Basic:
Air handling units for swimming pools complete with high efficiency air-air heat recovery section and externally powered water heating coil

Recovery:
With heat recovery system equipped with thermodynamic cycle to heat intake air and/or water in swimming pool

Recovery Plus:
With dehumidification with thermodynamic air intake cycle

AHU POOL 2.00 ÷ 30.00 Serie EVO

Independent swimming pool air handling units

Samp®
SOLUZIONI AEROMECCANICHE S.p.A.

AHU EVO POOL

Installation Solutions - General features

INDEX

The right solution for every type of installation

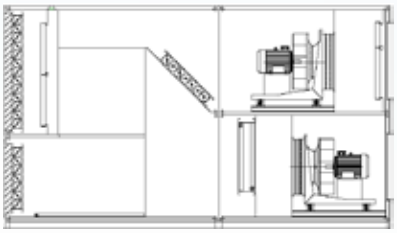
AHU-POOL series air handling units are machines specifically designed and developed to check temperature and humidity, recover energy and exchange air in indoor swimming pools and other applications with a high latent load environment.

This range consists of three types of unit:

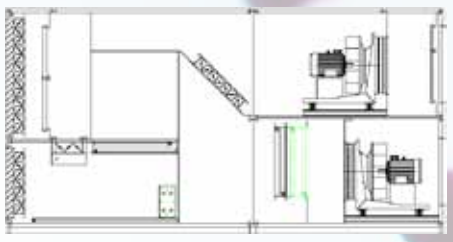
- **Basic:** with high efficiency air-air heat recovery section and externally powered water heating coil.
- **Recovery:** In addition to composition of Basic solution, unit comes complete with refrigeration section to heat intake air and/or water in swimming pool (with dedicated plate heat exchanger).
- **Recovery Plus:** in addition to composition of Recovery solution, intake air is also dehumidified with thermodynamic cycle.

All units are enbloc (except AHU POOL 30.00 and 24.00, see details and dimensional data on pages 4, 5 and 6) and come complete with electrical power supply panel, regulating device and all electrical and plumbing components connected, therefore supplied ready for start-up.

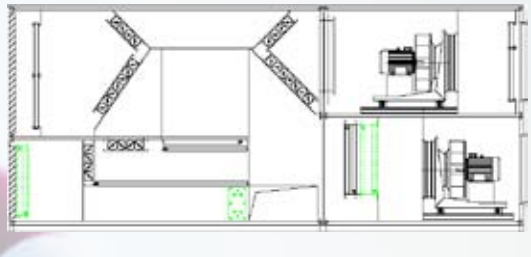
BASIC



RECOVERY



RECOVERY PLUS



Construction features

- Bearing frame made with 40 or 70 mm (according to the size) extruded aluminium sections, aluminium corner elements; a version with insulated sections and panels is available on request.
- Closed-cell seals.
- Sandwich panels with total thickness of 46 mm, in double pre-plasticised galvanised sheet steel, with hot injected polyurethane (flame resistance class 2B), density 40-45 kg/m3.
- Aluminium dampers with seal.
- Monobloc version (except for sizes 30.00 and 24.00); indoor version and, on request, outdoor version.
- Heat recovery unit sized according to total treated air flow, of the air-air type in aluminium with turbulence surface plate, treated with epoxy paint cycle, complete with stainless steel condensate collection tank.
- G4 efficiency pleated filters external air and intake side.
- Heating coil pack in Cu/Al.
- PLUG FAN type centrifuge fans with built-in motor.

Additional functions Recovery model:

- Refrigeration section, with one or two high performance scroll-type compressors (two compressors from size 15.00), with ecological R410A refrigerant loaded.
- Intake air heating coil, made with copper pipes and aluminium fins, directly connected to refrigeration unit condensation circuit.
- Evaporating coil downstream from recovery unit, exhaust air side, made with copper pipes and fins; HERESITER high resistance protective treatment available on request.
- Inspectable plate heat exchanger in AISI 316 with neoprene gaskets, for heating swimming pool water, connected hydraulically in parallel to air heating coil.
- Thermodynamic dehumidification in reduced operating mode, carried out in complete recirculation.

Additional functions Recovery Plus model:

- Intake air dehumidification and cooling with thermodynamic cycle and double passage through heat recovery unit. This configuration considerably increases dehumidification ability, with the same refrigerating power used.
- Air heat exchanger fitted on discharge circuit to disperse excess air, instead of/in addition to plate heat exchanger (also standard for this model), is available for installations where heat recovery for swimming pool water is not planned.

Electric control panel and regulation Basic model:

- Electric control panel accessible from side compartment on recovery section side, in compliance with IEC standards, equipped with key operated opening.
- Electric cabling prepared for power supply of 400 V, 3-phase +N–50Hz.
- Main knife switch, complete with safety door-locking device.
- Auxiliary circuit transformer.
- Supply and return fan inverter.
- Electronic controller with open communication protocol BACnet/IP via Ethernet and any pre-existing IT networks.
- Room temperature management.
- Environmental humidity managed via damper circuit, setting a minimum exchange air flow.
- Electronic air flow control.
- Setting reduced night operation with different time slots and temperature and humidity set-points to those used with open system, with reduced air flow.

Electric control panel and regulation Recovery and Recovery Plus models:

Unit has only one power supply however there is a dedicated control panel for refrigeration section whose main features include:

- Electric refrigeration section power supply and control panel, made in compliance with EN standards 60204-1/IEC 204-1, complete with:

  control circuit transformer;

  main door-locking knife switch;

  magneto-thermic switches and compressor contactors;

  cumulative alarm locking terminal boards;

  remote ON/OFF terminal boards;

  independent electronic controller.
- Heating coil management connected to refrigeration section condensation circuit via three-way modulating valve.
- Heat recovery managed in water with plate heat exchanger, with the option of choosing priority between heating intake air and swimming pool water.
- Built-in heating coil management (externally-powered), with three-way modulating valve, available on request.
- Consent to stop swimming pool exchanger secondary circulation pump.
- Consent to stop external heating coil pump, if present.

Electric control panel and regulation just for Recovery Plus model:

- Managing startup and operation with 100% external air (when external air enthalpy is less than that of internal air) and cooling/dehumidification with a thermodynamic cycle, if just external air is no longer able to reduce internal latent load, with the option of giving priority to checking temperature or environmental humidity. Temperature or humidity is checked, depending on chosen priority, linearly via a three-way modulating valve.
- Managing dehumidification function with complete environmental air recirculation (function that can be activated by user).
- Activating and managing 'economy' function with minimum air exchange when external air enthalpy is greater than that of internal air.

N.B. Please see operating diagrams and relative descriptions on page 8 of this brochure for greater details on how to operate this model.

Standard fittings Recovery and Recovery Plus models:

- Pumping section with circulation pumps on evaporator and condenser side, complete with expansion tanks and safety valves for both circuits.
- Automatic filling unit complete with pressure gauge.
- Glycol filling connections with shut-off cocks.
- Y-type filters with on-off valves on refrigerated water and condensation circuits.
- Manual and automatic air vents.

Accessories available:

Recovery model

- Supplementary heating coil with external power supply.
- Evaporator coil painted with special high resistance HERESITE® protective treatment.

Recovery Plus model

- Air dissipator as alternative/addition to plate heat exchanger.
- Supplementary heating coil with external power supply.
- Evaporator coil painted with special high resistance HERESITE® protective treatment.

Accessories supplied separately:

- **RT** – Remote keyboard duplicating that on refrigeration unit.
- **Net PC** – Network user interface via mini notebook
- **Touch Panel** – LCD panel with 5.7" screen, 256 colours for network user interface.

POOL AHU BASIC model | Technical features

MODEL	BASIC	2.00	3.00	4.50	7.50	11.00	15.00	19.00	24.00	30.00
Technical data										
Recovery potential air side*	kW	6,6	9,9	15,0	23,0	34,0	49,0	62,0	78,5	98,5
Recovery efficiency air side*	%	79,8	79,5	79,0	78,0	78,0	81,0	81,0	79,5	79,5
Recovery potential air side**	kW	4,2	6,1	9,1	13,4	20,8	31,0	39,5	46,5	57,5
Recovery efficiency air side**	%	59,4	58,9	58,3	55,0	55,0	60,7	60,7	57,2	57,8
Dehumidification capacity***	l/h	15,7	23,5	35,1	58,5	85,8	117,0	148,2	187,2	234,0
Dehumidification capacity****	l/h	11,1	16,3	24,3	40,5	59,4	81,0	102,6	129,6	162,0
Heating coil potential°	kW	13,5	20,0	30,2	50,2	73,7	100,5	127,2	160,8	200,8
Water flow rate°	l/h	780	1150	1735	2880	4228	5764	7295	9225	11520
Water load loss (incl. adjustment valve)°	kPa	45	50	50	50	55	55	55	60	60
Supply/return fans	N	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Nominal airflow supply	m^3/h	2000	3000	4500	7500	11000	15000	19000	24000	30000
Useful static head	Pa					250				
Nominal airflow return	m^3/h	2200	3300	5000	8000	12000	16000	20500	25500	32000
Useful static head	Pa					250				
Supply fan noise potential (outlet side)	dB(A)	82	84	85	86	89	92	90	91	92
Supply fan noise potential (suction)	dB(A)	74	76	78	79	82	83	83	85	86
Return fan noise potential (outlet side)	dB(A)	83	85	86	87	91	93	92	92	93
Return fan noise potential (suction)	dB(A)	75	77	79	80	83	84	85	86	87
Heating coil water content	l	9,0	13,0	16,0	18,0	21,0	28,0	34,0	38,0	44,0
Maximum admissible pressure	kPa	600	600	600	600	600	600	600	600	600
Regenerable filter eff. supply and return	Eff.					G 4				
Electrical data										
Nom. supply/return motor capacity	kW	0,75/0,75	1,1/1,1	2,2/2,2	3,0/3,0	4,0/4,0	5,5/5,5	7,5/7,5	11,0/11,0	11,0/11,0
Max. power absorbed by supply motor▲	kW	0,59	0,82	1,22	1,98	2,93	4,1	5,12	6,76	8,53
Max. power absorbed by return motor ▲	kW	0,62	0,87	1,36	2,01	3,10	4,25	5,41	7,97	8,85
Rated current supply/return motors	A	1,73/1,73	2,4/2,4	4,7/4,7	6,4/6,4	8,2/8,2	11,4/11,4	15,2/15,2	24,5/24,5	24,5/24,5
Electrical power supply	V-ph-Hz					400 – 3 - 50 + N + T				
Size										
Length (L)	mm	3900	4000	4250	4400	4500	4850	4900	5200	5800
Depth (D)	mm	1360	1480	1760	2000	2160	2290	2490	2490	2610
Height (H)	mm	1800	1900	2020	2280	2580	3080	3160	3560	3860

(*) At following conditions: discharged air temperature 30°C B.S., 65% Rel. hum.; replacement air temperature -5°C B.S. 80% Rel. hum., recovery unit treated air flow 35%

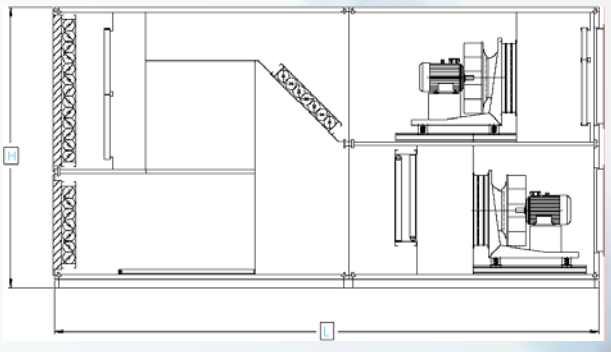
(**) At following conditions: discharged air temperature 30°C B.S., 65% Rel. hum.; replacement air temperature 20°C B.S. 90% Rel.
hum., recovery unit treated air flow 100%.

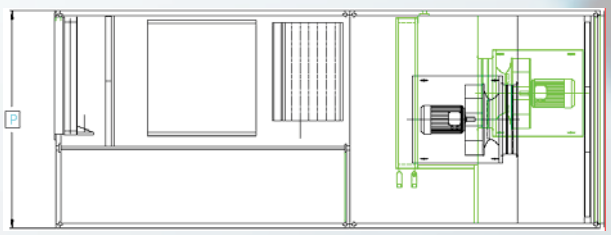
(***) At following conditions: absolute humidity external air 11 gm/kg (e.g. 20°C – 75% Rel. hum., 27°C – 50% Rel. hum.), environmental air temperature 30°C Rel. hum. 65%

(****) At following conditions: absolute humidity external air 11 gm/kg (e.g. 20°C – 75% Rel. hum., 27°C – 50% Rel. hum.), environmental air temperature 28°C Rel. hum. 65%

(°) At following conditions: air temperature on entering coil 25°C, water supply temperature 65°C - ΔT 15°C

(▲) At following conditions: 100% of return/supply air flow transiting through recovery unit



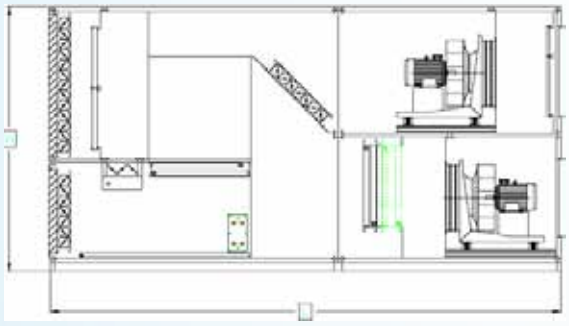


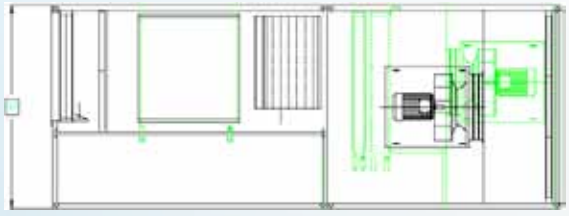
POOL AHU RECOVERY model

Technical features of additional functions (other features same as BASIC model)

MODEL	RECOVERY	2.00	3.00	4.50	7.50	11.00	15.00	19.00	24.00	30.00
Technical data of additional functions										
Water heating coil potential*	kW	8,6	12,8	19,2	25,4	36,8	46,9	55,7	68,5	84,2
Pool exchanger heating potential**	kW	9,0	13,2	19,5	25,8	37,6	47,6	56,5	69,5	85,4
Water heating coil potential ***	kW	10,1	14,7	22,0	32,3	46,3	59,3	68,4	80,3	100,3
Pool exchanger heating potential ****	kW	10,4	15,1	22,7	33,2	48,2	61,1	70,5	82,8	103,3
Dehumidification capacity reduced mode (1)	l/h	8,2	12,6	15,9	24,3	35,8	47,8	55,1	68,4	85,5
Dehumidification capacity reduced mode (2)	l/h	8,9	13,7	18,1	26,3	39,9	50,9	59,4	71,6	89,5
Exchanger water flow ***	l/h	1785	2595	3905	5710	8290	10510	12130	14245	17770
Δ P secondary side exchanger***	kPa	27	29	32	35	41	34	39	34	41
No. refrigeration section compressors	N	1	1	1	1	1	2	2	2	2
No. refrigeration circuits	N	1	1	1	1	1	1	1	1	1
Power absorbed by compressors	kW	1,9	3,2	4,0	5,8	8,4	10,5	11,7	13,5	17,5
Nom. power evaporator pump	kW	0,3	0,4	0,4	0,7	0,9	1,1	1,1	1,1	1,1
Nom. power condenser pump	kW	0,3	0,4	0,7	0,7	1,2	1,1	1,1	1,1	1,5
Supply fan noise potential (out)	dB(A)	85	86	86	87	90	92	91	92	92
Supply fan noise potential (in)	dB(A)	75	77	79	80	83	83	84	85	86
Return fan noise potential (out)	dB(A)	85	87	87	88	92	93	92	93	94
Return fan noise potential (in)	dB(A)	76	78	80	81	84	85	85	86	88
Electrical data										
Nom. supply/return motor power	kW	1,1/1,1	1,1/1,5	2,2/2,2	3,0/3,0	4,0/5,5	5,5/7,5	7,5/11,0	11,0/11,0	11,0/15,0
Max. power absorbed by supply motor ▲	kW	0,65	0,94	1,39	2,24	3,32	4,60	5,75	7,58	9,52
Max. power absorbed by return motor ▲	kW	0,75	1,11	1,72	2,56	3,91	5,30	6,71	8,61	10,90
Supply/return motor rated current	A	2,4/2,4	2,4/3,25	4,7/4,7	6,4/6,4	8,2/11,4	11,4/15,2	15,2/21,5	24,5/24,5	24,5/31,5
Electrical power supply	V-ph-Hz	400 – 3 - 50 + N + T								
Size										
Length (L)	mm	4100	4200	4450	4600	4700	5150	5200	5500	6100
Depth (D)	mm	1360	1480	1760	2000	2160	2290	2490	2490	2610
Height (H)	mm	1800	1900	2020	2280	2580	3080	3160	3560	3860

N. B. Air-air recovery unit potential and efficiency, same as BASIC model Dehumidifying capacity same as BASIC model.
Useful fan air flow and static pressure same as BASIC model. Features of ext. powered supplementary water coil same as BASIC heating coil model.
(*)At following conditions: discharged air temperature 30°C B.S., 65% Rel. hum.; replacement air temperature -5°C B.S. 80% Rel.
hum., recovery unit treated air flow 35% (100% of thermal power lost to coil)
(**)At following conditions: discharged air temperature 30°C B.S., 65% Rel. hum.; replacement air temperature -5°C B.S. 90% Rel.
hum., recovery unit treated air flow 35%,in/out temp. pool water 26/31 (100% of thermal power lost to exchanger)
(***) At following conditions: discharged air temperature 30°C B. S., 65% Rel. hum.; replacement air temperature 20°C B. S. 90%
Rel. hum., recovery unit treated air flow 100% (100% of thermal power lost to coil)
(****) At following conditions: discharged air temperature 30°C B. S., 65% Rel. hum.; replacement air temperature 20°C B. S. 90%
Rel. hum., recovery unit treated air flow 100%, in/out temp. pool water 27/32 (100% of thermal power lost to exchanger)
(1) At following conditions: internal air temp. 24°C B. S., 80% U. R, reduced air flow in full recirculation
(2) At following conditions: internal air temp. 26°C B. S., 80% U. R, reduced air flow in full recirculation
(▲) At following conditions: 100% of return/supply air flow transiting through recovery unit





POOL AHU RECOVERY PLUS model

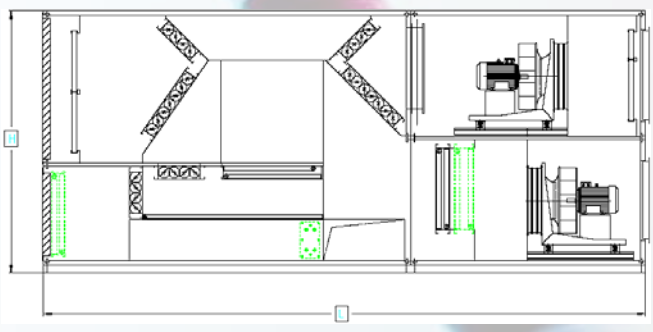
Technical features of additional functions (other features same as RECOVERY model)

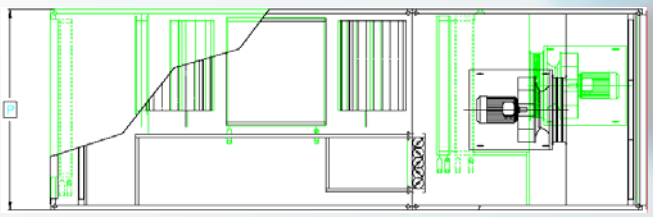
MODEL	R. PLUS	2.00	3.00	4.50	7.50	11.00	15.00	19.00	24.00	30.00
Technical data of additional functions										
Dehumidification capacity (100% recirculation)*	l/h	6,8	10,4	15,5	20,8	30,6	38,1	44,2	54,1	68,0
Dehumidification capacity (100% recirculation)**	l/h	6,2	9,5	14,8	19,2	28,2	35,6	41,0	49,5	62,4
Dehumidification capacity (100% external air.)***	l/h	14,6	22,3	30,2	50,4	73,8	100,6	127,5	161,1	201,0
Dehumidification capacity (100% external air.)****	l/h	10,0	15,1	20,1	33,1	48,2	65,7	83,3	105,1	131,0
Dehumidification capacity (100% external air.)*	l/h	14,0	21,4	28,7	48,3	70,0	96,0	122,1	154,4	192,8
Dehumidification capacity (100% external air.)**	l/h	9,3	14,2	18,9	31,5	45,7	62,2	79,1	100,3	124,9
Supply fan noise potential (out)	dB(A)	89	90	89	91	92	93	93	94	94
Supply fan noise potential (in)	dB(A)	80	81	83	84	86	85	86	88	88
Return fan noise potential (out)	dB(A)	88	88	89	90	92	94	93	93	94
Return fan noise potential (in)	dB(A)	77	79	82	83	85	85	86	87	88
Electrical data										
Nom. supply/return motor power	kW	1,1/1,1	1,5/1,5	2,2/2,2	4,0/4,0	5,5/5,5	7,5/7,5	11,0/11,0	15,0/11,0	18,5/15,0
Max. power absorbed by supply motor ▲	kW	0,96	1,35	2,03	3,24	4,74	6,44	8,45	11,07	14,19
Max. power absorbed by return motor ▲▲	kW	0,92	1,30	1,99	3,00	4,55	6,11	7,74	9,92	12,49
Supply/return motor rated current	A	2,4/2,4	3,25/3,25	4,7/4,7	8,2/8,2	11,4/11,4	15,2/15,2	15,2/21,5	28,5/24,5	38,5/31,5
Electrical power supply	V-ph-Hz	400 – 3 - 50 + N + T								
Size										
Length (L)	mm	4800/5400	4900/5500	4950/5550	5100/5700	5400/6000	5850/6450	6000/6600	6200/6800	6800/7400
Depth (D)	mm	1360	1480	1760	2000	2160	2290	2490	2490	2610
Height (H)	mm	1800	1900	2020	2280	2580	3080	3160	3560	3860

N.B. Air-air recovery unit potential and efficiency, same as BASIC model
Dehumidification capacity without refrigeration cycle, same as BASIC model
Useful fan air flow and static pressure, same as BASIC model.
Heating coil thermal power, same as RECOVERY model
Pool exchanger operating data, same as RECOVERY model
Supplementary heating coil, same as BASIC and RECOVERY models
Dehumidification capacity, reduced mode, same as RECOVERY model

Length (L*): Without/with air dissipation coil

(*) At following conditions: environmental air temperature 30°C B. S., 65% Rel. hum. (100% thermal power lost to heating coil
and/or pool exchanger)
(**) At following conditions: environmental air temperature 28°C B. S., 65% Rel. hum. (100% thermal power lost to heating coil
and/or pool exchanger)
(***) At following conditions: discharged environmental air temperature 30°C B. S., 65% Rel. hum.; replacement air temperature
30°C B. S. 50% Rel. hum., recovery unit treated air flow 100% (100% thermal power lost to heating coil and/or pool
exchanger)
(****) At following conditions: discharged environmental air temperature 30°C B. S., 65% Rel. hum.; replacement air temperature
30°C B. S. 50% Rel. hum., recovery unit treated air flow 100% (100% thermal power lost to heating coil and/or pool
exchanger)
(●) At following conditions: discharged environmental air temperature 28°C B. S., 65% Rel. hum.; replacement air temperature 30°C
B. S. 50% Rel. hum., recovery unit treated air flow 100% (100% thermal power lost to dissipative coil)
(●●) At following conditions: discharged environmental air temperature 28°C B. S., 65% Rel. hum.; replacement air temperature
30°C B. S. 50% Rel. hum., recovery unit treated air flow 100% (100% thermal power lost to dissipative coil)
(▲) At following conditions: 100% of intake air flow with double passage through supplementary heating coil and recovery unit installed
(▲▲) At following conditions: 100% of air flow extracted through recovery unit and dissipative coil (instead of heat exchanger to heat water in pool), installed on outlet.





OPERATING METHOD BASIC and RECOVERY MODELS

BASIC version is able to heat, dehumidify and exchange air in swimming pool area. In fact supplementary heating equipment is unnecessary.

Recovery version is, to all effects, an independent unit as, due to the refrigeration section installed, it is able to heat air introduced and/or pool water (through the water-water heat exchanger) by using discharged air flow as a source of heat for evaporator. Heat exchange is achieved with water coil installed downstream from recovery unit. Thermal powers (*) shown in Table on page 5 refer to a discharged air flow that is 35% of the total treated, with external air temperature at -5°C. As can be seen, even in such extreme conditions, system has an average COP of 4 (including electricity need to pump fluids).

BASIC unit operating method

1. Air heated during winter operation by externally powered hot water coil.
2. Environmental humidity controlled modulating quantity of external and discharged air and transferring sensitive and latent heat to high efficiency air-air heat recovery unit. Since recovery unit is the right size for entire air flow treated by unit, its efficiency significantly increases up to values higher than 80% when recirculating part of the environmental air.
3. Replacement air percentage increased progressively, reaching 100% of air treated by recovery unit, as external temperatures rises and, as a result, external air moisture increases.

Additional operating method for RECOVERY unit

RECOVERY unit has not only those functions described above for Basic unit but also:

1. Air heated during winter operation by refrigeration section powered water coil, transferring any excess heat to pool water exchanger. Priority can be selected according to customer needs. A supplementary heating coil with external power supply is available (Fig. 2) if the thermal power supplied by refrigeration unit is insufficient.
2. Thermodynamic dehumidification during reduced operation producing hot water (available on Recovery and Recovery Plus models).

A second reduced running state is available when the swimming pool is closed. This dehumidifies environment with full recirculation thus reducing energy requirement to a minimum and, at the same time, increasing refrigeration section efficiency. This still involves a reduction in the treated air flow and variation in the temperature and humidity set points. The difference compared to the first reduced running state described for the Recovery and Recovery Plus units lies in the way dehumidification is carried out and that is:

1. In method 1, dehumidification is guaranteed by the minimum contribution of external air, sufficient to ensure reduced temperature and humidity set points are maintained, however leaving refrigeration section in operation and transferring condensation heat to air heating coil and/or pool exchanger.
2. In method 2, dehumidification is carried out by fully recirculating environmental air and therefore entirely performed by refrigeration section (Fig. 3).

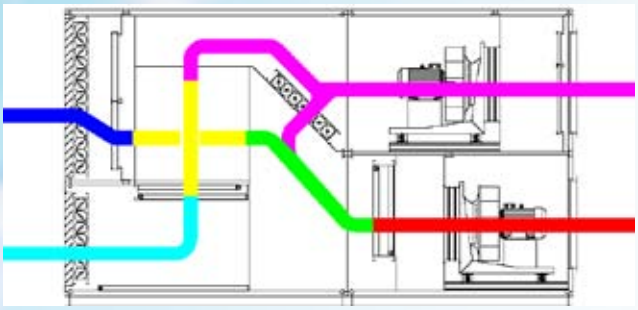


Fig.1

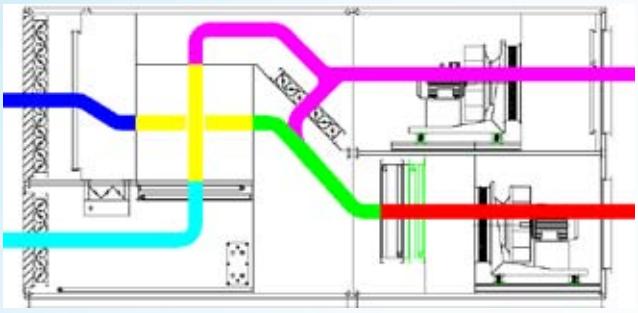


Fig.2

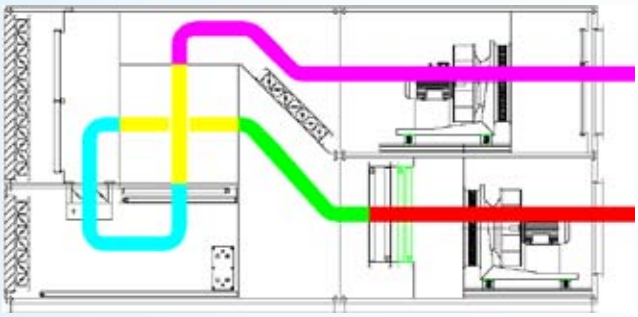


Fig.3

Adjustments automatically enable the first or second method, according to refrigeration section efficiency. However, both methods can be over-ridden manually.

Dehumidification achieved with method 2 is possible as surface of pool with still water has a degree of evaporation of 25-30% of that obtained considering movement of water as a result of swimming.

OPERATING METHOD RECOVERY PLUS MODEL

Recovery Plus version has all functions of Recovery version plus the following additional functions:

Operating method for RECOVERY PLUS unit

1. Air heated during winter operation by refrigeration section powered water coil, transferring any excess heat to pool water exchanger. Priority can be selected according to customer needs. A supplementary heating coil with external power supply is available if the thermal power supplied by refrigeration unit is insufficient.
2. Environmental humidity controlled modulating quantity of external and discharged air and transferring sensitive and latent heat to high efficiency air-air heat recovery unit. Since recovery unit is the right size for entire air flow treated by unit, its efficiency significantly increases up to values higher than 80% when recirculating part of the environmental air (Fig. 1).
3. Replacement air percentage increased progressively, reaching 100% of air treated by recovery unit, as external temperatures rises and, as a result, external air moisture increases (Fig. 1).

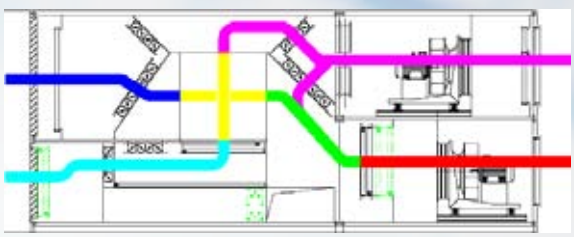


Fig.1

ADDITIONAL FUNCTIONS

4. When environmental humidity can no longer be controlled with only the contribution of external air, machine automatically changes to the operating mode shown in Fig. 2. Incoming external air is then diverted to the recovery unit and environmental air is expelled jumping the recovery unit. In this way, external air passes through recovery unit twice, inside which it is firstly precooled and subsequently post heated. This increases dehumidification capacity significantly thus resulting in a notable saving in refrigerating power, with the same effect. Free post-heating, generated by recovery unit, makes thermal power available to heat the pool via the special recovery unit. Unit can be fitted with a coil, placed on exhaust circuit, downstream from recovery unit, to dissipate refrigeration section condensation heat, if pool exchanger is not fitted. In this way, user can choose priority between humidity or temperature control, depending on installation requirements (Fig. 2).
5. Unit continues to work as described in Point 4 until enthalpy of internal air remains higher than that of external air. Operating mode indicated in Fig. 3 is automatically started when external air has an enthalpy higher than that of environmental air. A minimum exchange air value, that can be increased adjusting regulator parameters, is foreseen in this operating mode in order to guarantee a minimum air exchange (also required by legislation in force). Dehumidification capacity in these extreme operating conditions coincides almost exactly with data (*) indicated in the Table shown on page 6.
6. Fig. 4 shows operation with complete recirculation of environmental air and double passage through recovery unit. In normal operation, this method is activated manually by operator, only if enthalpy of external air is higher than that of internal air and system parameters are specifically adjusted in that way. This operating mode is then automatically assumed in reduced operation, together with attenuated air flow, as described in Point 2 of Recovery unit.

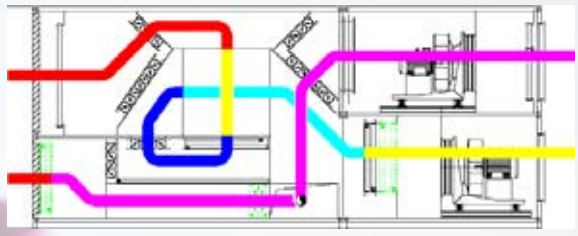


Fig.2

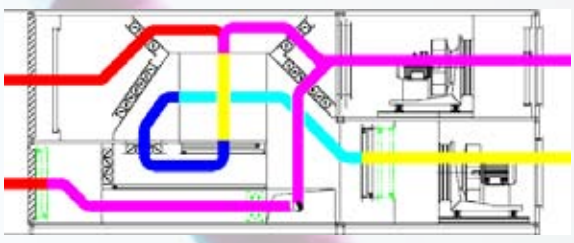


Fig.3

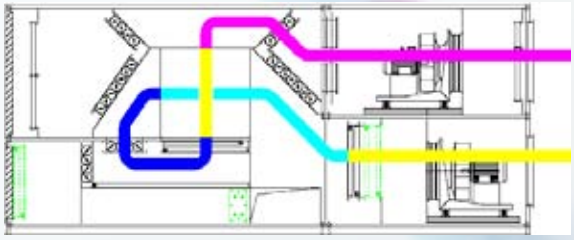


Fig.4

N. B. **Unit always uses the same external air intake and discharge outlet for all operating modes described here, even if refrigeration section condensation heat dissipation coil, supplied as an option or added to heat exchanger, is installed.**

ADVANTAGES OF POOL SERIES AHUs
Inverter and electronic flow control

All units have inverters and electronic flow controls, for input, output and normal and reduced operation.

This means:

1. Precise air flow setting with programming in the factory.
2. Reducing/eliminating system setting phases.
3. Constant air flow in any operating mode, an essential feature for units able to work with different and multiple operating modes.
4. Reducing power required for ventilation to a minimum, as no internal load loss equalization grids have been fitted.

Water-water refrigeration section

Water-water refrigeration section guarantees:

1. Absolutely precise regulation during heating stage, without oscillations due to thermal power modulation, diverting, more or less, depending on need, condensation circuit air flow to heating coil or exchanger.
2. Greater reliability, due to absence of recovery units on refrigeration circuit, involving a whole series of accessories, making operation more complicated. However, system output is higher than that of systems with batteries and exchangers with refrigerants as all components are large for all operating modes.
3. Regulation linearity even during cooling stage and dehumidification with thermodynamic cycle due to heat exchange with intermediate fluid that modulates cooling power, according to environmental requirements, thus reducing water flow within coil.
4. Option of being able to introduce 100% external air even in cooling mode, in order to make the most of dehumidifying power, until cost effective.
5. Impossibility of contaminating water in the pool with gas and oil from refrigerating circuit, if there is a leak, as intermediate water-water exchanger completely eliminates all possible contact of fluids from two circuits.
6. Use of water 'evaporating' coil, fitted to recovery unit, outlet side, eliminates temperature distribution related problems in front section of recovery unit. In fact, with direct expansion batteries different refrigeration load distribution in critical conditions (low expelled air flow and low external/expelled air temperature) could lead to icing of most penalised portion of coil and, in a short time, stop refrigeration unit. Temperature limits and/or air flows must be kept higher to prevent this from happening. Very low temperatures can be used to supply refrigerated water to coil in normal operation (when swimming pools are open), continuing to use refrigeration section to produce hot water for heating, thus more economic than traditional systems.

Deciding on model based on environmental conditions

Temperature of water in pool is normally kept at around 2°C under that of air to reduce amount of evaporated water.

The typical reference values are as follows:

Relative humidity of environment: 60-70%

Environmental air temperature: 28-30°C

Pool water temperature:

1. Swimming pools 26-28°C reducing temperature to 26°C during competitions (see Italian National Olympic Committee (INOC) regulations for sports facilities – section on swimming pools).
2. Learner pools and children's pools 28-30°C (see INOC regulations for sports facilities – section on swimming pools).

Choice of AHU size

To start, quantity of evaporated water from pool has to be calculated, so as to determine dehumidification capacity necessary for installation. Necessary external air flow is calculated setting an external humidity limit beyond which, if it has a refrigeration section, machine must operate with 100% external air in dehumidification mode with thermodynamic cycle to remove quantity of moisture that cannot be eliminated with just contribution of external air. Units in the POOL series, Recovery Plus model, are able to remove around 4.0 gm of moisture per kg of air introduced, with an environmental temperature of 28°C, Rel. Hum. 65% and around 5.5 gm per kg of air introduced and an environmental temperature of 30°C, Rel. Hum. 65%, as shown in Table on page 6. This data refers to absolute X of external air of around 13.5-14 gm/kg (e.g. 30-31°C, Rel. Hum. 50%, etc.).

For installations without summer dehumidification, reference absolute humidity value for external air is around 12 gm/kg, corresponding to temperatures of 18-20°C, Rel. Hum. 90-80% (rain in May-June) up to a temperature of 28°C, Rel. Hum. 50% (normal temperatures for end of May-beginning of June). Where present, open-air swimming pools are used beyond these temperatures and even lower.

Reference values for relative humidity of internal air are as follows:

- Environmental air temperature 28°C, Rel. hum. 65%: 15.5 gm/kg
- Environmental air temperature 30°C, Rel. hum. 65%: 17.5 gm/kg.

Table of values of evaporated water per m^2 of pool (kg/hr)

Air temp.	Rel. Hum. air	Temperature of water in pool						
°C	%	24	25	26	27	28	29	30
26	60	0,191	0,228	0,265	0,306	0,348	0,392	0,439
	65	0,158	0,194	0,232	0,272	0,315	0,359	0,406
	70	0,125	0,161	0,199	0,239	0,282	0,326	0,373
27	60	0,167	0,203	0,241	0,281	0,324	0,368	0,415
	65	0,132	0,168	0,206	0,246	0,289	0,333	0,380
	70	0,096	0,133	0,171	0,211	0,254	0,298	0,345
28	60	0,141	0,178	0,216	0,181	0,298	0,343	0,390
	65	0,104	0,140	0,178	0,219	0,261	0,306	0,352
	70	0,067	0,103	0,141	0,181	0,224	0,268	0,315
29	60	0,115	0,151	0,189	0,229	0,272	0,316	0,363
	65	0,075	0,111	0,150	0,189	0,232	0,277	0,323
	70	0,036	0,072	0,110	0,150	0,193	0,237	0,284
30	60	0,087	0,123	0,161	0,201	0,244	0,288	0,335
	65	0,045	0,081	0,119	0,159	0,202	0,246	0,293
	70	0,003	0,039	0,077	0,118	0,160	0,204	0,251
31	60	0,057	0,093	0,131	0,172	0,214	0,258	0,305
	65	0,013	0,049	0,087	0,127	0,170	0,214	0,261
	70	-	0,005	0,043	0,083	0,125	0,170	0,217
32	60	0,026	0,063	0,100	0,141	0,183	0,228	0,274
	65	-	0,015	0,054	0,094	0,136	0,181	0,227
	70	-	-	0,007	0,047	0,089	0,134	0,180

Calculating amount of evaporated water

The corresponding amounts of evaporated liquid per m2 of water can be obtained from the Table shown above.

The values shown are clearly to be considered as indications.

The amount of water evaporated overall will be given by the following expression:

Evaporation (Kg/h) = **q x Pool surface** (m_2)

where q is the amount of specific evaporated water per m2 of pool. Values in Table refer to swimming pools with normal activity during courses and sports (E = 20, see below).

Tabulated values have been obtained from the expression below, i.e.:

$$Q = \frac{(SVP - VP)}{P} \times S \times E$$

Q = Evaporation rate in kg/hr

SVP = Saturated steam Pressure referred to temperature of water in pool

VP = Environmental air saturated steam pressure = SVP x Relative Humidity (Rel. Hum.) with SVP saturated steam pressure referred to air temperature and Rel. Hum. value divided by 100

P = Atmospheric pressure at sea level is 101.32 kPa; atmospheric pressure value referred to altitude of where system is located is obtained inserting a denominator

S = pool surface in m2

E = Constant, whose value is obtained from practice i.e.:

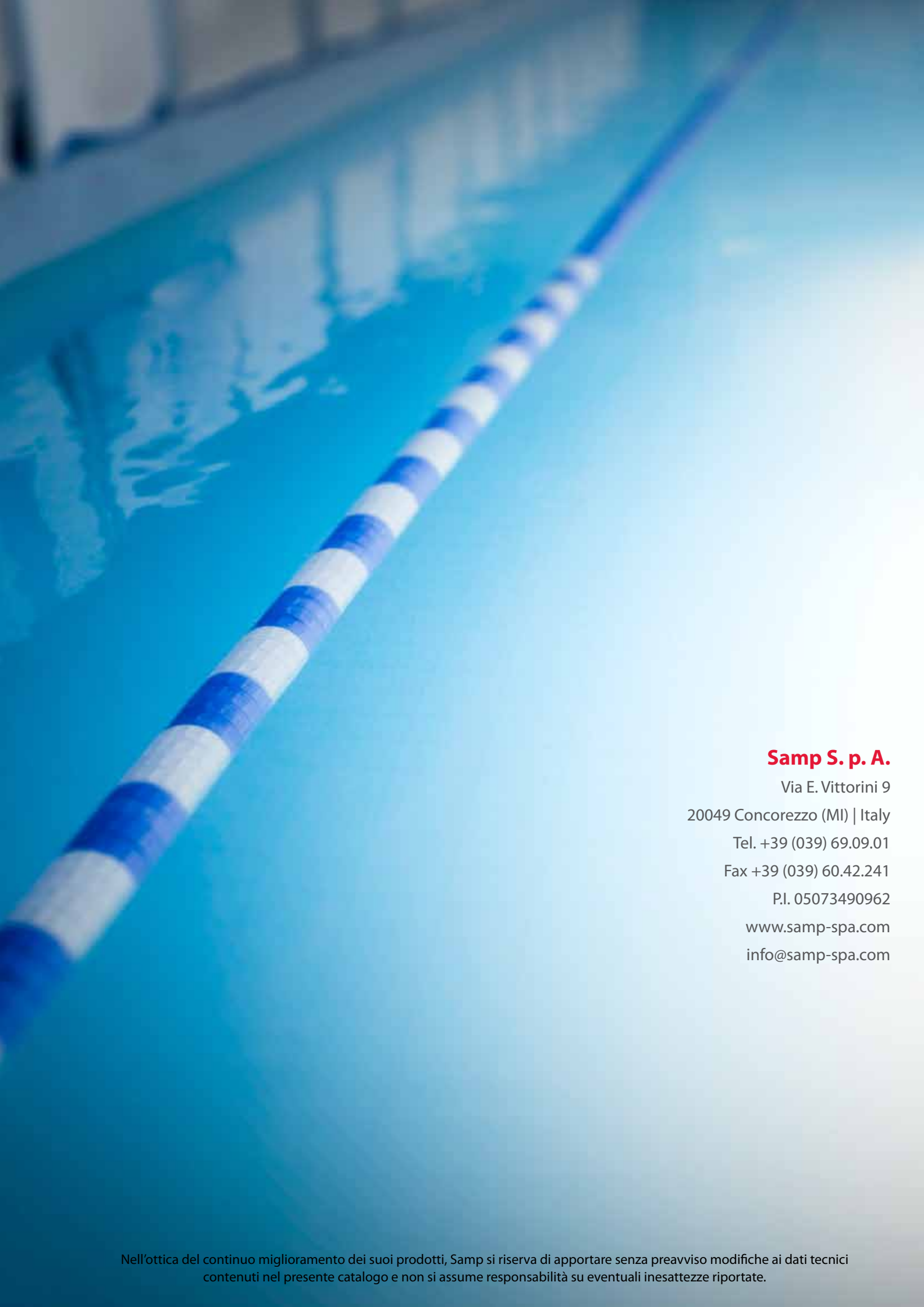
5 = Surface with still water

15 = Pools with low user numbers (typical of private pools)

20 = Pools with normal activity level, used for courses and races (typical of public pools)

30 = Pools with water games and waves

50-60 = Pools with hydro-massage.



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