the public present. In addition, there is a risk that the moisture contained in the water vapour condenses on colder surfaces, such as metal components, external walls or glass surfaces.

This can lead to the formation of mould and can cause corrosion. If all this were to occur, the building would suffer considerable damage over time, which would lead to costly renovation work, accompanied by business interruptions and economic losses for the site manager. In these applications, room ventilation is mandatory and is strictly regulated by specific international regulations. Ventilation, however, involves considerable energy consumption, and good heat recovery systems combined with advanced controls systems must be used to manage it. The most important aspect of ventilation systems in a public indoor swimming pool are not the investment costs, but the operating costs, for this reason the correct choice of the air handling unit can lead to very important savings in the long term and a recovery of costs in a very short time.

SELECTION PRINCIPLES

The water surface and the use of the pool are key factors in calculating the evaporation of the pool water. Evaporation is as high as the difference in pressure between the saturation water vapour at the pool water temperature and the partial water vapour pressure in the pool air. Based on these factors, the mass of evaporated water can be determined.

EXAMPLE OF CALCULATION OF DEHUMIDIFICATION AND FRESH AIRFLOW IN INDOOR SWIMMING POOLS

SWIMMING POOL DATA

Room volume	m^3	1.0
Pool surface	m^2	100.0
Pool water temperature	°C	28.0
Vapour pressure: Water 100% R.H.	mbar	37.79
Room temperature	°C	30.0
Relative humidity	%	60.0
Vapour pressure: Air	mbar	25.45
Full operation factor:		1.0
Stand-by factor:		0.5

EVAPORATION CALCULATION

Max. evaporation:	kg/h	11.03
Max. evaporation:	kg/24h	264.79
Min. evaporation:	kg/h	5.52
Min. evaporation:	kg/24h	132.40

FRESH AIRFLOW RATE CALCULATION

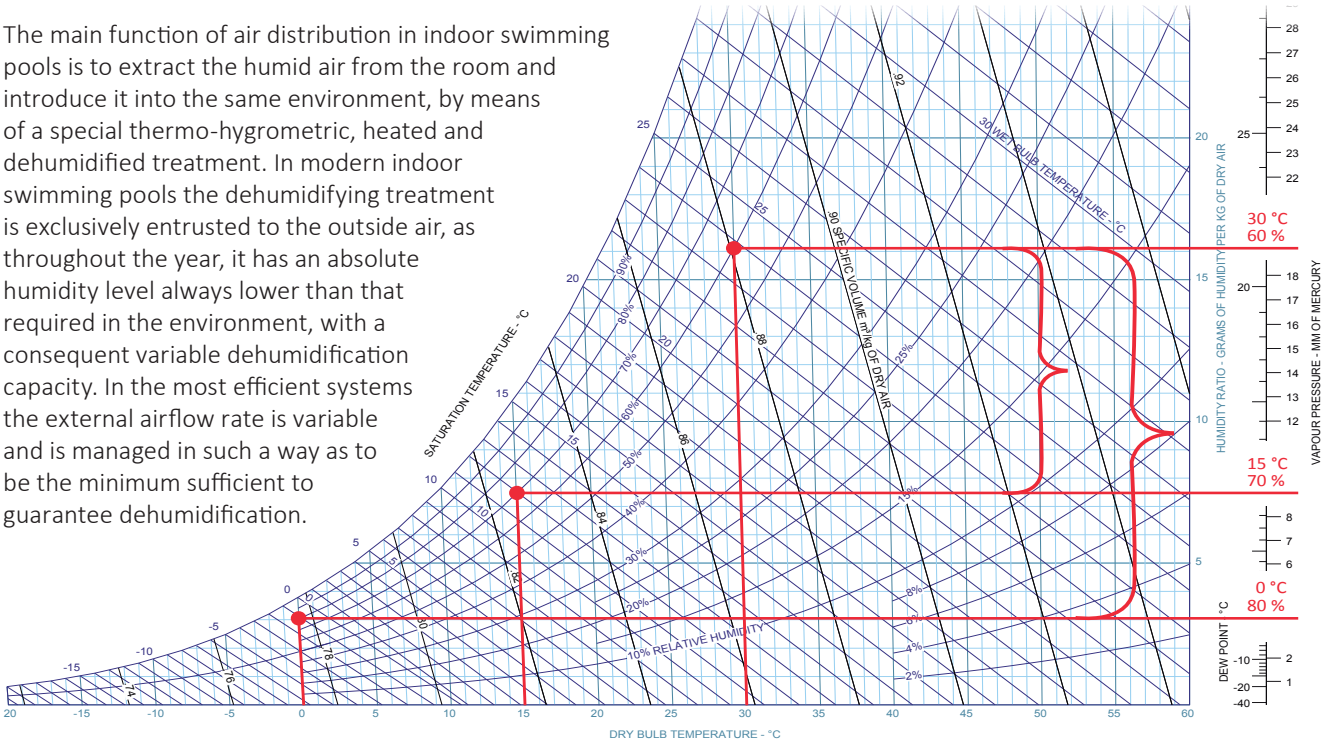
Fresh airflow (VDI 2089 B1-94)	m^3/h	1.365
Fresh airflow (Italian law 16/03)	m^3/h	2.000

= input data = output data

USE FACTORS:

0.3 = swimming pools not in function (with cover)
0.6 = swimming pools not in function (without cover)
1.0 = private swimming pools
1.5 = hotel swimming pools
2.0 / 2.5 = public swimming pools (2.2 average factor)
2.7 = wave pools, children's slides
3.0 = whirlpools, waterfalls or other attractions

The main function of air distribution in indoor swimming pools is to extract the humid air from the room and introduce it into the same environment, by means of a special thermo-hygrometric, heated and dehumidified treatment. In modern indoor swimming pools the dehumidifying treatment is exclusively entrusted to the outside air, as throughout the year, it has an absolute humidity level always lower than that required in the environment, with a consequent variable dehumidification capacity. In the most efficient systems the external airflow rate is variable and is managed in such a way as to be the minimum sufficient to guarantee dehumidification.



The design parameters normally used in the various environments are shown in the following table:

Air temperature

Swimming pool	30- 34 °C
Locker rooms	22- 28 °C
Showers	26- 34 °C
Offices	22- 26 °C
Hall	> 20 °C
Connecting area	> 20 °C

Water temperature

Public pools	28 °C
Leisure pools	28 - 32 °C
Children's pools	32 °C
Therapeutic pools	36 °C
Whirlpools	36 °C
Cold water pools	15 °C

Fresh airflows

Hall	5 m^3/hm^2
Locker rooms	15 m^3/hm^2
Infirmary	25 m^3/hm^2
WC (unitary)	100 m^3/h
Showers (unitary)	220 m^3/h

OPERATING MODE

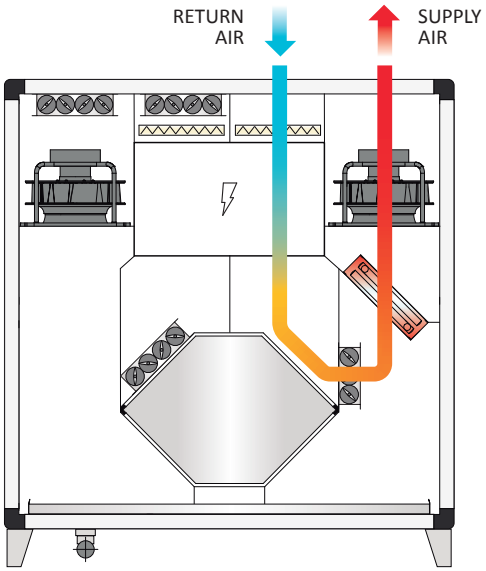
• 100% RECIRCULATION AIR

The unit operates in 100% recirculation mode without the addition of external fresh air.

The pool room air is recirculated and heated by the water coil in the unit and supplied by an external energy source (e.g. boiler or heat pump).

The fans operate at a constant flow rate in power modulation mode to minimise the unit's power consumption.

This mode does not allow dehumidification and is used during system start-up or night operation.



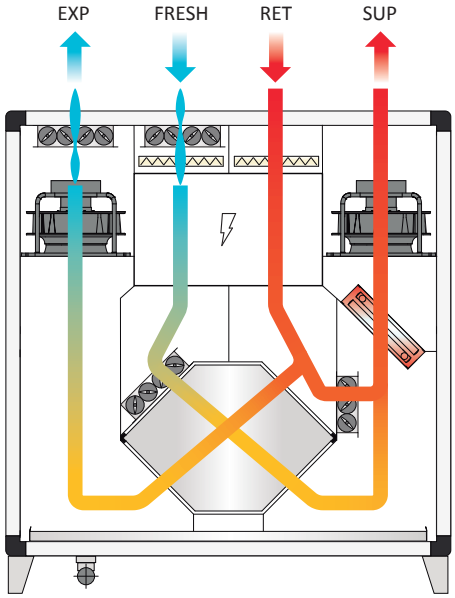
• PARTIAL FRESH AIR INLET

In most climatic conditions the external fresh air, modulating its flow rate according to its own thermo-hygrometric conditions, is able to dehumidify the room.

In this mode, the unit minimises the amount of external fresh air by mixing the remaining air flow through the by-pass damper.

A (variable) percentage of the air flow is still exhausted and its thermal load is recovered in the plate heat exchanger, which heats the air to be sent to the room.

In the event that the air temperature is still not warm enough, integration with the hot water coil takes place.



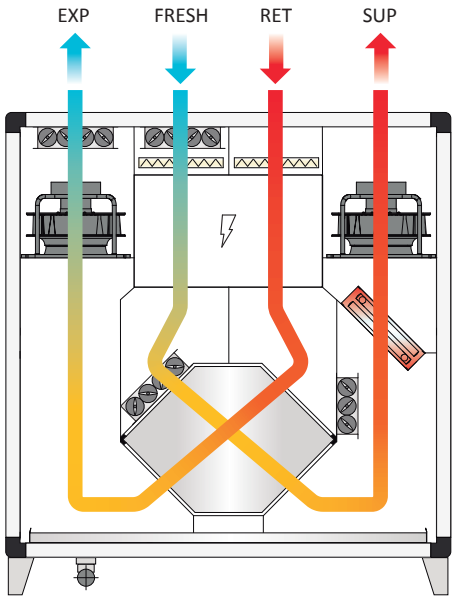
• 100% FRESH AIR INLET + BYPASS

When external and ambient conditions are convenient, the unit operates with 100% fresh air inlet.

The heat exchanger by-pass damper is closed and dehumidification takes place using the thermo-hygrometric conditions of the external fresh air.

In this mode the entire air flow goes through the plate exchanger where it is heated and sent to the room. If the air temperature is still not warm enough, integration with the hot water coil takes place.

When the external temperature is lower than the room to be air-conditioned and when the room requires cooling, the unit operates in Free-Cooling mode by opening the By-Pass damper installed on the plate exchanger and thus allowing external fresh air to enter without recovery.



MAIN CHARACTERISTICS

STRUCTURE AND PANELS

Profiles 50x50 mm in self-supporting extruded painted RAL 9010 aluminium, with mechanical strength requirements in accordance with EN 1886: D1 (M).
50 mm thick double-wall sandwich type paneling with both exterior and interior side painted RAL 9010 galvanized sheet steel with interposed insulation made of polyurethane foam with a density of 40 kg/m^3. This structure has a seal class L1 while the thermal transmittance and the thermal bridge characteristic is class T3/TB3 according to EN1886.

AIR FILTERS

The filter sections on the return and fresh air are supplied with panel filters class ePM$_{10}$ 60% (M5) and ePM$_1$ 55% (F7) in accordance with international norms.

All units are equipped with differential pressure switches to monitor the air side pressure drops of the filtering sections.

FANS

The units are equipped with high efficiency plug-fan type fans with built-in brushless EC motor.

In this way it is possible to guarantee an accurate control of the airflow both in the supply and extract section, ensuring that all regulatory requirements such as SFP are met.

The airflow rate of the fan is managed through the integrated electronic control system.

HEAT RECOVERY

The units are equipped with a counter-flow heat exchanger made of aluminium treated for chlorinated environments and used to transfer heat from the exhaust air to the fresh air inlet.

The fin spacing is optimised to reduce air pressure drop and fan power consumption.

The heat exchanger is also equipped with an additional by-pass damper to manage the free-cooling and free-heating mode as required by **ERP regulations**.

100% air flow by-pass damper included.

AIR DAMPERS KIT

The units are supplied complete with 3 regulation air dampers, each equipped with a specific actuator.
The dampers manage the air flows within the unit and control the various operating modes. They are managed directly by the microprocessor control.

HOT WATER COIL KIT

The units are supplied complete with hot water coil kit with modulating 3-way valve and water pipe kit, managed directly by the microprocessor control.

CONTROLS

The unit is managed by a microprocessor electronic board with dedicated software and external LCD display as user interface. Through the external or remote LCD display it is possible to set all the working set-points of the unit and display the operating status and any alarm conditions present.
Through the values acquired by the room temperature probe and the supply air, the thermoregulation will be managed with reference to the set-points.

The unit can manage the automatic change of operating modes by comparing the temperature and humidity of the outside and room air.

The microprocessor also activates and modulates all the dampers of the unit and optimizes all the operating parameters of the refrigerant circuit.
The RS485 interface is standard (MODBUS protocol) to be used for connection to remote supervision and control systems.
The control can also be supplied with a second remotable control panel (optional).

LCD REMOTE GRAPHIC DISPLAY

TECHNICAL DATA

MODEL		006	010	015	020	030	040
Nominal airflow rate	m^3/h	650	1000	1500	2000	3000	4000
External air flow	%	0 ÷ 100	0 ÷ 100	0 ÷ 100	0 ÷ 100	0 ÷ 100	0 ÷ 100
Dehumidification capacity (1)	kg/h	11,0	16,9	25,4	33,9	50,8	67,7
Nominal electric power absorbed (1)	kW	0,21	0,47	0,67	0,86	1,35	1,71
Max electrical power absorbed	kW	0,36	1,16	1,16	1,56	2,56	4,80
Max electrical current absorbed	A	2,90	4,90	4,90	6,80	3,90	7,60
Type of heat recovery system (HRS)	type/n°	static counter-flow / 1					
Thermal efficiency recovery (1)	%	90,3	89,2	89,2	89,2	88,6	88,5
Thermal power recovery (1)	kW	6,9	10,5	15,8	21,0	31,4	41,8
Hot water coil heating capacity (1) (2)	kW	2,36	3,11	4,73	6,25	7,88	12,0
Heating coil waterflow (1) (2)	l/h	410	540	820	1090	1370	2090
Hot water coil + valve kit water pressure drops (1) (2)	kPa	18	15	13	18	18	18
Total unit heating capacity (1)	kW	9,3	13,6	20,5	27,3	39,3	53,8
Type of fans	type/n°	EC/2	EC/2	EC/2	EC/2	EC/2	EC/2
Supply fan available static pressure	Pa	150	150	150	150	150	150
Return fan available static pressure	Pa	150	150	150	150	150	150
SFP_{int}	$W/(m^3/s)$	503	1019	1019	932	998	896
SFP_{lim}	$W/(m^3/s)$	1169	1119	1092	1073	1008	959
Max. external / internal leakage percentage	%	max 3,5 % at -400 Pa | max 5,0 % at +250 Pa					
Energy classification filters		ePM1 55% (F7) | ePM10 60% (M5)					
Filters pressure switch		present					
Sound power level L_{WA} (3)	dB(A)	63	63	66	68	67	71
Sound pressure level (4)	dB(A)	47	47	49	52	50	55
Power supply	V/ph/Hz	230/1/50				400/3/50	

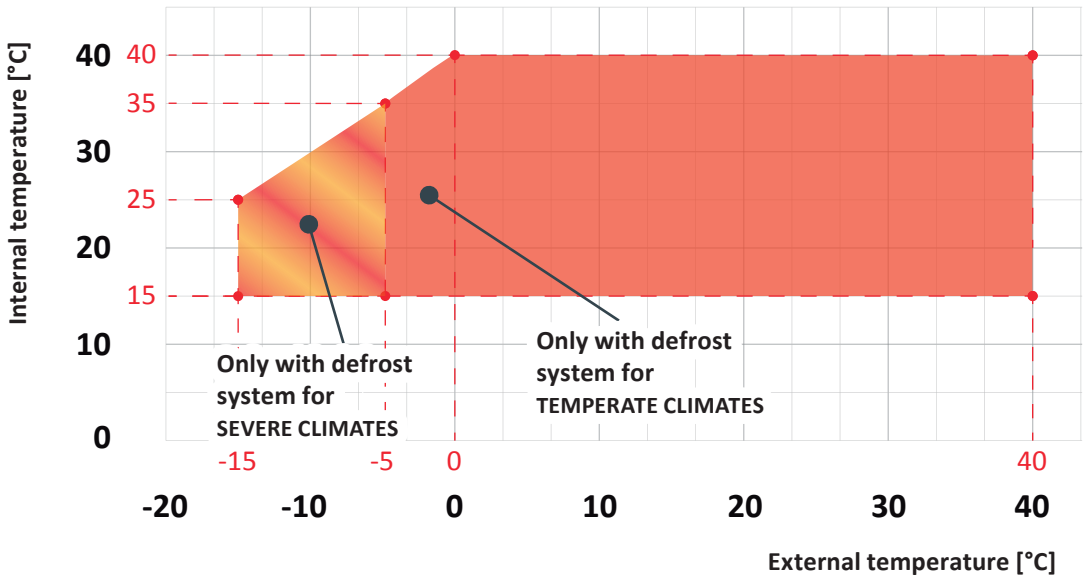
(1) 100% external air flow, external air conditions -5°C / 80% R.H. ambient air conditions 30°C / 60% R.H.

(2) inlet/outlet water temperature 70/60°C

(3) sound power level calculated in accordance with EN 3744

(4) sound pressure level measured at 1 m free field distance, ducted unit, in accordance with EN 3744

OPERATING LIMITS



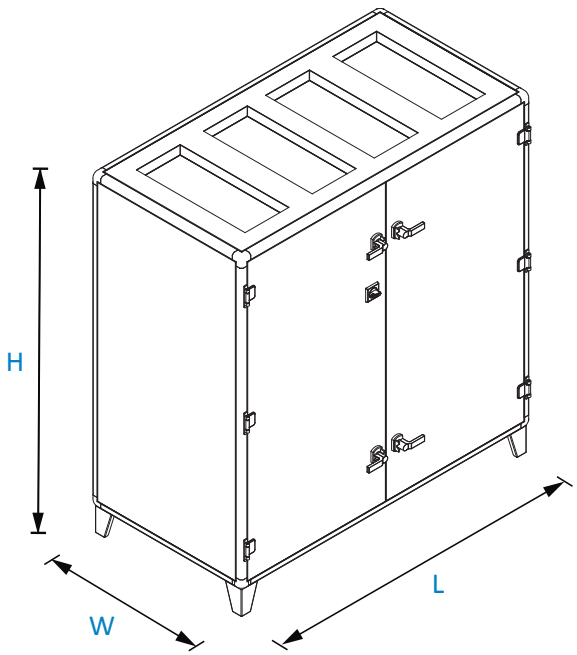
ACCESSORIES

MODEL	006	010	015	020	030	040
RAL 9010 painted frame	■	■	■	■	■	■
Supply and return EC fans	■	■	■	■	■	■
Filters differential pressure switches on return / supply air	■	■	■	■	■	■
Counter-flow plate heat recovery	■	■	■	■	■	■
ePM_{10} 60% (M5) + ePM_1 55% (F7) filter on return / supply air	■	■	■	■	■	■
Hot water coil with 3 way modulating valve	■	■	■	■	■	■
Dampers with actuators (3 pcs)	■	■	■	■	■	■
Microprocessor control system + remotable control panel with LCD display	■	■	■	■	■	■
RS485 serial interface Modbus protocol	■	■	■	■	■	■
Door lock mainswitch	■	■	■	■	■	■
Modbus RTU RS485 card	■	■	■	■	■	■
50 mm frame with 40 kg/m^3 polyurethane panels insulation	□	□	□	□	□	□
50 mm frame with 90 kg/m^3 mineral wool panels insulation	□	□	□	□	□	□
TCP/IP ethernet and modbus port | BACnet and ethernet port	□	□	□	□	□	□
Second remotable control panel with LCD display	□	□	□	□	□	□
Unbalanced airflows desfrost system for temperate climates	□	□	□	□	□	□
Unbalanced airflows desfrost system for severe climates	□	□	□	□	□	□
Flexible joints kit for duct connections (4 pcs) [1]	□	□	□	□	□	□

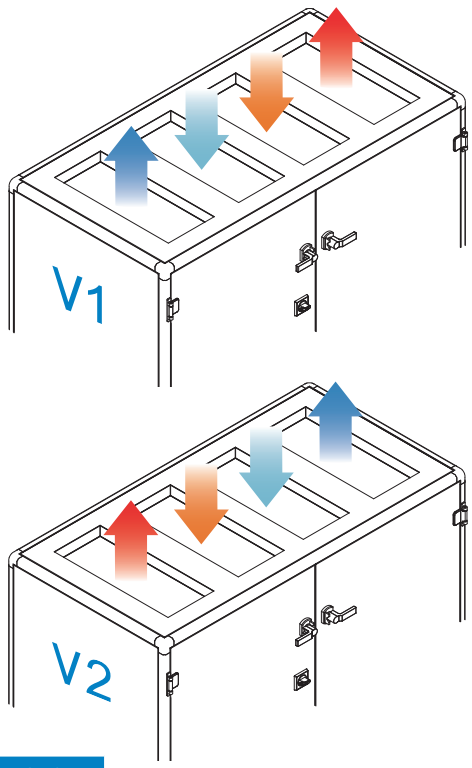
[1] supplied loose

■ Standard □ Optional – Not available

DIMENSIONAL DRAWING



CONFIGURATIONS



ROOM RETURN AIR
STALE ROOM EXHAUST AIR
FRESH AIR INLET
SUPPLY AIR TO THE ROOM

DIMENSIONS AND WEIGHTS

MODEL	006	010	015	020	030	040
L (mm)	1260	1560	1560	1860	1860	2160
W (mm)	660	660	810	810	960	1260
H (mm)	1390	1540	1690	1840	1840	1840
Weight (kg)	215	233	302	397	472	690

Dimensions and weights referred to the standard configuration