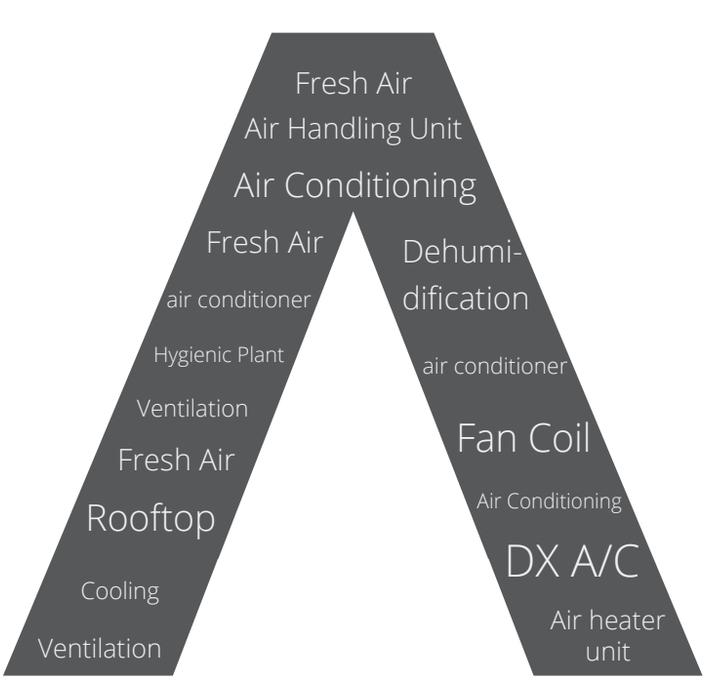

AIR+PLUS

Air Conditioning Technologies

APHS Indoor Swimming Pool
Dehumidification Plant

41

AIR+PLUS
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Plug & Play

AIR+PLUS

We Protect the Pool Location and Human Health

APHS Series Indoor Swimming Pool Dehumidification Plant

▶ Why is Humidity Control Important?

At indoor swimming pools, water evaporates because of ambient conditions, pool surface area and pool activities. As a result, bacteria that form in the environment threaten human health and the structure is damaged due to high humidity. Therefore, humidity control at indoor swimming pools where intensive humidity occurs is highly important for facility users in terms of necessary hygienic conditions, human health and lifetime of building. Why Humidity Occurs in Indoor Swimming Pool Areas? If partial pressure of water vapor of ambient air is below saturation temperature then evaporation occurs on surface of pool water. Ambient air temperature and relative humidity, pool water temperature, ambient air movements and pool usage type affect evaporation.

▶ Casing Structure

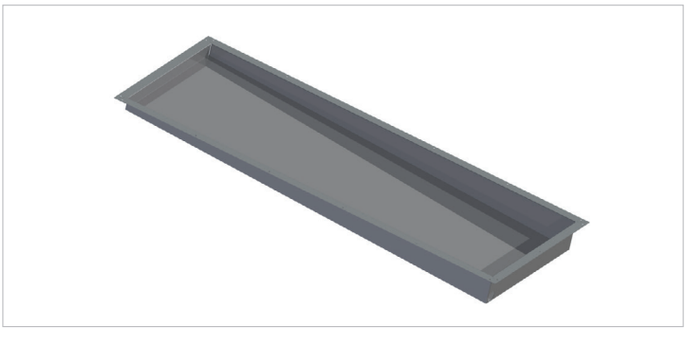
The framed/carcass structure of Airplus Indoor Pool Dehumidification Plant consists of anodized aluminum profiles, anodized aluminum intermediate records, ABS corner and intermediate record connecting parts. With the snap-on design of the profiles, an easy-to-clean environment is obtained by providing a smooth inner surface after panel mounting. Thanks to its special leg design, it is possible to transfer the total weight of the power plant as a distributed load to the ground. The forklifts and carrying rings are standardized on both length and width of the legs, making it easier to transport the device horizontally and vertically.

▶ Panel Structure

Panel structure in Airplus Indoor Pool Dehumidification Plant is manufactured as double walled and insulated with 70 kg/m3 42 mm rock wool. The thickness of the panel is 42 mm forming a smooth surface on the inner surface of the plant thanks to its snap-on design. The panel thickness can optionally be increased to 50 mm. The inner and outer metal sheets of the panels are manufactured with a thickness of 0,9 mm and painted with oven paint in order to be suitable for working under pool ambient conditions. Thermal bridging and sealing is ensured by using EPDM gasket at the joints of the panel and carcass/frame.

▶ Pan Structure

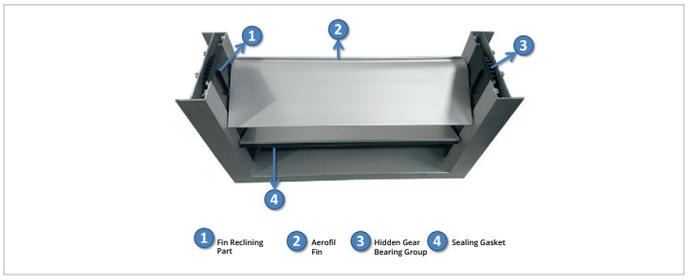
Since the condensation amount is high in Indoor Pool Dehumidification Plants, it is of great importance that this water is discharged quickly and appropriately. Owing to two sloped design trays with 90 mm depth of Airplus Indoor Pool Dehumidification Plant, it is possible to quickly collect and discharge the condensate formed. 1.2 mm stainless steel sheet is used as a tray material. Condensation of the outdoor air is prevented owing to 50 mm rock wool insulation applied under the tray. The standardized leg height of 180 mm provides sufficient siphon height.



▶ Damper Structure

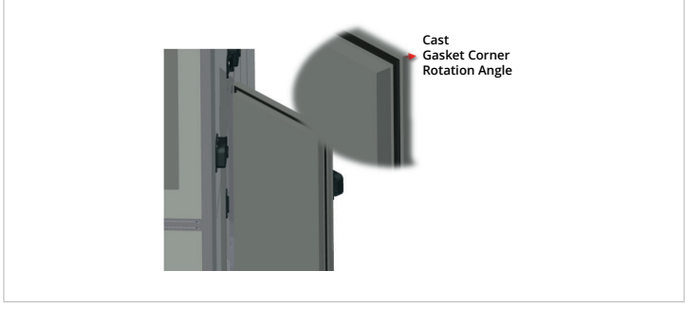
The dampers, made up of specific design aluminum profiles, embody hidden plastic gear structure and bearings. In this way, the moving parts are protected from dust particles coming from the external environment and the system works smoothly.

Minimum pressure loss is provided by preventing distortion of air flow lines thanks to the airfoil design of the damper blades.



▶ Door Structure

Due to the movable structure of the air handling units, doors are of great importance for air leakage. In the doors manufactured from 0,9 mm painted sheet, a spaceless structure was formed by the use of a special cast gasket, thus creating a hermetical structure. Since the corner rotating angles of the used special cast gaskets are calculated, and installation is carried out according to these values, no leakages occur in these regions. A smooth surface is dominant in the interiors by using external gear system as the door handle and the hinge system. The thermal bridges between the indoor and outdoor environments have been eliminated thanks to the significantly important door latches.



▶ The Fan

EC fan complying with ERP Directives is used as the standard in the Airplus Indoor Pool Dehumidification Plant. The body structure is made up of special sheet metal with increased corrosion resistance. It is designed to be highly efficient for the required total air flow and pressure value. Flow control can be ensured depending on the pressure.

▶ The Coil

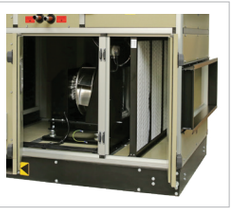
Airplus Indoor Pool Dehumidification Plant includes an evaporator, a heat pipe, a condenser and a water heater Coil. In order to protect against moisture and chlorine, all coils are manufactured with their blades coated with epoxy and hydrophilic coating and the frames are painted. Condensate water is prevented from going to the other cells and channels by using a drop holder following the evaporator with a painted frame made of PP material.

▶ The Heat Pipe

Allows heat transfer between the air, which is required to be conditioned (supply air) and the air, which is required to be evacuated from the environment (exhaust air). When the humidity in the air needs to be removed, this system gives a very big advantage in cases where it is required to maintain a low temperature, then to heat the air again in order not to make too cold blowing. The heat pipe provides convenience and important energy gain in this application. Increases the interior environment air quality. It is easily installed in the air handling unit just as any coil. R134A is used as the refrigerant in the heat pipe.

Pan Structure:	Lamella Coating	Frame Coating
Evaporator	Hydrophilic	Painted
Condenser	Epoxy	Painted
Heat Pipe	Epoxy	Painted
Water Heater Coil	Epoxy	Painted

The general elements of the cycle consist of evaporator, condenser, expansion valve (thermostatic), compressor, solenoid valve, drainer and a bullseye. R407C refrigerator is used as the coolant. The general elements of the cycle consist of evaporator, condenser, expansion valve (thermostatic), compressor, solenoid valve, drainer and a sight glass.R407C is used as refrigerant/ reactor coolant.

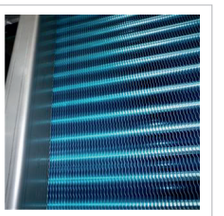


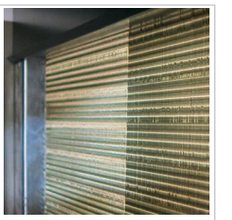
▶ Compressor and Cooling Cycle

A scroll compressor is standardized in the cooling cycle used for dehumidification in the AirPlus Indoor Pool Dehumidification Plants.

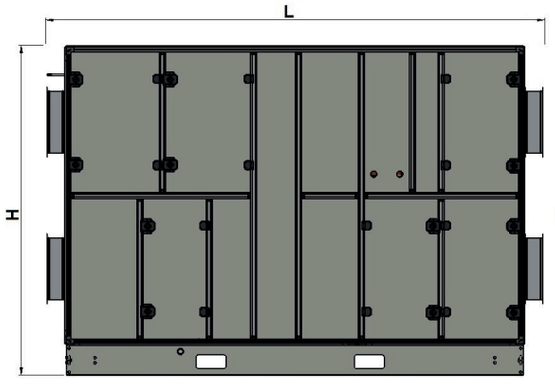
▶ Filters

G4 class filter is used as the standardized. Special design filter slide mechanism provides easy service. A low depth bag filter can be applied optionally. The filter pressure losses value was calculated based on the formula (clean + dirty)/2. The impurity of the filters can be monitored from the automation system thanks to the differential pressure switches used.

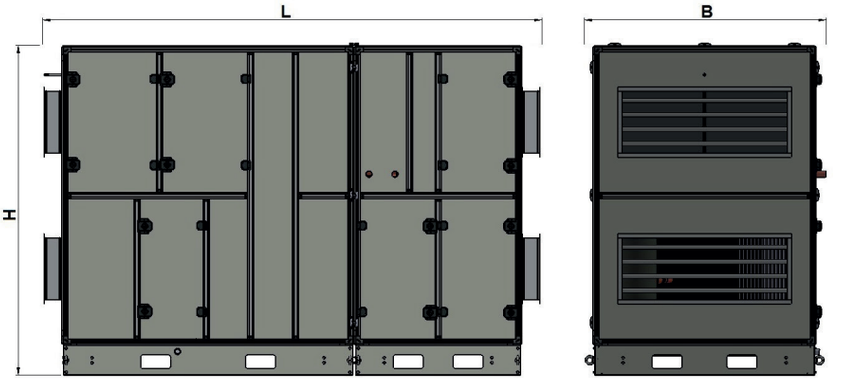




APHS - 2750 / APHS - 4000 / APHS - 5750
APHS - 9000 / APHS - 11000 / APHS - 16000



APHS - 20000 / APHS - 25000



▶ Airplus Pool Dehumidification Plant Technical Specifications

Model		APHS 2750	APHS 4000	APHS 5750	APHS 9000	APHS 11000	APHS 16000	APHS 20000	APHS 25000
Pool Area	m^2	59	83	122	182	228	336	405	525
Dehumidification Capacity	kg/h	17	23,5	35	52	65	96	115	150
Air flow	m^3/h	2750	4000	5750	9000	11000	16000	20000	25000
Cooling Capacity	kW	18,7	26	38,5	57	72	107	128	167,5
Heating Capacity	kW	30	42	64	93	115	175	220	251
Heat Recovery Capacity	kW	9	12	17,3	27	32,5	48	59	74
External Pressure Rating (Suction Line)	Pa	350	350	350	330	350	350	350	350
External Pressure Rating (Blowing Line)	Pa	400	400	400	400	400	400	400	400
Ventilator Motor Power	kW	1,19	1,56	2,16	4,27	5,14	8,1	7,62	13,8
Aspirator Motor Power	kW	1,04	1,46	2,06	3,29	4,78	6,6	9,2	12,06
Compressor Electric Power	kW	5,56	8,1	11,4	16,8	20,7	33,78	41,4	50,38
Device Installed power Rating	kW	8,44	11,77	16,27	25,01	31,27	49,13	59,12	77,14
Filter - Suction Air/ Blow Air		G4/G4	G4/G4	G4/G4	G4/G4	G4/G4	G4/G4	G4/G4	G4/G4
Refrigerant		R407C	R407C	R407C	R407C	R407C	R407C	R407C	R407C
Compressor Type - Number of Circuits		Scroll - 1	Scroll - 1	Scroll - 1	Scroll - 1	Scroll - 1	Scroll - 2	Scroll - 2	Scroll - 2
Fan Type - Pcs		EC Plug -2	EC Plug -2	EC Plug -2	EC Plug -2	EC Plug -2	EC Plug -4	EC Plug -4	EC Plug -4

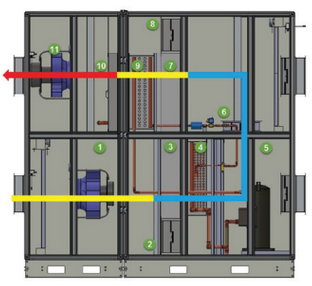
According to ASHRAE HVAC Applications 2015 Handbook, in the Pool Surface Area calculations, the values of 27°C, 30°C 55%, and 1,5 were taken as the references for the Pool Water Surface Temperature, the Environment, and the Activity factor, respectively.

▶ Airplus Pool Dehumidification Plant Dimensions

Dimensions Bypass Damper EXCLUDED	L (mm) B (mm) H (mm)	3216 1265 1690	3501 1435 1820	3566 1595 2260	3666 1765 2200	3906 1925 2500	3906 2385 2760	4106 2785 2760	4310 2810 2760
Dimensions Bypass Damper INCLUDED	L (mm) B (mm) H (mm)	3236 1265 2070	3501 1435 2230	3566 1595 2460	3666 1765 2830	3906 1925 2920	3906 2385 3160	4106 2785 3360	4310 2810 3360
Heating Coil In - Out Pipe Diameters	mm	27	27	33	42	42	48	48	60
Drain Pan Outlet Pipe Diameter	mm	33	33	33	33	33	33	33	33

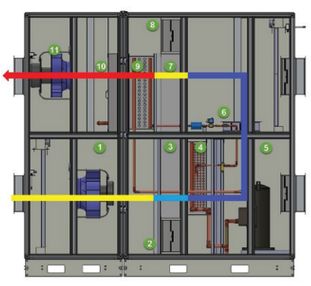
The operating scenario, in which the pool usage rate is low, and the dehumidification process is not applied:

- Heat recovery is active
- The final heater is active when needed
- The suction and blower fan is active at lower air flow
- Cooling circuit off



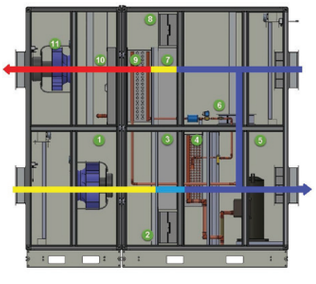
The operating scenario, in which the pool usage rate is low, and the dehumidification process is applied:

- Heat recovery is active
- The final heater is active when needed
- The suction and blower fan is active at lower air flow



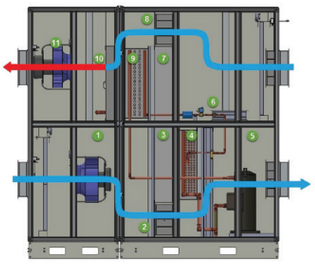
The operating scenario, in which the pool usage rate is high, and the dehumidification process is applied:

- Heat recovery is active
- The final heater is active when needed
- The suction and blower fan is active at higher air flow
- The cooling circuit is active



Mid season (free cooling) operating scenario:

- Heat recovery is off
- The final heater is active when needed
- The suction and blower fan is active at higher air flow
- Cooling circuit off



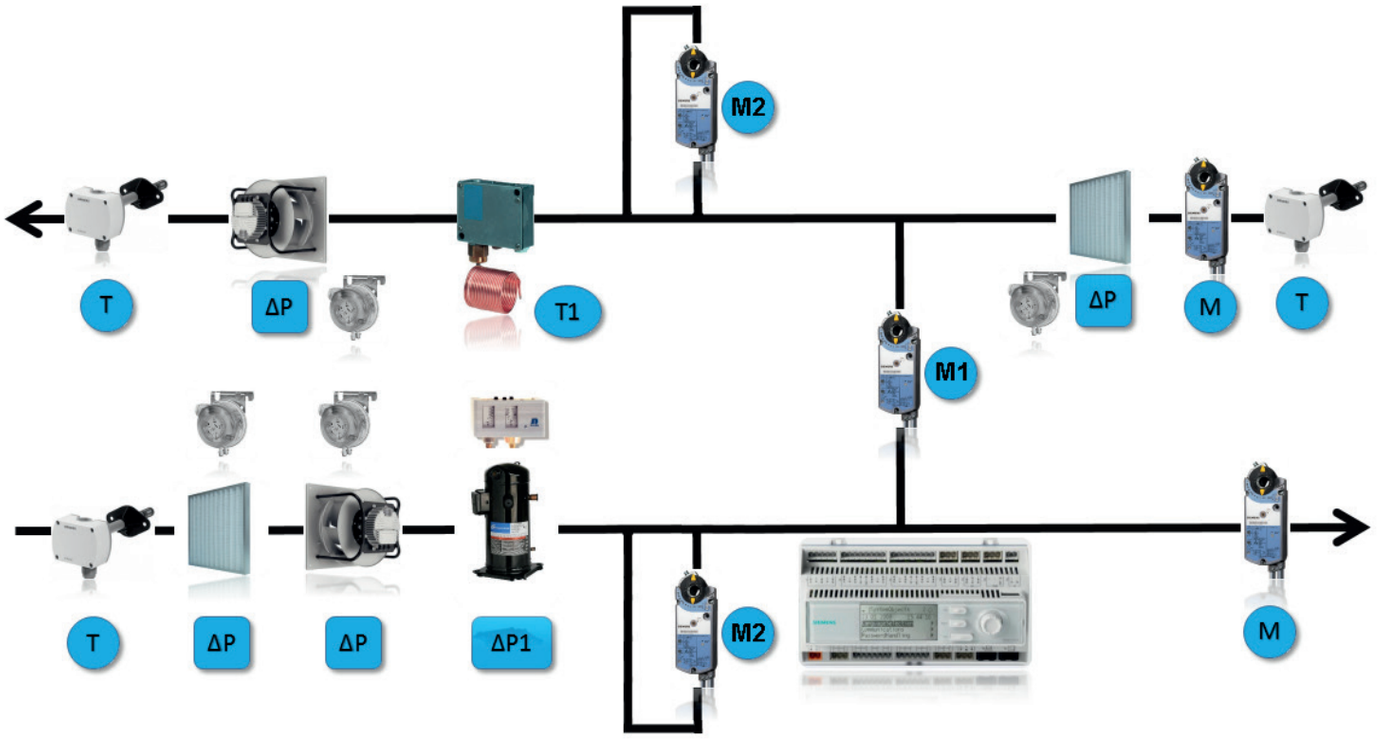
1. Suction Fan
2. Heat Recovery By-Pass Damper
3. Heat Pipe Heat Recovery
4. Evaporator
5. Compressor
6. Mixture Damper
7. Heat Pipe Heat Recovery
8. Heat Recovery By-Pass Damper
9. Condenser
10. Water Heater
11. Blower Fan

Automation System and Flow Diagrams

Airplus Indoor Pool Dehumidification Plant is provided as a package device together with the automation system. By this means, the device can be started-up directly only by making the power connections and the presets. All the automation equipment are positioned in the device and thus protected from external factors.

With the automation system;

- Controlling and monitoring the temperature and humidity values of the external environment, internal environment and blowing.
- Controlling contamination situation of the filters according to the set pressure value.
- Flow control of the EC fans depending on the pressure.
- Proportional controlling and monitoring of the fresh air, return air, and mixture dampers.
- Controlling and monitoring of pressure of the compressor.
- Freezing control of the heater coil.
- Possibility to view all the alarms on the LCD display.
- Can be integrated into building automation systems.
- Possibility to customize the end-user interfaces.
- Possibility to view all functions of the device on the LCD display
- Free Cooling control.
- Automatically detecting and activating determined different operating scenarios.



T Temperature Humiditiy Sensor

ΔP Pressure differential cut-out

M1 Proportional damper motor

M2 On- Off Damper Motor

ΔP1 A-Y Prostate

T1 Freeze Thermostate

▶ Technical Specifications
The Evaporation Amount to occur on the Pool Surface, Calculation Example

The need for dehumidification in the pool facilities is caused by human activities, evaporation on the surface of the pool and other external factors. The most important source here is the amount of evaporation that occurs on the surface of the pool. The factors affecting this;

- Ambient air temperature
- Pool water temperature
- Relative humidity of environment
- Amount of air movement
- Pool usage type

- In the Pools with Low Usage: 13 $\left(\frac{g}{hm^2mbar}\right)$
- In the Pools with Medium Usage: 28 $\left(\frac{g}{hm^2mbar}\right)$
- In the Pools with High Usage: 35 $\left(\frac{g}{hm^2mbar}\right)$

Example: The water temperature of a hotel pool with low usage having a surface area of 650 m² is 28°C. The ambient air is 30°C and the relative humidity is %55. Accordingly, calculation of the water amount to evaporate:

$W = e \times A \times (P_B - P_L)$ (According to VDI 2089 Norm),

A: Surface area of the pool (m2)

P_B: The saturated vapor pressure at the water temperature (mbar),

P_L: Partial vapor pressure at the air temperature (mbar),

e: Total vaporization coefficient

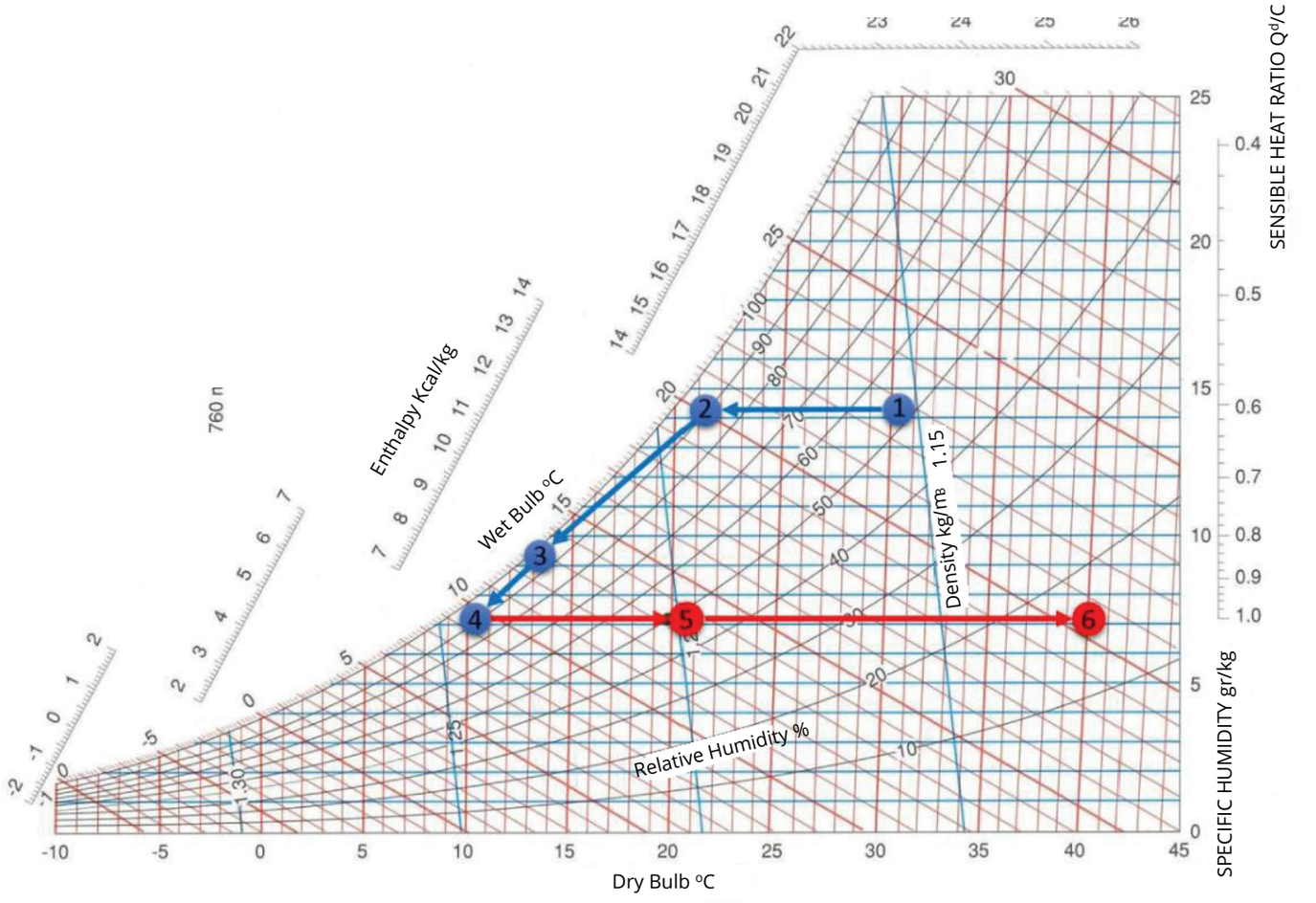
P_B: 38.54 mbarA: Surface area of the pool (m2)

P_L: 23,5 mbar

P_L: Partial vapor pressure at the air temperature (mbar),

e: 13 $\left(\frac{g}{hm^2mbar}\right)$

W = 13 x 650 x (38.54 - 23.5) = 128 kg/h



1-2: Heat Recovery, 2-3: Evaporator, 4: Mixing Point,
4-5: Heat Recovery, 5-6: Condenser

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