Technical Catalogue

OPTIMA
OPTIMA ECO SILENT
OPTIMA TOP
OPTIMA CRYSTAL
OPTIMA TURQUOISE
OPTIMA SPEC
OPAL
TOPAZ
PURO
Control Systems

Diagnostic and Surgery Pavillion Module of Provincial Hospital [Szpital Wojewódzki] in Opole

Warminska Cooperative of Disabled Persons in Biskupiec

Dr Antoni Jurasz' University Hospital in Bydgoszcz

Regional Development Agency in Torun

RABEN Offices in Piła

Clima Gold is a Polish manufacturer of air handling and air-conditioning equipment..

We are a team of talented and motivated persons involved in the creation and implementation of new solutions in air handling and air-conditioning industry.

Our target is to make you familiar with you the new and economical air handling and air-conditioning systems. Our devices are designed for general purpose buildings, i.e. stores, offices, sports halls as well as for facilities with special requirements such as manufacturing halls, laboratories, hospitals, operation rooms, swimming pools.

Our designs consider both the people who want to feel comfortable and easy and the technologies which must work in strictly prescribed conditions.

Our silent and reliable equipment provides the feeling of well-being to its users.

The implemented ISO 9001 certificate and a number of awards and distinctions confirm the quality of our equipment. We keep taking advantage of the EU subsidies and investing in modern machines, devices and IT technologies, which make our Company grow constantly.

The solutions which we create guarantee obtaining optimal conditions for work, fun and leisure.

On the basis of our experience on the demanding market of air handling equipment we have pleasure to present our new catalogue. We hope that this catalogue will help to describe our products and will make our cooperation easier. We appreciate the trust which we have gained from our customers and we are open for any new cooperation.

Welcome to cooperation with us!

Clima Gold
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Any possible modifications do not bind the company Clima Gold to make such modification in already supplied units.

Technical catalogue

OPTIMA	Standard Section Air Handling Unit
OPTIMA SPEC	Special Air Handling Unit
OPTIMA CRYSTAL	Hygienic Air Handling Unit
OPTIMA TURQUOISE	Swimming pool Air Handling Unit
OPTIMA ECO SILENT	Energy saving and silent Air Handling Unit
OPTIMA TOP	Ductless Air handling units
OPAL	Suspended Air Handling Unit
TOPAZ	Heating and Air handling Unit
PURO	Hygienic Modular Air Handling Unit
Control systems	

Clima Gold

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1. General description – Production review

Clima Gold: products range

OPTIMA	(standard) – designed for different types of objects in order to provide the appropriated air handling and air conditioning in the rooms. The air handling units are supplied in typical configurations using the standard solutions suitable for a wide range of applications.
CRYSTAL	(hygienic) – designed to work in hospital facilities, laboratories, pharmaceutical, food processing plants and other objects which have special requirements as far as "clean facilities" are concerned.
TURQUOISE	(swimming pools) – designed for providing heat and humidity balance on swimming pools.
SPEC	(special) – air handling units completed on special order, with a non-standard configuration, non-catalogue dimensions and capacity (up to 110 000 m3/h) for air handling in garages, etc.
OPTIMA ECO SILENT	(economical and silent) – designed for objects with high operational requirements, most user friendly, with exceptionally low electrical energy consumption and noise emission.

OPAL Suspended Air handling units

OPAL	Suspended air handling units designed for small and medium size objects such as restaurants, cafes, pubs, shops, cinemas, garages, hotels or offices.

TOPAZ Heating and Air handling Devices

TOPAZ	Heating and air handling devices designed for heating and air handling of industrial plants, warehouses, workshops, wholesale or retail stores.

PURO Hygienic Modular Air handling units

PURO	- (hygienic) – designed to work in hospital and laboratory rooms, electronic elements manufacturing plants and other objects with higher purity standards, user friendly at each stage – at designing, assembly, operation and maintenance.

CONTROL SYSTEMS

CONTROL SYSTEM – optimized process of air handling units control.

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2. OPTIMA type Standard Section Air Handling Units

2.1 General description

OPTIMA air handling units have received a Hygienic Approval Certificate issued by the National Institute of Hygiene in Warsaw. The manufacturer declares their products compliance with any required European directives which is the condition for using the CE mark.

The Hygienic Approval Certificates are issued by the National Institute of Hygiene approves of using **OPTIMA CRYSTAL** equipment in facilities with higher air purity standard such as health service, pharmaceutical and food processing plants.

Our air handling units are built of the subsystems made by recognized and reliable suppliers. All the devices are selected by means of equipment selection IT software delivered also by subsystems suppliers.

These are the tested structure of the units, the subsystems manufactured by known and experienced companies and the top quality of the assembly which guarantee a long life operation of the equipment preserving its required technical parameters.

OPTIMA air handling units are based on sections which are designed to perform different functions and, when combined with each other, build up different configurations. These units are used in air handling and conditioning of different types of objects.

The description and functions of the sections can be found in the subsequent chapters.

Some examples of **OPTIMA** units are shown in Chapter 8.

The air handling and air conditioning units are used both for air transport in the existing air handling and conditioning systems of buildings as well as for adjusting the supplied air to the required physical parameters.

Size	Recommended range of air capacity		Height H	Width B	Height NW* 2xH
	m³/h	m³/h	mm	mm	mm
1	1 000	3 000	650	700	1 300
2	2 000	4 500	650	985	1 300
3	4 000	7 500	955	985	1 910
4	6 000	11 000	1 050	1 290	2 100
5	8 000	14 000	1 260	1 290	2 520
6	10 000	17 000	1 260	1 585	2 520
7	14 000	23 000	1 660	1 585	3 320
8	16 000	28 000	1 660	1 885	3 320
9	20 000	38 000	1 960	2 180	3 920
10	26 000	48 000	1 960	2 770	3 920
11	35 000	65 000	1 960	3 680	3 920

* height of the combined supply and exhaust unit

The sections of the air handling unit are placed on a structure frame. The dimensions shown in the table do not include the height of the frame (120 mm).

The units are manufactured in the following versions:

- Indoor – for fitting inside the building
- Outdoor – for fitting outside the building.
-

The units can be manufactured in the following options:

- Supply,
- Exhaust,
- Supply and exhaust,
- Ductless

The functional type classification allows for manufacturing the units in different configurations corresponding to the individual needs of any customer.

The total length of the unit equals to the total of lengths of its sections.
The functional sections are grouped in blocks in the same housing. The maximum length of any section block should be 2500 mm (for sizes 1-6) and 1650 mm (for sizes 6-10). In the case of any limitations, e.g. in transport (unit too big or too heavy for transport) or any limitation in assembly at the assembly site (the access road to the assembly site is too narrow) it is recommended to order the equipment in non-combined sections or to specify the maximum dimensions of the blocks (sections) at the stage of equipment selection and configuration.

2.2. Quick selection– OPTIMA

The size of the air stream, flow speed in the device and the intersection of any air handling unit depend on its size. The air flow speed in the following unit sections should be within their corresponding speed range. The size of the unit should be selected in such way so that the speed of the air flow related to the intersection of the unit was 2,5 – 3,5 m/s for the required capacity. The suggested ranges of capacity for different sizes have been shown on the charts. It must be remembered that the faster is the air flow, the higher is the flow resistance and, by the same, the higher is the power demand of the fan engines, energy consumption and noise emission. However, if the flow speed for which the device was selected is too low, this means that the chosen device is too big and that the project has been overinvested.

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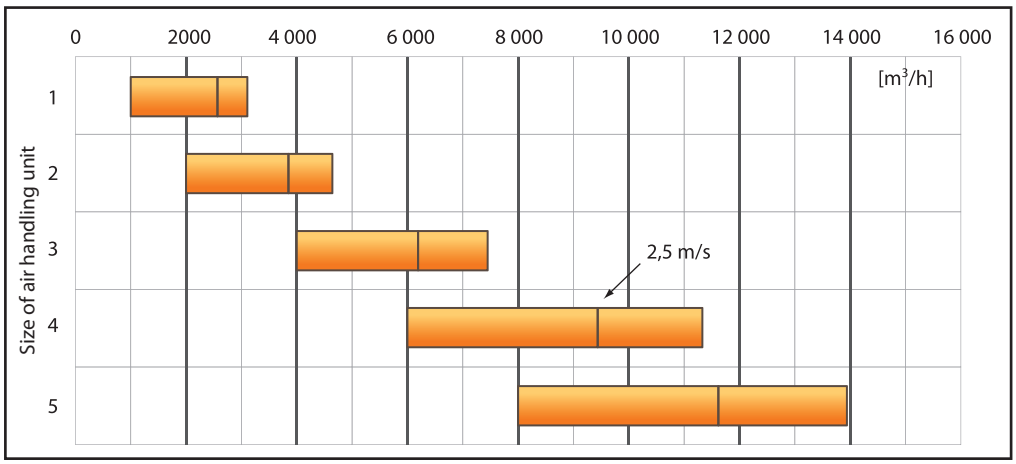

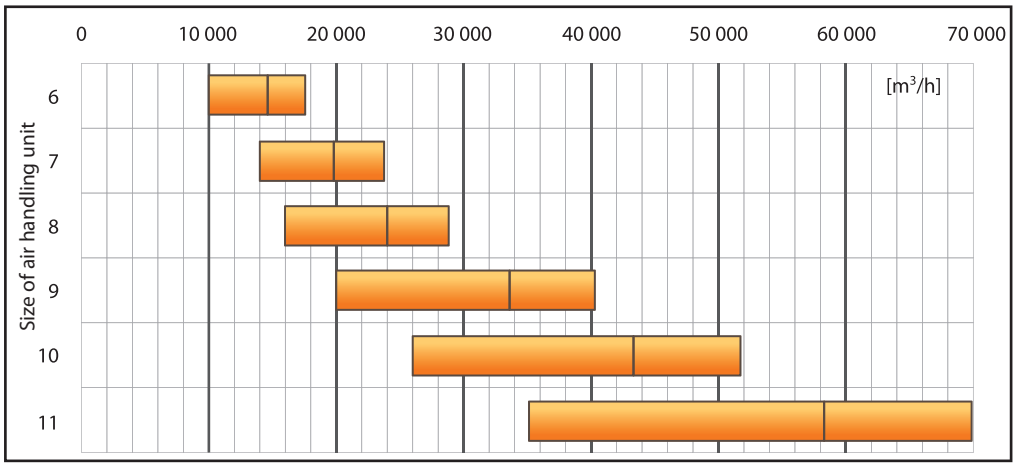

The air speed in the unit should be determined by the minimum optimal speed in its sections of which this unit has been configured.
E.g. For the units having the cooling function, the optimal speed should be about 2,5 m/s.

Recommended speeds and speed ranges for the selected types of air handling units

Section	Optimal	Minimum	Maximum
Primary filter	2.5	-	3.5
Precise filter	1.7	-	3.0
Water heater	2.5	0.5	3.5
Electric heater	3.0	1.5	4.0
Cooler	2.0	0.5	3.5
Cross flow heat exchanger	2.5	1.4	4.0
Rotary heat exchanger	2.5	-	4.0

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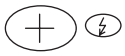
Unit sections and their functions

Section	symbol	Unit section subsystem	Function of section
	W	Fan set	Transport of air
	Hw	Water heater	Heating of air1
	He	Electric heater	Heating of air
	CHw	Water cooler	Cooling of air
	CHf	Evaporation cooler	Cooling of air
	RU	Refrigeration unit (fitted in the air handling unit)	Cooling of air
	RE	Mixing chamber - Recirculation	Heat recovery
	WK	Cross flow exchanger	Heat recovery
	RC	Heat pipe	Heat recovery
	WO	Rotary exchanger	Heat recovery
	CZP	Run-around coil	Heat recovery
	PC (PCR)	Heat pump (Reverse heat pump)	Heat recovery
	T	Silencer	Reduction of noise
	F/ FW	Filter/ secondary filter	Reducing air pollution
	NP	Steam humidifier	Humidifying of air
	NW	Water humidifier	Humidifying of air
	SP	Empty section	Keeping distance between the adjacent section devices or other

The appropriate configuration of sections in a unit allows for preparation of air with the expected parameters subject to the optimal equipment operation and minimum effect upon the environment.

The series of the manufactured units includes 11 sizes which allow to cover the capacity from 1 000 m3/h to 65000 m3/h (0.27-18.05 m3/s). They are based on the standardized sizes of air filters which comply with international standards. Some units designed for lower and higher capacities than these described above can be manufactured at the customer's place upon special order.

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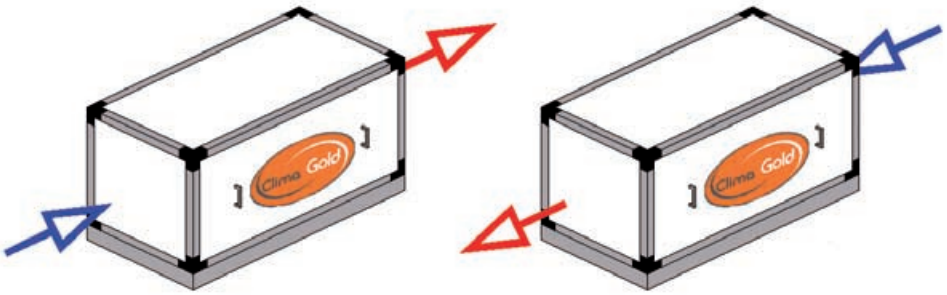
2.3. The housing and structure

The structure of the unit consists of a frame built of aluminium and plastic profiles as well as permanent and movable panels or doors. The panels are made of the external and internal zinced or coated steel, depending on the use of the unit, and of the filling which is mineral wool (or polyurethane on request).

The external surface of the unit made of coated steel or aluzinc.

The thickness of the panel and door insulation is 50 mm.
In order to enable the access to the unit components, movable panels with clamps or inspection doors are fixed on the access side of the unit. The door is fixed to the unit structure on hinges and it has a handle.
The units are manufactured in two options in terms of the location of access side: left or right side.



In the case of supply and exhaust units, it is the direction of supply flow air which decides about the access side of the unit.

The units are equipped with multi-leaf damper in standard (typically from the air intake side) and flexible connections.

The structure is normally assembled on a screwed frame, 120 mm high, made of zinced steel profiles or of welded steel profiles. The frame has holes for transport and holes for fixing the unit.

The external units are additionally equipped with a roof made of coated steel sheet, the inlet has an air intake grill with a droplet eliminator and the outlet has an air exhaust grill. The dampers are fixed inside the unit due to the possible low temperatures.

In these sections where drip tray are fixed, also the draining traps must be fitted. The drip trays are used in all places where any water vapour can condense from the air, e.g. in the cooler and cross flow exchanger sections.

Coils connections and the drains from the drip trays are normally placed on the access side.

Air handling units can be equipped with such additional elements as internal lighting, inspection windows, locks with keys and other.

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2.4. The dimensions of OPTIMA unit sections

The table below shows the dimensions of the sections.

Some sections can have different lengths for a certain unit size depending on the volume of the ventilated air and the quality of air processing in that section. The values shown below are the most frequent ones.

Symbol of section	
W	Fan set
Hw	Water heater
He	Electric heater
Chw	Water cooler
CHf	Evaporative cooler
RE	Mixing chamber - Recirculation
WK	Cross flow exchanger
RC	Heat pipe
WO	Rotary exchanger
CZP	Run-around coil
T	Silencer
F	Filter
NP	Steam humidifier
NW	Water humidifier
SP	Empty section
MG	Gas module

Section length [mm]

Size	F				Hw		He	Chw		Chf		W	
	Cassette	Pocket											
	G4	G4	F5	F7,F9	from	to		from	to	from	to	from	to
1	260	520	660	750	340	340	460	610	610	610	610	770	880
2	260	520	660	750	340	340	460	610	610	610	610	770	880
3	260	520	660	750	340	340	460	610	610	610	610	880	1080
4	260	520	660	750	340	340	460	610	610	610	610	880	1090
5	260	520	660	750	340	340	460	610	610	610	610	1090	1240
6	260	520	660	750	340	360	460	610	610	610	710	1080	1240
7	260	520	660	750	340	360	460	610	610	710	710	1080	1410
8	260	520	660	750	360	390	460	610	610	710	710	1250	1680
9	260	520	660	750	360	390	460	610	710	710	710	1250	1680
10	260	520	660	750	390	420	460	610	710	710	710	1520	1680
11	260	520	660	750	390	470	460	610	710	710	710	1520	1990

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Section length [mm]

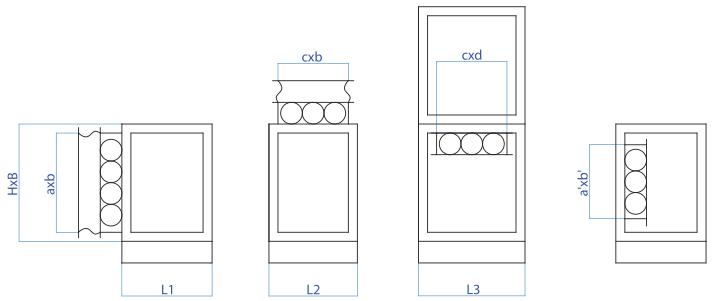
Size	Re		WK		CZP					
					WO	Supply		Exhaust		RC
	Ext.	Int.	from	to		from	to	from	to	
1	410	475	910	1150	450	400	560	720	920	720
2	410	475	1000	1150	450	430	560	720	920	720
3	510	615	1150	1720	450/500	430	560	720	920	720
4	610	675	1370	2000	450/500	430	560	720	920	720
5	710	775	1500	2430	450/500	430	560	720	920	720
6	710	775	1500	2430	450/500	430	620	720	920	720
7	910	975	1720	3130	450/500	430	620	720	920	750
8	910	975	1720	3130	450/500	430	620	720	920	750
9	1010	1115	2000	3700	450/500	490	620	820	1020	750
10	1010	1115	2000	3700	450/500	490	620	820	1020	750
11	1010	1115	2000	3700	450/500	490	620	820	1020	750

Section length [mm]

Size	T		SP		NW	NP
	dB1	dB2	min	max		
1	780	1180	300	as	1000	1600
2	780	1180	300		1000	1600
3	780	1180	300	y	1000	1600
4	780	1180	300	o	1000	1600
5	780	1180	300	u	1000	1600
6	780	1180	300		1000	1600
7	780	1180	300	w	1000	1600
8	780	1180	300	i	1000	1600
9	780	1180	300	s	1000	1600
10	780	1180	300	h	1000	1600
11	780	1180	300		1000	1600

Section width of the rotary heat exchanger [mm]

Size	WO	
	from	to
1	710	1110
2	810	1210
3	1110	1760
4	1210	2060
5	1460	2260
6	1660	2460
7	1860	2760
8	1960	3110
9	2160	3860
10	2360	3860
11	2660	3860



Dimensions – dampers, mixing chambers [mm]

Size	Damper/ Flexible connection (unit inlet/ outlet)			Damper/ Flexible connection (rec. connection outside)			Damper (internal rec.)			Roof unit Damper (unit inlet/ outlet)	
	a	b	L1	c	b	L2	c	d	L3	a'	b'
1	550	600	300	310	600	410	310	535	475	450	390
2	550	885	300	310	885	410	310	820	475	450	675
3	855	885	300	410	885	510	450	820	615	755	675
4	950	1190	300	510	1190	610	510	1125	675	850	980
5	1160	1190	300	610	1190	710	610	1125	775	1060	980
6	1160	1485	300	610	1485	710	610	1420	775	1060	1275
7	1560	1485	300	810	1485	910	810	1420	975	1460	1275
8	1560	1785	300	810	1785	910	810	1720	975	1460	1575
9	1860	2080	300	910	2080	1010	950	2015	1115	1760	1870
10	1860	2670	300	910	2670	1010	950	2605	1115	1760	2460
11	1860	3580	300	910	3580	1010	950	3515	1115	1760	3370

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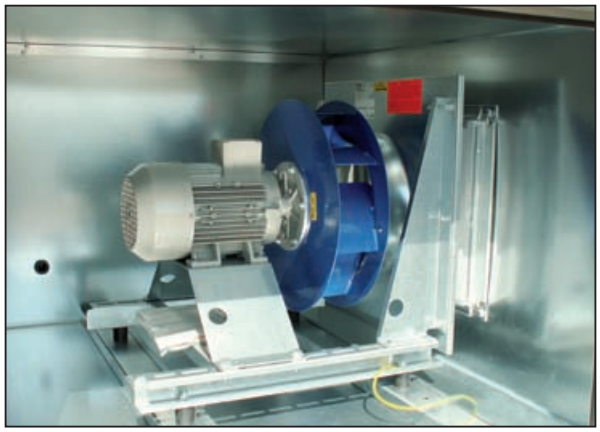
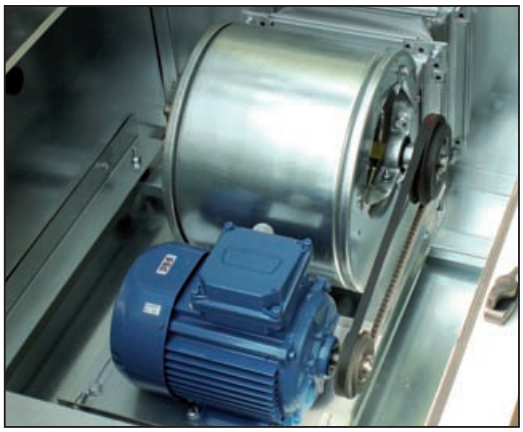
2.5 Functional sections

2.5.1 Fan sets
Fan set is the basic component of each air handling unit.
The following fan sets can be fitted in fan section:
A centrifugal plug fan with an impeller fitted directly on the shaft of the inverter controlled electrical motor (so called plug-in) with sizes from 200 to 1.120 mm (Standard Clima Gold),
Fans with EC (electronically commuted) motors with upgraded performance and fluent rotation adjustment which are characterized by low noise emission and low energy consumption,
A centrifugal fan with air double inlet with an electrical one speed motor or multi speed motor or with an inverter controlled motor.





Maximum capacity:	110 000 m3/h
Total static pressure:	up to ca. 2350 Pa (in standard execution)

! All OPTIMA air handling units have either EC motors or inverter controlled motors fitted in them.

The fans are placed with the motor on a common frame isolated from the unit structure by rubber shock absorbers. Centrifugal fans with air double inlet have the drive transferred by a belt gear. The type, quantity of belts and the diameter of the gear wheels are specified by the manufacturer according to the unit operating parameters.

The motor with the inverter (frequency converter) allows for the adjustment of the fan rotations and for the optimal adjustment to the characteristics of the air handling network, which leads to reducing the fan drive energy consumption to minimum.

Two speed motors can work with different speeds, e.g.:

- 3000 / 1500 1/min (100%/50%)
- 1500 / 1000 1/min (100%/67,7%)

It is possible to use motors with different speed division.

The maximum temperature of the air flowing through the fan sections should not exceed 40OC. For any higher temperatures a specially designed motor should be used.

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2.5.2. Water heater

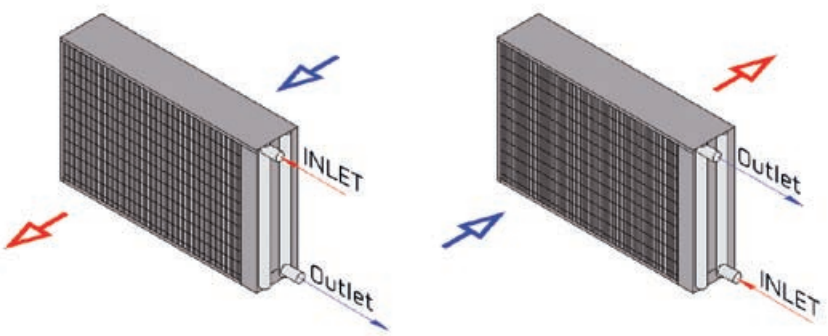
Water heaters are made of copper pipes with aluminium fins. The collectors and threaded coil connections are made of steel or copper . The heaters can be equipped with venting and drainage plugs placed on the coli connections .

The maximum temperature of the heating agent is 130°C, maximum working pressure is 1,6 MPa.

Technical parameters of water heaters.
The values shown in the list should be indicated by a design engineer, the other are to be specified by the manufacturer.

√	Volumetric intensity of air flow	(m3/h)
√	Inlet air temperature	(OC)
√	Inlet air humidity (10% - 100%)	(%)
	or temperature of wet inlet air thermometer	(OC)
	or inlet air humidity rate	(g/kg)
√	Outlet air temperature or heating output	(OC) (kW)
√	Heat transfer agent parameters – t feeding / t return (eg. 80/60 OC)	(OC)
	Maximum pressure drop of the air	(Pa)
	Permissible pressure drop of the heat transfer agent	(kPa)
	Maximum or required dimensions of the heat exchanger	(mm)
	Requirement reg. housing material	

Left hand option **Right hand option**



Connection method of water exchanger.

2.5.3. Electric heater

The electric air heaters are used for primary heating, basic heating, antifreeze and peak heaters. The housing of the heater is made of zinced steel sheet and the heating elements are made of stainless steel. As the heating elements have no ribbed (extended) structure they render minimum flow resistance, omittable by the calculation of the unit pressure loss. A 450 mm section is designed for the assembly of the electric heating device or it is assembled directly in the channel.

The electric air heater is secured by two thermally controlled switches.
The first self-resetting switch will switch the power off if the temperature of the housing of the heater section reaches 75OC. If the temperature falls below the set value, the power will be switched on again. The second protection switch will turn the power off if the temperature of the housing reaches 90OC and it will require a manual resetting by pressing the button in the switch gear. This function must be taken into account by designing the control system for the unit.

The electric heater is designed for 230 V or 400 V voltage in the standard option.

The minimum speed of the air flowing through the heater is: 1.5 m/s.
It is necessary to cool the heater down before switching off. It means that the fan must work after the electric heater is switched off until the heating elements have been cooled down. This function should be performed by the control system of the device.

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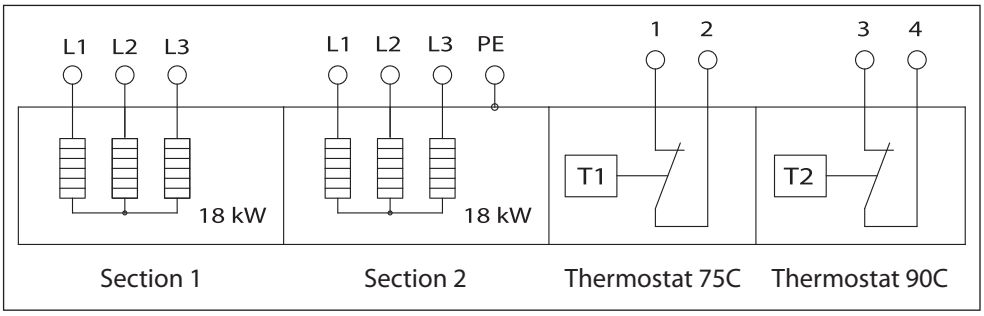
Unit size	Maximum power of electric heaters [kW]
1	27
2	54
3	72
4	108
5	144
6	216
7	252
8	Upon request
9	
10	
11	

If Clima Gold control system is used, in Section 1 the heating power is controlled fluently.



Example.

A 36 kW electric air heating device.

The automatic set controls up to 18 kW the heating power in Section 1 fluently. If the heating power demand rises above 18kW, the circuit turns on the constant output Section 2 and adjusts the output with Section 1 from 0 to 18 kW. While using this solution the automatic controls the power from 0 to 36 kW fluently.
Analogously the system operates with higher power electric heaters.

2.5.4 Gas heater.

The air heater section can be equipped with a gas air heater as an alternative solution for any water or electric air heating device. The section has a burner and combustion chamber with a flue gas/ air heat exchanger made of high grade stainless steel. The burner can be powered by such fuels as: earth gas, LPG or heating oil. The heat exchanger is a system of specially manufactured flattened pipes assuring the possible longest time of flue gas flow, highly efficient in the whole air heater output range. In order to ensure the best heat transfer from the combustion chamber surface and heat exchanger the appropriate air flow must be provided. One stage, two stage or modulating gas burners supplied by recognized companies, or, upon request, oil burners, can be used.

In order to make the unit work properly the gas air heater must be connected to:

- Gas installation
- Flue gas installation
- Electrical installation
- Air handling unit control system.

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2.5.5. Water air cooler

Water air coolers are designed for cooling or drying the air in summertime.

They are made of copper pipes with aluminium fins. The housing is made of zinced steel, stainless steel upon request. The collectors and threaded coil connections are made of steel or copper . The heaters can be equipped with venting and drainage plugs placed on the coli connections. The cooling section has drip tray made of stainless steel and a droplet eliminator for stopping the water drops taken away with the air. The drain pipe of the drip tray must have a water trap.

The supply and return pipelines of the heat exchangers must be connected in such way, so that the heat exchangers could work in a countercurrent, that is, so that the heat transfer agent could flow in a direction contrary to the air stream flow.

The maximum working pressure is 1.6 MPa.

Technical parameters of water coolers.

The values shown in the list should be indicated by a design engineer, other ones are specified by the manufacturer.

The air coolers can be fed with water or a mixture of water and antifreeze agent at a proper concentration (e.g. ethylene glycol). The concentration and type of the antifreeze agent should be determined at the stage of the heat exchanger selection.

√	Volumetric intensity of air flow	(m3/h)
√	Inlet air temperature	(OC)
√	Inlet air humidity (10% - 100%)	(%)
	or temperature of wet inlet air thermometer	(OC)
	or inlet air humidity rate	(g/kg)
√	Outlet air temperature or cooling output	(OC) (kW)
√	Parameters of heat transfer agent – t feeding / t return (eg. 6/12 OC)	(OC)
	Maximum pressure drop of the air	(Pa)
	Permissible pressure drop of the cooling agent	(kPa)
	Maximum or required dimensions of the exchanger	(mm)
	Requirement reg. housing material	

2.5.6. Evaporative cooler

Evaporative air coolers are designed for cooling or drying the air in summertime.
They are made of copper pipes with aluminium fins. The housing is made of zinced steel, stainless steel upon request. The distributor is made of brass and the return collector is made of a copper pipe. The cooling section has drip tray made of stainless steel and a droplet eliminator for stopping the water drops taken away with the air. The drain pipe of the drip tray must have a water trap Evaporative coolers can be manufactured in the following options: one or two stage (output division: 1/2 +1/2 or 1/3 + 2/3).

The maximum working pressure is 2.2 MPa.

Technical parameters of evaporative coolers.

The values shown in the list should be indicated by a design engineer, other ones are specified by the manufacturer.

√	Volumetric intensity of air flow	(m3/h)
√	Inlet air temperature	(OC)
√	Inlet air humidity (10% - 100%)	(%)
	or temperature of wet inlet air thermometer	(OC)
	or inlet air humidity rate	(g/kg)
√	Outlet air temperature or cooling output	(OC) (kW)
√	Type of cooling agent (R134a-R12, R407C-R22, R404A, R410A)	
√	Temperature of Freon vaporization (-7.5OC + 15OC)	(OC)
	Temperature of Freon overcooling (25 OC – 40 OC) (temperature before expanding valve)	(OC)
	Temperature of Freon overheating (3 OC – 10 OC)	(OC)
	Maximum pressure drop of the air	(Pa)
	Permissible pressure drop of Freon	(kPa)
	Maximum or required dimensions of the exchanger	(mm)
	Requirement reg. housing material	

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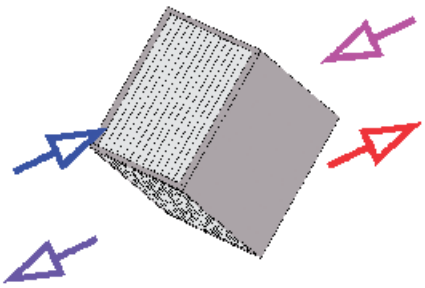
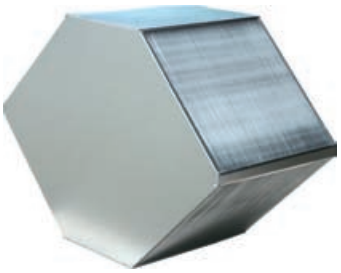
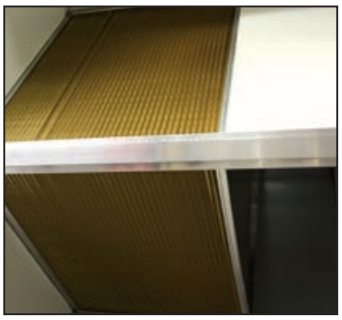
2.5.7. Cross flow exchanger

The cross flow exchanger is constructed of thin, pressed aluminium plates which constitute separated supply and exhaust channels. The supply and exhaust air streams, not coming in contact with each other, flow through the exchanger perpendicularly to each other. The heat recovery with this exchanger does not require any external power supply and is generated by the cold air stream recovering the heat from the plates heated by the hot air stream. This exchanger has a by-pass damper in standard option, which protects the exchanger against freezing at very low temperatures of fresh air, by the part of external air omitting the exchanger, and it allows to limit or turn off the heat recovery in summer.
The section is standing vertically in standard option, however, it is possible to manufacture this unit with a horizontal







cross flow heat exchanger upon request.

The advantage of this exchanger is its very simple structure, no movable parts, which increases its reliability, tightness and high heat recovery efficiency.

The cross flow heat exchanger is equipped with a droplet eliminator for water drops condensed in the exhaust air and a drip tray placed behind the cross flow exchanger at the outlet. The drain pipes from the drip trays must have a water trap.

Optimal heat recovery: 50 ÷ 70%
Capacity range: 500 m3/h ÷ 100 000 m3/h.

The performance of the exchanger is determined by the air handling unit's manufacturer on the basis of the device operating parameters supplied by the customer.
Options:

- Epoxide exchanger
- Non-silicon sealant – strength up to 90OC
- Painted frame
- Plates sealed with paint.

Parameters required for choosing the right type of cross flow heat exchanger:

		Air supplied	Air exhausted
Air flow	m^3/h	√	√
Air temperature at exchanger inlet	[OC]	√	√
Air humidity at exchanger inlet	[%]	√	√

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2.5.8. Rotary heat exchanger

In the rotary heat exchanger heat is recovered by means of the energy accumulating in the exchanger material. A stream of hot air heats the exchanger while flowing through it, while a stream of cold air recovers the heat from the exchanger. The section consists of a rotary exchanger and drive system, all these segments being enclosed in one housing. The housing structure of the rotary exchanger section allows for the possibility of mixing the streams of the supply and exhaust air. Therefore, it must be remembered that this kind of heat recovery cannot be applied in all systems. High performance in terms of heat recovery is achieved in a rotary heat exchanger.

The air supplied should always flow in the direction contrary to the air exhausted by the heat exchanger. The heat exchanger is being self-cleaned in this way. However, filters are recommended to be used before the exchanger, both at the supply and exhaust side.

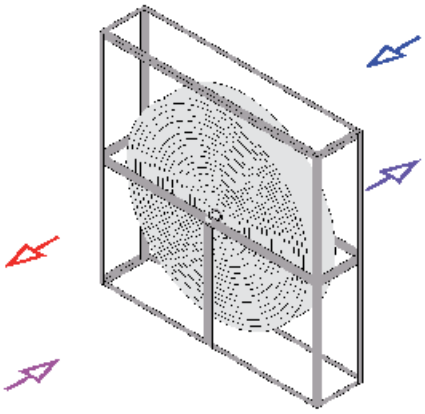
The rotary heat exchanger is made of aluminium foil, alternately corrugated and flat, which builds the air flow channels. The driving motor can have either constant or variable rotation speed. The drive is transmitted from the motor to the exchanger by a driving belt.

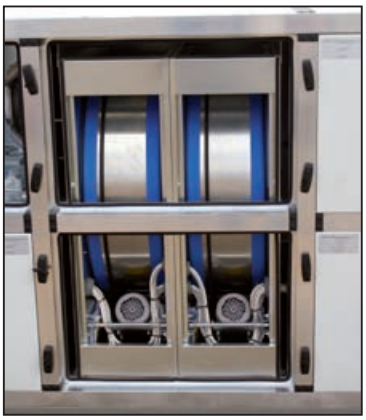
The exchanger can be completed either in hygroscopic or non-hygroscopic version, also the option with epoxy coated aluminium with a painted or stainless steel housing is available. A drip tray can be fitted upon the customer's request. The section can be completed both in vertical or horizontal option.
In order to achieve higher performance the exchanger rotor is covered with a hygroscopic or absorptive coating. Then, it is possible to recover not only the sensible heat but also the latent heat (vaporization heat of the humidity contained in the air).
Fluent control of the rotations can optimize the performance of heat recovery or it can prevent the rotor against freezing.

In the case when the air handling unit operates in the air contaminated with substances which can affect the exchanger material, the rotor can be finished with an epoxide coating.
Rotor options:

- standard (non-hygroscopic)
- hygroscopic
- coated with epoxide.

The optimal heat recovery:	60÷85% (humidity recovery 60÷85%).
Capacity range:	1000 m^3/h ÷ 10 000 m^3/h
Operation temperature:	up to 50÷60°C





Parameters required for choosing the right rotary heat exchanger:

		Air supplied	Air exhausted
Air flow	m3/h	√	√
Air temperature at exchanger inlet	[OC]	√	√
Air humidity at exchanger inlet	[%]	√	√

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Electric parameters of the motor

Condensation rotor	Hygroscopic rotor	Nominal power	Power supply (V/Hz)	Nominal rotations	Nominal current	Poles	Iso class	Insulation class	Weight with transmission (kg)
-500	-500	15W	1x220/50	1200	0,16	4	-	IP54	1,5
501-900	501-600	25W	1x220/50	1200	0,23	4	-	IP54	2
			3x220/50	1200	0,24	4	-	IP54	2
901-1100	601-900	40W	1x220/50	1250	0,36	4	-	IP54	3,4
			3x220/50	1450	0,39	4	-	IP54	3,4
1101-1500	901-1100	90W	3x220/50	1350	0,51	4	56	IP55	3
			3x380/50	1350	0,29	4	56	IP55	3
1501-2100	1101-1700	180W	3x220/50	1350	0,97	4	63	IP55	4,1
			3x380/50	1350	0,56	4	63	IP55	4,1
2101-2500	1701-2500	370W	3x220/50	1350	1,82	4	71	IP55	6
			3x380/50	1350	1,05	4	71	IP55	6

2.5.9. Heat pipe

The heat pipe exchanger is constructed of copper pipes closed on both ends – filled with coolant, on which aluminium fins are placed in order to intensify the heat exchange. This type of heat recovery is based on the phenomenon of vaporization and condensation of coolant. The heat pipe housing divides the device into two sectors: the lower and the upper sector. In the lower sector the heat is recovered from the exhaust air stream in result of the coolant vaporization. In the upper sector the heat is transferred to the supply air stream in result of the coolant condensation. For this reason the exhaust system is always on the bottom of the supply and exhaust unit. Heat transmission is possible only when the temperature of the air flowing through the upper sector is lower than the temperature of air flowing through the lower sector. In the standard option this section is equipped with a by-pass damper ensuring that the exchanger can be used throughout the year. The by-pass damper is also used as antifreeze protection. The section has also a drip tray with droplet eliminator in standard option. The exchanger can be epoxy coated and with painted or stainless steel housing. The section can be completed both in vertical or horizontal option.

Parameters required for choosing the right heat pipe exchanger:

		Air supplied	Air exhausted
Air flow	m3/h	√	√
Air temperature at exchanger inlet	[OC]	√	√
Air humidity at exchanger inlet	[%]	√	√

The optimal heat recovery: 40÷70% depending on the number of pipe rows in the exchanger.

2.5.10. Run-around glycol system

Run-around glycol system consists of two heat exchangers:

- cooling coil (cooler - located in the exhaust air stream)
- heating coil (heater - located in supply air stream)

The exchangers are combined with each other by a system of pipelines filled with a liquid agent (mostly a 30-40% glycol concentration). The delivery of the liquid agent, installation (pipes, control valves, sanitary ware, frost protection system and other) is normally beyond the air handling unit supplier's services.

The structure of the exchangers is the same as of the normal water heat exchangers.

The exchangers are made of copper pipe coils and aluminium fins placed on them.
A drip tray is placed under the heat exchanger of exhaust air, and droplet eliminator in the further part. The drain from the drip tray must have a water trap.
The inlet and outlet pipelines of the heat exchangers must be connected in such way, so that the heat exchangers can work in a countercurrent, that is, so that the liquid agent flows in a direction contrary to the flowing air stream.

The supply and exhaust systems are totally separated in this option. It is possible to combine several supply and exhaust units so that they can work together.

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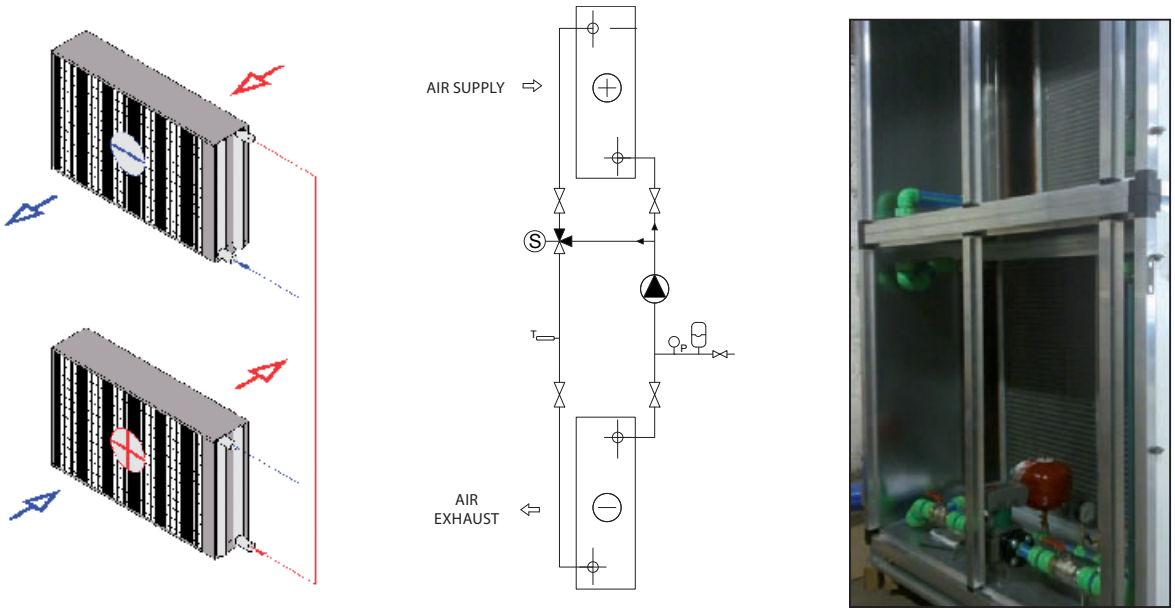
Technical parameters of run-around system.
The values indicated in the list should be provided by a design engineer, the other are specified by the manufacturer.

		Supply air	Exhaust air
Volumetric intensity of air flow	(m3/h)	√	√
Inlet air temperature	(OC)	√	√
Inlet air humidity (10% - 100%)	(%)		
or temperature of wet inlet air thermometer	(OC)	√	√
or inlet air humidity rate	(g/kg)		
Outlet air temperature of heat recovery output	(OC) (kW)	√	√
Type / concentration of glycol	(%)	√	√
Maximum pressure drop of the air	(Pa)		
Permissible pressure drop of the liquid agent	(kPa)		
Maximum or required dimensions of the exchanger	(mm)		
Requirement reg. housing material			

The optimal heat recovery: 40÷60%.
An example of installation for a run-around system.



2.5.11. Heat pump

Air handling units can be equipped with a heat pump.
A heat pump is a device built in the same way as a cooling device. Its major elements are: heat exchangers placed in air streams (supply and exhaust air), a compressor and an expansion valve. All the components are placed inside the air handling unit.

Versions of the device according to their function:

- **heat pump** – heating the supply air (cooler fitted at the exhaust and condenser fitted at supply),
- **reverse heat pump** – heating the supply air in the heating season, cooling in summertime (the heat exchangers change their function depending on the operation mode: the exchanger working as a cooler in summertime turns into a heater/ condenser in wintertime, the exchanger working as a condenser at the exhaust in summertime turns into a vaporizer in wintertime).

The heat pump is meant to recover the heat from the exhaust air and transfer it to the supply air. Also, the supply air takes over the compression energy of the coolant supplied to the compressor motor.

Differently from recuperators, a heat pump can be used for heat recovery even if there is no temperature difference between the supply and exhaust air.

Clima Gold select the components of the heat pump at the customer's individual request.

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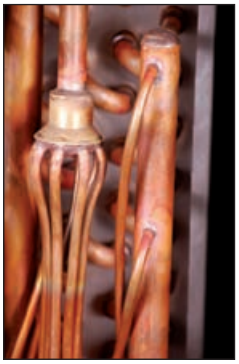


2.5.12 Mixing chamber – recirculation

Recirculation is the simplest and cheapest heat recovery method. It is the secondary use of the previously heated air. It takes place in the recirculation chamber where the air exhausted from the ventilated rooms is reversed and then mixed with the fresh air and resupplied into the rooms again. Recirculation must not be used if the exhaust air contains any harmful or explosive etc. substances. This section consists of two inlets and one outlet equipped with multi leaf dampers which enable the adjustment of proportions of the fresh and exhaust air (0-100%). The advantage of recirculation is the linear dependency between the temperature performance of heat recovery and the percentage of the return air, i.e. 30% of the recovered heat corresponds to 30% recirculation.

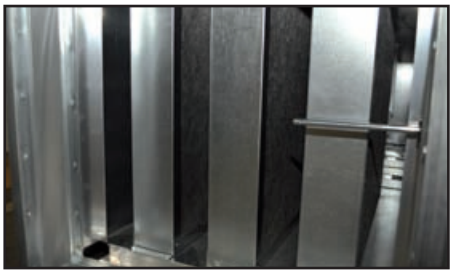
The drawings and dimensions characteristic for the mixing section are shown in Chapter 2.3. Mixing sections are also available in other dimensions.

2.5.13 Noise damping section.

In order to reduce the noise generated by the air handling units, the acoustic silencers are used. They are fitted from the room side and air intake and outlet side. These are absorption type silencers with the cartridges filled with nonflammable mineral wool consuming acoustic energy. They are covered with a fiberglass veil which protects them against damage by the air stream. The number of cartridges depends on the size of the air handling unit. Three silencer lengths are available for each unit size. The longer is the silencer the higher is the noise damping rate.

It is recommended to use the silencers at the source of noise. Noise is also damped along the air handling ducts network in a natural way. Damping the noise directly at the unit and natural damping in the channels allow to avoid using the channel silencers.

Size of silencer	Length of damping cartridges
dB1	600
dB2	1000
dB3	1200



2.5.14 Filtering section

The filtering section is responsible for protecting the air handling unit and channel system t against pollution and providing appropriately clean air to be supplied to the ventilated rooms. The class of filters used depends on the type of rooms and type of the air handling unit.

G4 or F5 class cassette or bag filters are used as primary or main filters. The filter cover is made of zinced, painted or stainless steel sheet. In cassette filters the filtering fabric is stretched on a wire net, is made of nonflammable synthetic polyester material. G4, F5, F7 and F9 pocket filters are used as main filters (higher class filters are available on the customer's request). The filtering fabric has a bag shape in order to increase the filtering area. The dimensions of filters are standardized according to international standards.

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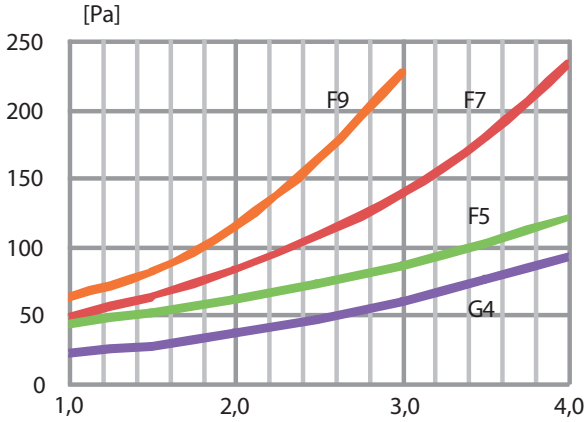
List of pocket filters lengths

Filter class	Length [mm]
G4	360
F5	500
F7	590
F9	590

The length of the cassette filter: 100 mm



The speed of the air flow in an air handling unit [m/s]

Pressure loss on a clean filter

Maximum final pressure drop on a filter

Filter class	Maximum final pressure drop on a filter according to PN-EN 13053
G 4	150
F 5	250
F 7	250
F 9	350

Specification of filters for each OPTIMA unit

Unit size	Width [mm] x Height [mm] x number of pcs.	
1	490-590-1	
2	490-590-1;	490-287-1
3	490-590-1;	490-287-1; 287-879-1
4	590-590-2;	287-590-2
5	590-590-2;	490-590-2; 490-590-2; 490-287-1
6	590-590-2;	590-287-1
7	590-590-4;	287-590-1; 590-287-2; 287-879-1
8	590-590-6;	287-590-3
9	590-590-9;	590-287-3
10	590-590-12 ;	590-287-3
11	590-590-18	

Maximum permissible temperature of the flowing air: cassette filter 90°C, pocket filter 80°C.

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Classification of filters and filtering effectiveness rate

Filter class			Total filtering effectiveness [%]		Filtering performance	Type of pollution stopped
			Synthetic dust test	Natural dust test	DES, DOP spray test or paraffin oil spray test	Good and very good effectiveness
Classification basis	EN 779	DIN 24185 EUROVENT	PN-B-76003:1996	DIN 24185 EUROVENT 4/5	DIN 24185 EUROVENT 4/5	PN- EN 1822	
Primary filters	G1	EU1	A1/A2	$\eta < 65$			Insects, fabrics, sand
	G2	EU2	B1	$65 \le \eta < 80$			Bigger pollen
	G3	EU3	B2	$80 \le \eta < 90$			
	G4	EU4	B2	$90 \le \eta$			Bigger pollen, rough metal-lurgical dust
Precise filters	F5	EU5	C		$40 \le \eta < 60$		Bigger pollen, rough metallurgical dust
	F6	EU6	C		$60 \le \eta < 80$		
	F7	EU7	C		$80 \le \eta < 90$		All kinds of dust, soot, oil spray, fungal spores
	F8	EU8	C		$90 \le \eta < 95$		Soot, oil spray, bacteria (high effectiveness)
	F9	EU9	Q		$95 \le \eta$		
HEPA	H10	EU10	Q			>85	Bacteria, tobacco smoke, all kinds of smoke and spray (high effectiveness)
	H11	EU11	R			>95	
	H12	EU12	S			>99.5	
	H13	EU13	-			>99.95	Bacteria, radioactive dust, tobacco smoke, all kinds of smoke and spray (high effectiveness), good effectiveness with most of viruses
	H14	EU14	-			>99.995	
ULPA	U15	EU15	-			>99.995	
	U16	EU16	-			>99.99995	
	U17	EU17	-			>99.999995	

2.5.15. Humidifying section

Any air handling unit can be equipped with a humidifying section if necessary.
Humidifying can be performed by either water of steam devices.
The size of the humidifier is chosen on the basis of the required volume of humidifying water specified by the customer or on the basis of parameters required for maintaining a specific level of humidity of the supplied air.

Available types of humidifiers:

Water humidifier with sprayed deposit

The humidifier is built of a deposit pads made of nonorganic material of high water absorption. The deposit pad is sprayed with water. The flowing air causes the vaporization of water.
The maximum humidifying efficiency rates can be: 65% or 85% or 95%.
The humidifier can be fed directly either from general water supply system or by circulating water.
The humidifier has a circulating water tank with a drain pipe on the operational side which must have a water trap.

Water humidifier with spraying chamber

The water spraying section with a spraying chamber is the section of the unit which has water nozzles and droplet eliminator. Water is sprayed directly into the air stream.
The humidifier has a circulating water tank with a drain pipe on the operational side which must have a water trap.

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Steam humidifier

The steam vaporizing section constitutes of a unit section equipped with steam lances. Technological steam made in a boiler or steam generator or the steam generated in a steam generator located by the unit, e.g. electrode or resistance humidifier, can be led to the steam humidifying section.

Technological details of the humidifying section are available on direct request at **Clima Gold**.

2.5.16. Empty section.

The empty section is a section not containing any subsystems. It can be used in the following cases:

- in order to fit a new device if any extension of the unit is planned in future,
- as a distance section, so that the air is distributed properly between two adjacent sections,
- as an inspection section providing access to maintenance requiring components (if there is no access to them from the adjacent sections).

An empty section should be minimum 300 mm long.

2.5.17. ION GENERATOR

Air cleaning system – removing particles, i.e. smell, smoke, eliminating bacteria, nicotine, toxins, viruses, allergens, dust mites, dust and any other organic compounds.

2.5.18. UV LAMPS

Air purifying system – eliminating bacteria, viruses, mould, spores, allergens, fungi, smell.

2.6. Accessories

2.6.1. Flexible connections

The flexible connections prevent from transmitting any vibrations caused in the air handling unit to any ventilation channels and make connecting these elements easier. Flexible connections are made of polyester fabric. They are characterized by high strength and long life and they can work in temperature range from -30OC to +80 OC. A tape is fixed in the frames made of 30 mm zinced steel profiles. The maximum connection span is 130 mm and working span 110 mm.

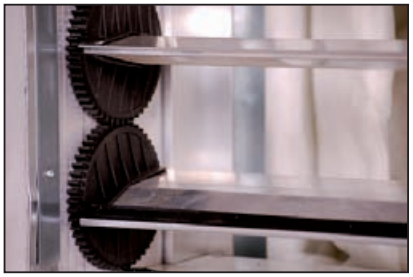
2.6.2. Multi-leaf dampers

The units are equipped with dampers at fresh air inlet and exhausted air outlet in standard option. These are used for closing the AHU or for controlling the air stream volume.
The damper casing and the movable opposed blades are made of aluminium profiles. The shape of the blade profiles ensures small flow resistance and low noise emission. Rubber seals fitted on the edges of the blades make the dampers tight. The dampers are driven by the coupled plastic gear wheels. The standard dampers have a drive cylinder combined with the automatic control actuator.

Operation temperature range is from -30°C to + 60°C.

Up to the dimensions 1340x1340 the damper consists of one block with one drive cylinder, however, above this dimensions, it is divided and equipped with two drive cylinders coupled with a rod.

The damper of the cross flow exchanger by-pass consists of one block divided into two parts controlled by one drive cylinder, one adjusting the air flowing through the cross flow exchanger and one adjusting the so called by-pass flow. The dimensions of the multi-leaf dampers correspond to the dimensions of the flexible connections.



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2.7 OPTIMA - outdoor execution.

Standard **OPTIMA** air handling units are available in outdoor execution, i.e. they can operate for many years as devices mounted outside of the buildings, exposed to weather conditions.

The units finished in this version have a roof made of paint coated steel, air intake with droplet eliminator at the inlet of the air supply unit, air jet mounted at the outlet of the exhaust unit. All dampers are fitted inside the unit. For this reason, the external dimensions of the roof mounted unit section containing dampers at inlet or outlet are longer by the length of each damper.

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3. Air handling units in special executions.

3.1. OPTIMA SPEC Special Air Handling Units.

OPTIMA SPEC are (examples):

- units equipped with EX elements,
- chemically resistant units,
- units designed to work in higher salinity conditions,
- units for nonstandard air volumes
- other units.

3.2. Garage units.

Air handling units are also used for the ventilating of garage facilities.
Exhaust air handling units are used for this purpose and they can have a filter as an option.

Air handling unit options used for mechanical ventilation of garages.

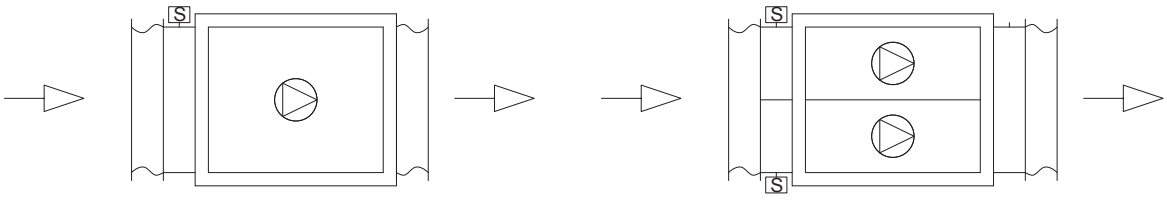
- Exhaust devices with one fan and two speed motor – **G1**.
- It is possible to use motors with different speed division depending on the demand, e.g. 100%/67,7%, 100%/50%,
- Exhaust devices with two fans – **G2**.

The air handling equipment is normally working at lower capacity rate. It removes air from the garage in the amount planned by a design engineer, assuming a certain number of air exchange cycles in the room. The air can be supplied to the garage by subatmospheric pressure through the openings located in the external compartments or through the mechanical supply air handling systems.

In the case when the permissible concentration of carbon oxide in the room is exceeded, the detector switches the device over to maximum capacity mode. This is done in a way depending on the equipment option, either through switching the motor rotations over to higher level in a multi speed motor or through turning on another fan.

At the moment when the concentration is reduced down to the permissible level, the device returns to the normal working mode.

Garage air handling units can be manufactured within **OPTIMA** and **OPAL** series.4.



G1 **G2**

4. OPTIMA CRYSTAL – Hygienic Air Handling Units

Based on the **OPTIMA** series, **OPTIMA CRYSTAL** has been created as a hygienic application device.

These units are designed to work in the buildings and rooms requiring significantly higher hygienic standards, so called "sterile rooms" (pharmaceutical plants, hospitals, operation rooms, laboratories, advance technologies production etc.).

These air handling units provide a high purity air by means of using the appropriate configuration of function sections and subject to special structural solutions.

Some of these solutions allow for easy cleaning of the device, which leads to maintaining the purity of the supply air.

The amount of the handled air, the physical and chemical parameters of the air prepared by the air handling unit are determined by the function and technology of the rooms handled and they are prescribed by the investor and air handling system engineer.

The configuration of the air handling units depends on the requirements of the handled rooms and buildings.

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OPTIMA CRYSTAL – Hygienic version of AHU

Equipment characteristic of hygienic version units.

Structure:

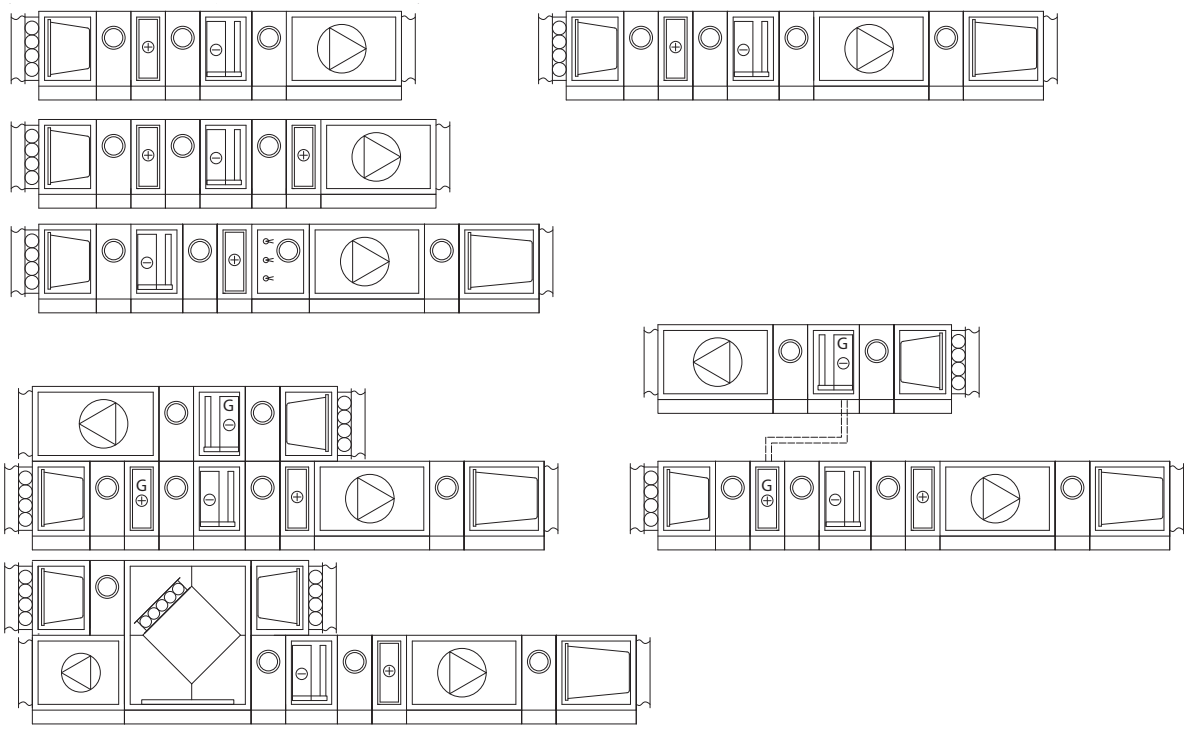
- Permanent, removable covers, doors: inner sheet – standard: coated sheet steel (option aluzinc), outside sheet – standard: coated sheet steel (option aluzinc),
- Floors, membranes of fans, coils fixing guides, filters and droplet eliminators frames – standard: coated steel (option aluzinc),
- High pressure proof structure and sealing
- Unit door mounted on hinges with handles and a clamp,
- Drip trays under coolers and humidifiers,
- Access to heat exchangers for cleaning
- All edges and faultings filled with mould and fungus resistant silicon (including a fungus killing agent) to minimize the risk of bacteria and microorganism cultures,
- Standard coils are made of copper and epoxide aluminium, exchanger housing is made of stainless steel,
- Heat recovery systems (cross flow exchangers, heat pipes), painted housing (cross flow exchanger) or 304 stainless steel (heat pipes), fins and plates epoxide aluminium,
- Painted or aluzinced fan sets,
- Collector outlets going through the cover are insulated with insulation wool and sealed with rubber seals and NAF silicon on the edges,
- Inspection windows and lamps (24V) make the cleaning inspection easier without turning off and opening the device,
- Cable glands provide proper tightness,
- Filters used in the unit have any obligatory health approval certificates,
- Construction materials of the unit are resistant to any disinfecting agents,
- Available fitting of drip gutters and ball traps.

Technical advice regarding functional performance:

Heat recovery – as high purity air must be supplied, heat recovery is not used here because there is a possibility of intrusion of the exhaust air into the supply air. For this reason the cross flow exchanger, heat pipe, run-around coil and heat pump are recommended for the hygienic version of AHUs.

Humidifying – steam humidifiers fed by individual steam generators located beside the unit or by steam boilers located in boiler house should be used.

Examples of **OPTIMA CRYSTAL** hygienic units configuration



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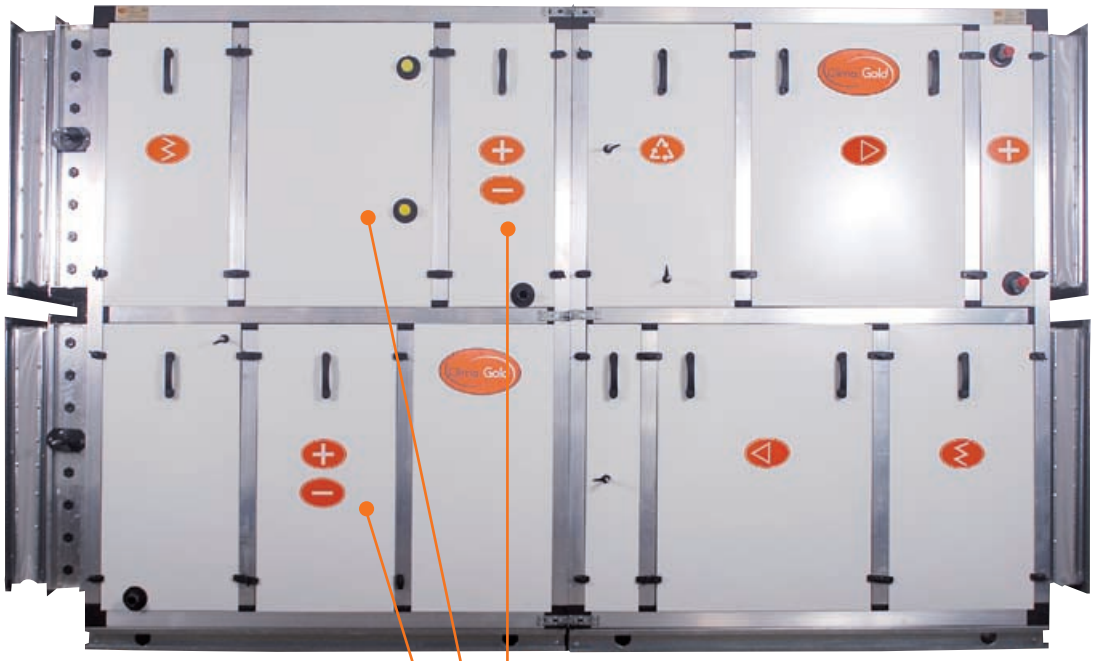
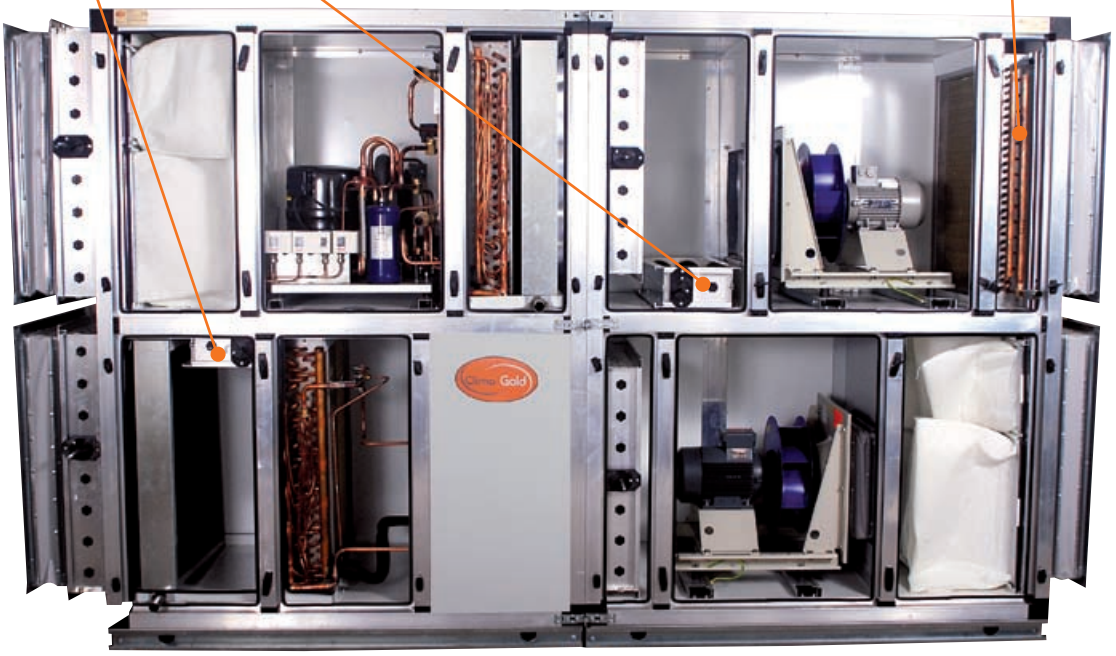


REVERSE
HEAT PUMP WITH POOL WATER
WARMING IN A PLATE HEAT EXCHANGER.

AIR
RECIRCULATION

REHEATING



5. OPTIMA TURQUOISE Swimming pool air handling units

5.1. General information

The series of **OPTIMA TURQUOISE** swimming pool air handling units has been created on the basis of **OPTIMA** unit type.

These air handling units can be used in swimming pool objects due to their structure and technical solutions. The units supply the required volumes of air to the ventilated halls, including air drying and the air handling system is operated at minimum energy cost due to heat recovery applications.

Swimming pool air handling units working with high humidity air and air contaminated with chemical compounds used in swimming pool technology, offer special technical solutions.

Structure:

- Permanent, removable covers, door: inner sheet – standard: coated sheet steel (option aluzinc), outside sheet – standard: coated sheet steel (option aluzinc),
- Floors, membranes of fans, coils fixing guides, filters and droplet eliminators frames – 316 standard stainless steel (either coated steel or aluzinc),
- Unit door mounted on hinges, with handles,
- Drip trays under coolers,
- Coated aluminium profiles,
- All edges and faultings filled with mould and fungus resistant silicon (including a fungus killing agent) to minimize the risk of bacteria and microorganism cultures,
- Standard heat exchangers are made of copper and epoxide aluminium, exchanger housing is made of 316 stainless steel,
- Heat recovery systems (cross flow exchangers, heat pipes), painted housing (cross flow exchanger) or 316 stainless steel (heat pipes), fins and plates epoxide aluminium,
- Painted (standard) or aluzinced (option) fan sets,
- Collector outlets going through the cover are insulated with insulation wool and sealed with rubber seals and NAF silicon on the edges,
- Inspection windows and lamps (24V) make the cleaning inspection easier without turning off and opening the device,
- Cable glands provide proper tightness,

Apart from special technical solutions, the unit functional sections are configured in such way in order to treat the ventilated air optimally.

Supply and exhaust swimming pool AHUs can be configured in the following systems:

Unit configuration No.	Number of recovered heat degrees	Heat recovery			
		Recirculation	Cross flow exchanger	Heat pipe	Heat pump
1	1	√	-	-	-
2		√	√	-	-
3	2	√	-	√	
4		√	-	-	√
5	3	√	√	-	√
6		√	-	√	√

The air handling unit can also be configured according to the customer's request.



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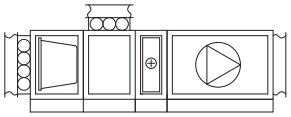
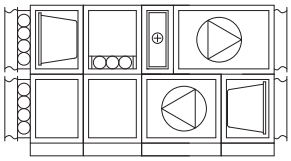
5.2. Proposed configuration of swimming pool air handling units

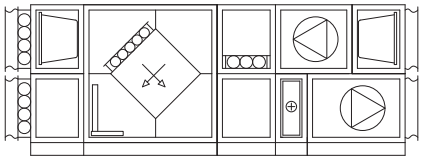
1
Supply unit with recirculation

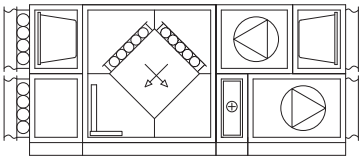


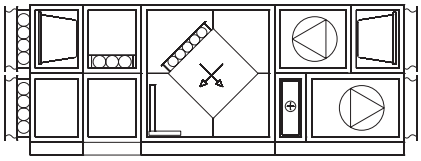
2
Supply and exhaust unit with recirculation



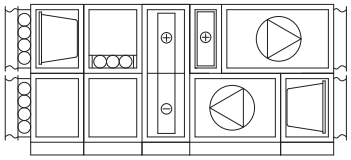
3
(three options)
Supply and exhaust unit with cross flow exchanger and recirculation



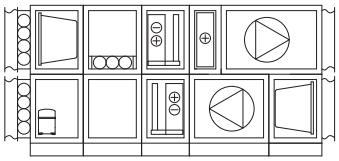




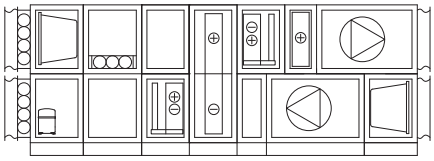
4
Supply and exhaust unit with heat pipe and recirculation



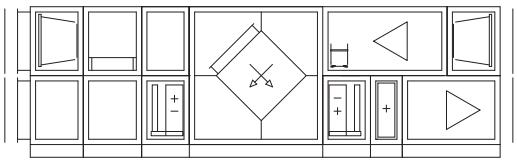
5
Supply and exhaust unit with heat pump and recirculation



6
Supply and exhaust unit with heat pipe, heat pump and recirculation



7
Supply and exhaust unit with cross flow exchanger, heat pipe, heat pump and recirculation



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5.3. Selection of units.

The size of the device must be selected depending on the volume of air necessary for appropriate air handling of the swimming pool hall. The predetermined volume of air must guarantee:

- Effective absorption of humidity generated in the swimming hall,
- Minimum volume of outdoor air required in hygienic terms,
- Maintaining the homogeneity of air inside the swimming hall by performing (including but not limited to) a required number of air exchange cycles,
- Protection of the building structure by preventing vaporization upon such elements like windows, by means of a direct air supply,
- Possibility of heating and/ or cooling of the swimming hall, keeping at the same time the required parameters of the supplied air.

Determining the volume of the ventilated air based on the humidity gain rate.

Calculation of humidity gains:

The main source of humidity gain can be determined by means of estimation method prescribed by VDI 2088.

$$W = \sigma (xs - x)$$

Whereas
W [кг/ч] – stream of vaporized water mass,
σ- vaporization coefficient,
10 kg /m^2 *h – for calm water,
20 kg /m^2 *h – for moderate water movement,
30 kg /m^2 *h – for stormy water movement,

xs [kg/kg] – absolute moisture content in the saturated air at pool water temperature,
x [kg/kg] – absolute moisture content in the air inside the swimming pool hall.

It is recommended to assume the following values for calculations:

- Maximum moisture content in the air inside the swimming pool hall: 14,3 g/kg,
- The moisture content in fresh air does not exceed 9g/kg (it is assumed that a short term aggravation of conditions inside the swimming hall for several days a year, when the contents of steam in outdoor air is higher than 9 g/kg, is permissible).

An example of calculation:

Assumptions:

$t_{Pool\ water\ temp.}$	°C	28
x_s	g/kg	24,4
$t_{Hall\ air\ temp.}$	°C	30
$x_{air\ in\ the\ hall}$	g/kg	14,5
σ	kg/m^2h	20

Outdoor air parameters

		SUMMER	WINTER
x_z	g/kg	9	2
ρ_z	kg/m^3	1,175	1,25
Vaporization rate	kg/h m^2	0,198	

The example of vaporization rate for different sizes of swimming pools and fresh air demand for the situation when drying is performed only by means of the fresh air.

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Size of swimming pool			Vaporization from the pool	Volume of fresh air (Minimum)	
Width	Length	Area		Summer	Winter
[m]	[m]	[m2]	[kg/h]	[m³/h]	[m³/h]
10.0	15.0	150.0	29.7	4 600	2 000
12.5	25.0	312.5	61.9	9 600	4 000
12.5	50.0	625.0	123.8	19 200	8 000

The volumes of air shown for summer time, for the assumptions and for drying of halll air only by fresh air.

The volume of fresh air for winter time is the minimum volume of air which can recover the humidity gains for the calculation conditions.

Using an air drying device in a unit (e.g. a heat pump, a cooling device) reduces the fresh air demand and, by the same, it reduces the size of the unit.

The volume of the supplied air cannot be reduced at the user's discretion. In order to determine the right volume, all criteria for determining the volumes of supply air must be taken into account.

The minimum volume of fresh air must be determined from the point of view of the fresh air hygienic volume demand.

5.4. Heat pump

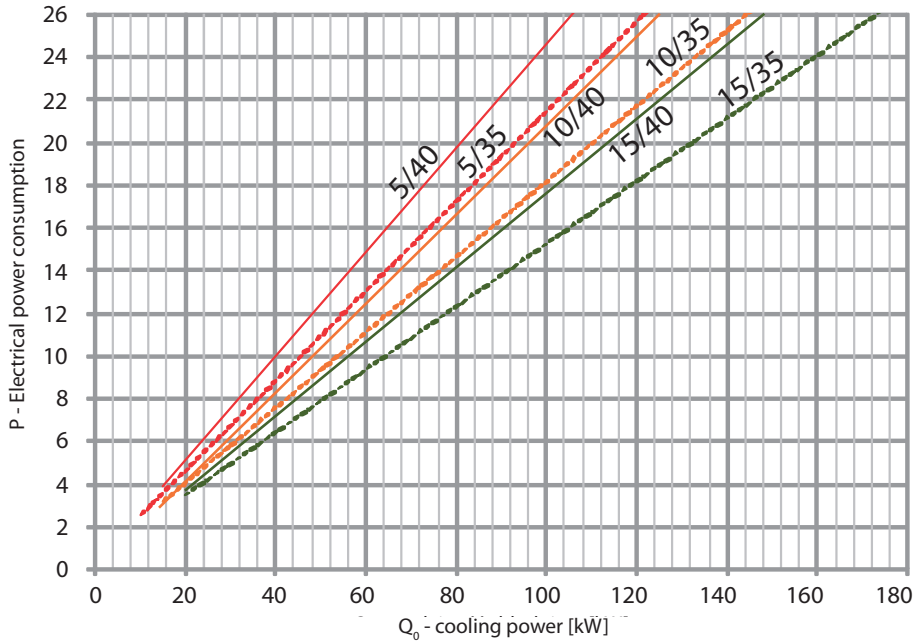
The cooling device, depending on the function it performs in a particular air handling unit and technical solutions applied in it, can be used for the following purposes: cooling (a cooling device), heating (heat pump –PC), cooling and heating (revers heat pump – PCR). The air is being dried at the same time by the condensation of humidity contained by the air transported by the air handling unit as a result of contact with the evaporator's fins, whose temperature is lower than the air dew-point.

Components of a heat pump used for swimming pool air handling units:

- Heat exchanger located at the supply (condenser in PC, condenser/ evaporator in PCR)
- Heat exchanger located at the exhaust (evaporator in PC, evaporator / condenser in PCR)
- Hermetic compressor (1 or 2 pcs), coolant tank with emergency valve
- Control system
- Pipeline installation

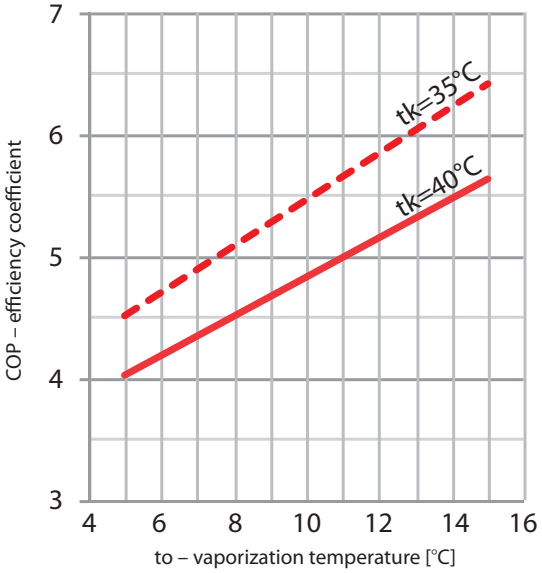
The heat recovery is performed by recovering the heat from the humid and warm exhaust air and transferring it to the supply air. The energy transferred in the condenser is the total of PC compressor supply energy (P) and of latent and sensible heat recovered in the evaporator (Qo).

Depending on the parameters of the supply and exhaust air, the cooling system of the heat pump is selected with respect to the optimal operation conditions by choosing the right temperatures of vaporization (to) and condensation (tk). For different vaporization and condensation temperatures the unit achieves different capacity rates.



Electrical power consumption in respect to the cooling efficiency rate for different vaporization and condensation temperatures.

The heat pump is characterized by COP – heat pump capacity coefficient which indicates the proportion between the heat transferred to the supply air (through the condenser) and the electrical energy consumed by the compressor motor. COP for ventilation units varies between 3,5 and 6 and it depends on the parameters of air flowing onto the heat exchangers.



COP – heating efficiency coefficient in the function of different vaporization and condensation temperatures

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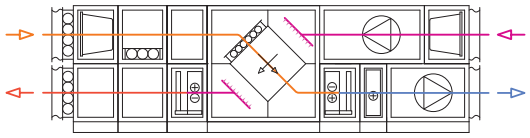
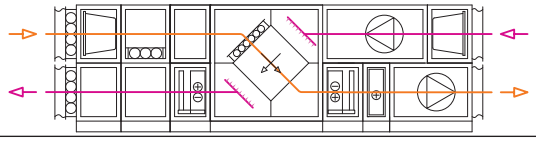
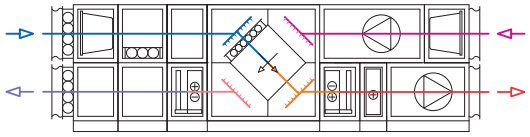
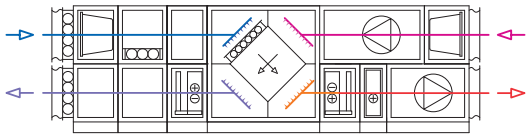
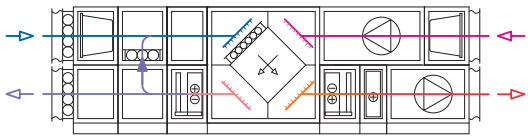
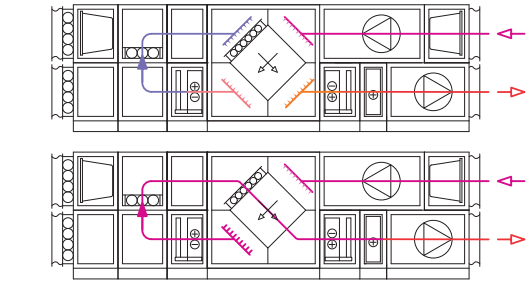
5.5. Operation modes of the swimming pool air handling unit – Example.

Depending on the current weather conditions and the type of use of the building, an air handling unit can operate in different modes. The operation modes are shown on the example of a swimming pool air handling unit with three level heat recovery (recirculation, cross flow heat exchanger, reverse heat pump).

The control system of the units allows to control them in two modes: day mode – during the opening hours of the swimming pool, night mode – during other hours.

Summertime **Outdoor air temperature T_z is higher than the indoor air temperature T_w.** By high temperature of the outdoor air and/or high heat gains the heat pump works as a cooling device. The supply air is cooled on the evaporator, the condenser transmits the heat to the exhaust air.	
T_z is similar to T_w. Air handling is carried out only by means of the outdoor air without any heat and humidity treatment. Fresh air omits the cross flow exchanger totally through by-pass.	
T_z is lower than T_w 100% of the supply air is fresh air. The air is warmed in the cross flow heat exchanger, possibly on the heat pump condenser.	
Transition period **T_z is lower than T_w** The air needs to be warmed and dried. The exhaust air from the swimming hall after passing through the cross flow heat exchanger is cooled on the heat pump vaporizer and dried. A part of the exhaust air is reversed and recirculated again. The mixture of the fresh and recirculated air passes through the cross flow heat exchanger where it is primarily warmed by the recovered heat and then heated up in the heat pump condenser. The volume of the fresh air is selected in the function of swimming hall conditions.	
Wintertime **T_z is much lower than T_w** The device is working in the same way as in the transition period. During a higher heat demand the heat pump is supported by the peak air heater placed behind the heat pump condenser. The minimum fresh air volume is determined by hygienic requirements.	
Period when the swimming pool is not used The exhaust air is totally recirculated and supplied to the swimming hall again. The temperature is maintained by means of water heater. In the case when the air needs drying and heating up the heat pump is switched on and the air is being dried. After passing through the cross flow exchanger, the air is recirculated, it passes through the evaporator, is recirculated again and flows again through the cross flow exchanger and heat pump condenser.	

5.6. Additional elements.

Swimming water heat exchanger.

The swimming pool air handling unit can be equipped with a coolant / water heat exchanger which can heat the pool water or tap hot water in the periods when excessive energy occurs in the air handling system. This energy can be transmitted only when the control system detects any demand for this energy.

6. OPTIMA TOP Ductless air handling unit.

OPTIMA TOP roof mounted ductless air handling units are designed for the air handling and heating of large area rooms of open nature, i.e. having no partition walls inside, including production halls, warehouses, store halls, gymnastic halls. Generally, it is impossible to install a typical ducted air handling in such facilities or, at least, it is very difficult. In order to install OPTIMA TOP system, the room in question must be located inside a building, so that there is a roof directly above (a room in a single story building or the last floor of a multistory building).

Any ductless air handling unit consists of two units combined in one single device:

- Outdoor unit mounted on the roof of the ventilated object,
- Indoor unit (suspended) mounted inside the ventilated room.

Types of OPTIMA – TOP units

Symbol	Method of heat recovery	Capacity [m³/h]
OPTIMA TOP-R	• Recirculation	5 000
		8 000
OPTIMA TOP-K	• Cross flow exchanger • Recirculation	5 000
		8 000

These units are equipped with a set of regulation dampers which allow for working at different operation modes.

Operation modes

OPTIMA TOP-R	OPTIMA TOP-K
• Air handling with heating and recirculation	• Air handling with heating and heat recovery
• Air handling with recirculation without heating	• Air handling with heat recovery without heating
• Air handling without recirculation and heating	• Air handling without heat recovery and heating
• Full recirculation with heating	• Full recirculation with heating

The external unit consists of:

- supply fan
- exhaust fan
- recirculation dampers system (**OPTIMA TOP-R**)
- cross flow exchanger and dampers system (**OPTIMA TOP-K**)
- air intake and air ejector
- supply filter

The internal unit consists of:

- - swirl diffuser
- - water heater
- - exhaust filter.

The structure of the unit is based on a frame made of aluminium profiles and plastic corners. The walls and doors are made of zinced steel sheet and insulated with 50 mm mineral wool (or polyurethane on request) in standard option. Inspection covers are mounted from operational side in order to provide access to the components.

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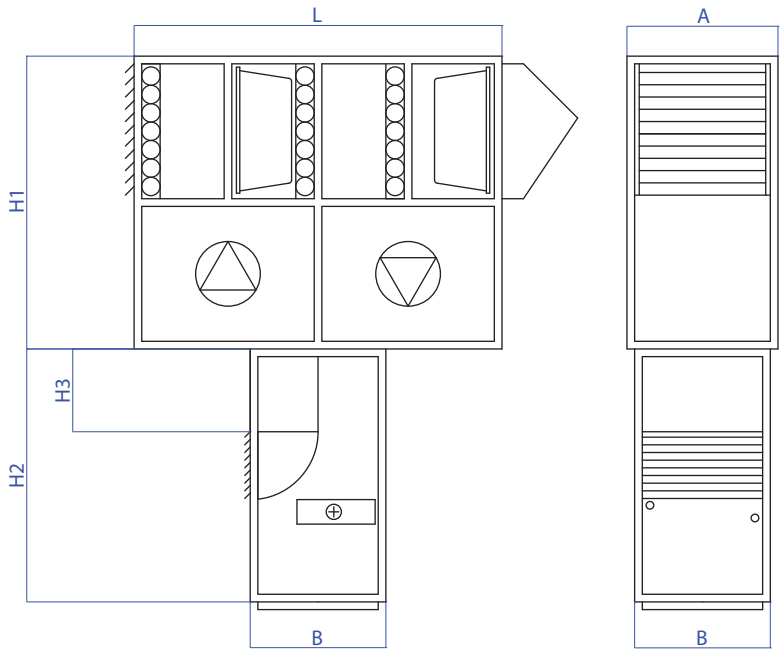
OPTIMA TOP – R



Roof section

Unit size		OPTIMA TOP	
		R-1	R-2
Length	L	2400 mm	2600 mm
Height	H1	1910 mm	1910 mm
Width	A	985 mm	1290 mm
Weight		345 kg	475 kg

Internal section

Размер аррегата		OPTIMA TOP	
		R-1	R-2
Length	L	885 mm	1190 mm
Height	H2	1650 mm	1800 mm
Width	H3	540 m	540 mm
Weight		165 kg*	210 kg*

*estimated weight +/-10% without swirl diffuser weight

Technical details	Unit	OPTIMA TOP	
		R-1	R-2
Air treatment capacity	m^3/h	5,000	8,000
Heater power (parameters: water 90/70 °C, air + 5/35 °C)	kW	55	80
Pressure drop of water in the heater	kPa	10	15
Maximum temperature of the output air	oC	50	
Maximum relative humidity output air	%	60	
Minimum temperature of the outdoor air	°C	-30	
Maximum temperature of the heating agent	°C	130	
Maximum pressure of the heating agent	MPa	1.6	
Power supply voltage of fan motors	V	3x400	3x400
Nominal power of the supply/ exhaust motor	kW	1.5/1.5	2.2/2.2
Height of the supply air diffuser above the floor	m	4 – 9	12-May
Ventilated area (max)	m x m	18 x 18	22 x 22

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The device has a control system for air handling unit control.

The control system consists of the following elements:

- actuators of the supply, exhaust and recirculation dampers
- actuator of swirl diffuser
- supply and exhaust filter pressure controls,
- supply and exhaust fan pressure control (when a centrifugal fan with air double inlet is applied)
- sensors of supply, indoor and outdoor temperature,
- sensor of agent return temperature from heater or antifreeze thermostat,
- three-way valve with a actuator
- power supply and control cabinet.

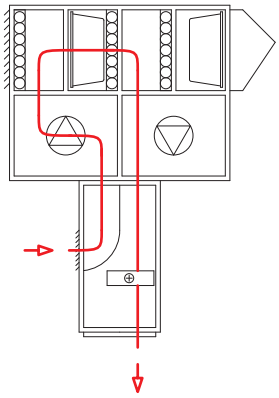
The control system keeps the required temperature in the room by controlling the heating coil and recirculation.

Depending on the conditions this device can work in the following operation modes:

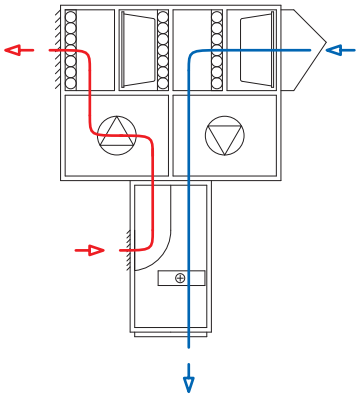
- Full recirculation with heating – e.g. during the night when it is not necessary to supply fresh air,
- air handling without recirculation and heating – when there is no demand for heat, 100% of the supply air is fresh air,
- air handling with recirculation without heating – the device is operating with the heater switched off. The air supply temperature is controlled by the level of the recirculation of the supplied air. The volume of the recirculated air is limited in such way so that the minimum fresh air volume in the supply air is not exceeded.
- air handling with heating and recirculation – the device is working with the heater switched on by minimum volume of fresh air.

The diffuser work is controlled by the actuator in temperature function.
The control system protects the water heater against freezing.

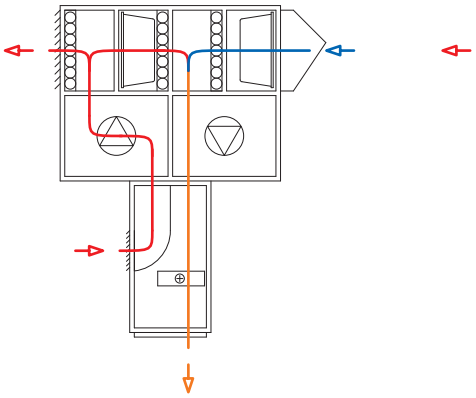
OPTIMA TOP - R – Operation modes



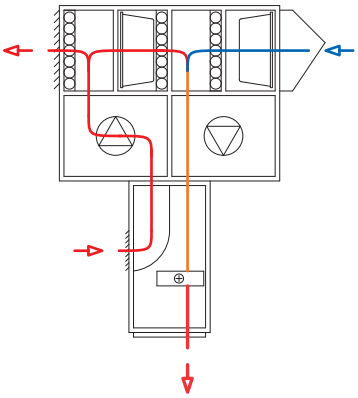
Full recirculation



Air handling without recirculation and heating



Air handling with recirculation and without heating



Air handling with heating and recirculation

Clima Gold reserve their right to introduce any amendments without prior notice.
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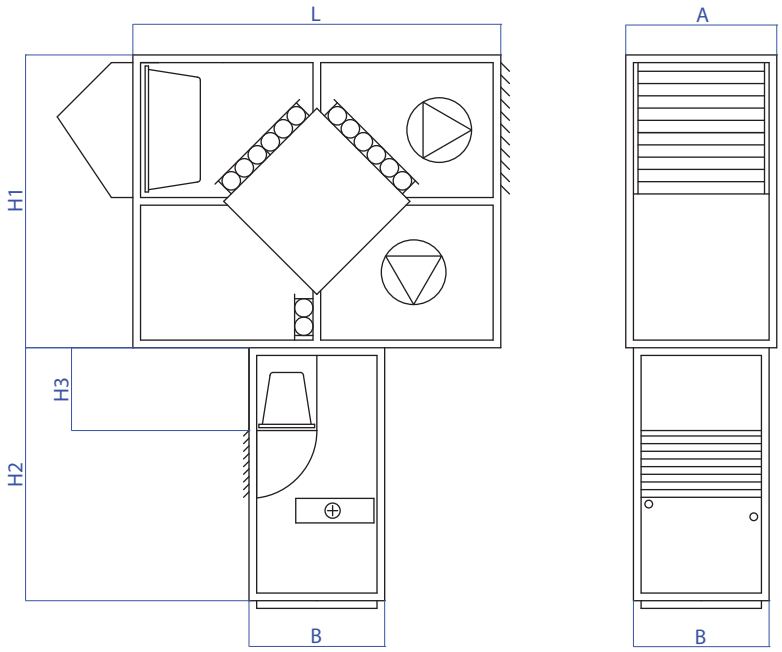
OPTIMA TOP - K



Roof section

Unit size		OPTIMA TOP	
		K-1	K-2
Length	L	2400 mm	2600 mm
Height	H1	1910 mm	1910 mm
Width	A	985 mm	1290 mm
Weight		450 kg	580 kg

Internal section

Unit size		OPTIMA TOP	
		K-1	K-2
Length	B	885 mm	1190 mm
Height	H2	1650 mm	1800 mm
Width	H3	540 mm	540 mm
Weight		170 kg*	245 kg*

*estimated weight +/-10% without swirl diffuser weight

Technical details	Unit	OPTIMA TOP	
		K-1	K-2
Air treatment capacity	m^3/h	5000	8000
Heater power (parameters: water 90/70 oC, air + 5/35 oC)	kW	55	80
Pressure drop of water in the heater	kPa	10	15
Maximum temperature of the output air	°C	50	
Maximum relative humidity of the output air	%	60	
Minimum temperature of the outdoor air	°C	-30	
Maximum temperature of the heating agent	°C	130	
Maximum pressure of the heating agent	MPa	1.6	
Power supply voltage of fan motors	V	3x400	3x400
Nominal power of the supply/ exhaust motor	kW	3.0/2.2	3.0/3.0
Height of the supply air diffuser above the floor	m	9-Apr	5 – 12
Ventilated area (max)	m x m	18 x18	22 x 22

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The device has a control system for the air handling unit.

The control system consists of the following elements:

- actuators of air supply, cross flow heat exchanger and recirculation dampers
- actuator of swirl diffuser,
- supply and exhaust filters pressure controls,
- cross flow heat exchanger pressure control,
- supply and exhaust fan pressure control (when a centrifugal fan with air double inlet is applied) - sensors of air supply, indoor and outdoor temperature,
- sensor of agent return temperature from heater or antifreeze thermostat,
- three-way valve with a actuator
- power supply and control cabinet.

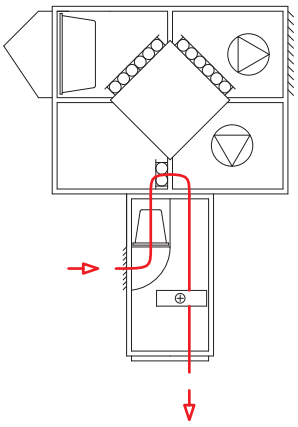
The control system keeps the required temperature in the room by controlling the heat recovery and the operation of the heater.

Depending on the conditions this device can work in the following operation modes:

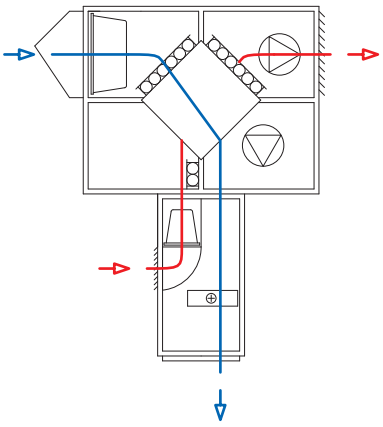
- Full recirculation with heating (1) – e.g. during the night when it is not necessary to supply fresh air,
- air handling without heat recovery and heating (2) – when there is no demand for heat, 100% of the supply air is fresh air (the air passes through the cross flow exchanger by-pass),
- air handling with heat recovery without heating (3) – the device is operating with the heater switched off. The supply air temperature is controlled by the level of heat recovery by regulating the volume of the air passing through the cross flow exchanger and by-pass.
- air handling with heating and heat recovery (4) – heat demand is so high that the whole air passing through the cross flow exchanger does not reach the required air supply temperature and the heater needs to be switched on.

The diffuser work is controlled by the actuator in temperature function.
The control system protects the water heater against freezing.

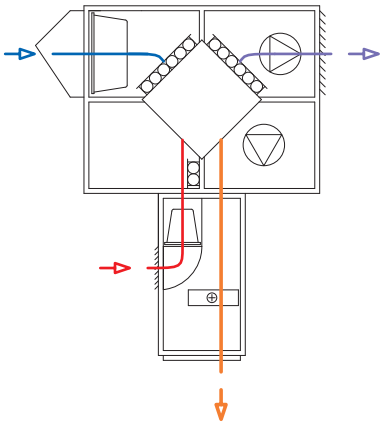
OPTIMA TOP – K – Operation modes



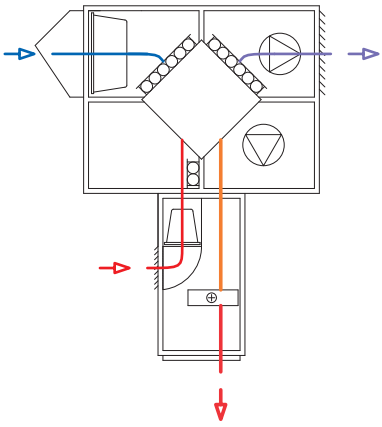
Full recirculation with heating



Air handling without heat recovery and heating



Air handling with heat recovery and without heating



Air handling with heating and heat recovery

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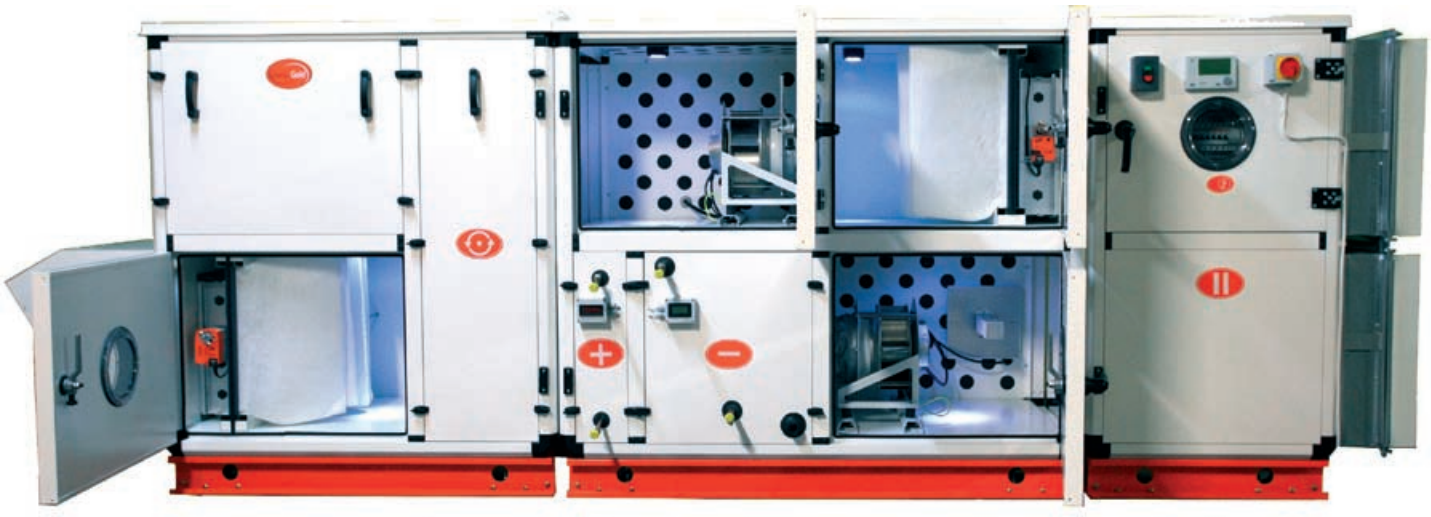
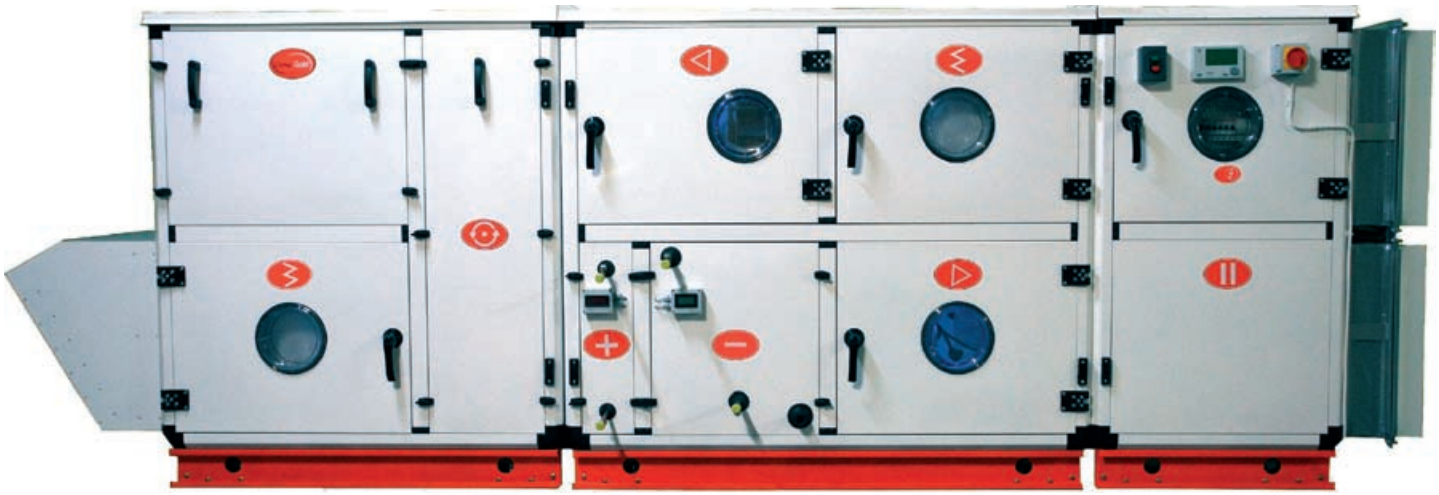
7. OPTIMA ECO SILENT Energy saving and silent air handling units

7.1 General description

In response to the users' growing expectations we have created a new **OPTIMA ECO SILENT** unit on the basis of **OPTIMA** air handling type. The new air handling unit combines the advantages of room air conditioning with reduction of the some inconveniences such as noise emitted by the device and its high energy consumption.

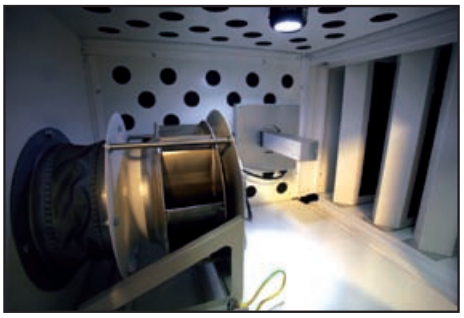


The energetic efficiency is a significant factor due to the economic and ecological reasons. A rational energy consumption is the key aspect of environment and climate protection. On the other hand, noise is a factor strongly affecting our health. Noise above 60 dB(A) is not only the cause of one's bad feeling or anxiety, but it is also harmful for one's mental and physical health. **Our OPTIMA ECO SILENT air handling units combine low cost operation with top well-being conditions for people working within their range**.



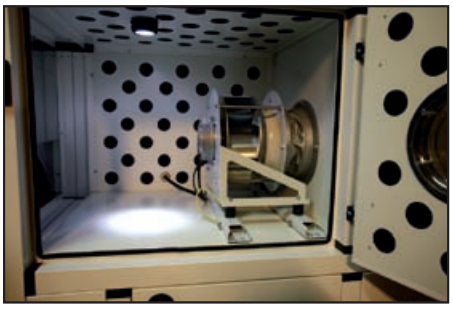
In order to guarantee the low noise emission **OPTIMA ECO SILENT** unit has been equipped with:

- a specially designed minimum noise fan system
- flexible connections, special shock absorbers and noise damping pads,
- perforated internal steel sheets,
- double layer cover insulation
- specially designed silencers



In order to reduce the energy consumption of **OPTIMA ECO SILENT** units, the following elements have been introduced:

- Electronically commuted fans – equipped with top performance silent and small dimension motors which guarantee easy control and reliability,
- LED lamps – an environment friendly and effective lighting solution.



In order to create an exceptional solutions, additionally, the following elements have been used:

- Ion generator which guarantees an extraordinary quality air,
- A built-in control system which enables to control the quality of air and efficiency easily according to the current or programmed demand. The controlling is performed on a top technology panel. There is a possibility of connection to BMS,
- A new profile and all external elements finished in white colour.

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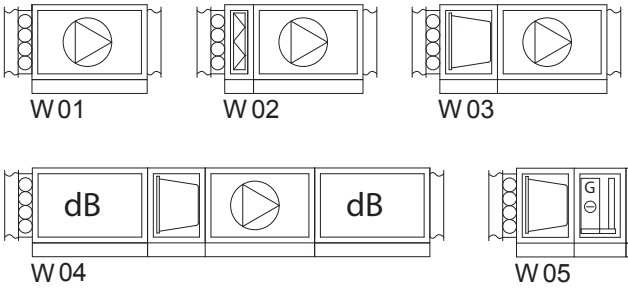
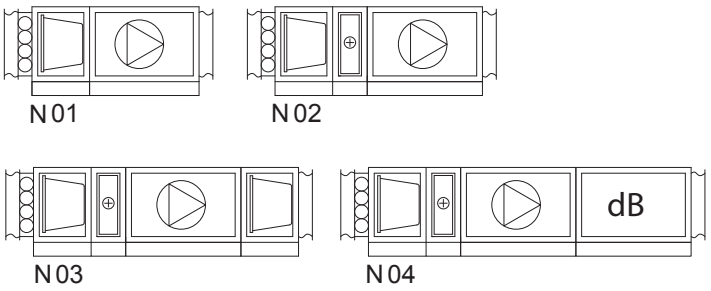
8. Examples of OPTIMA STANDARD air handling units configuration

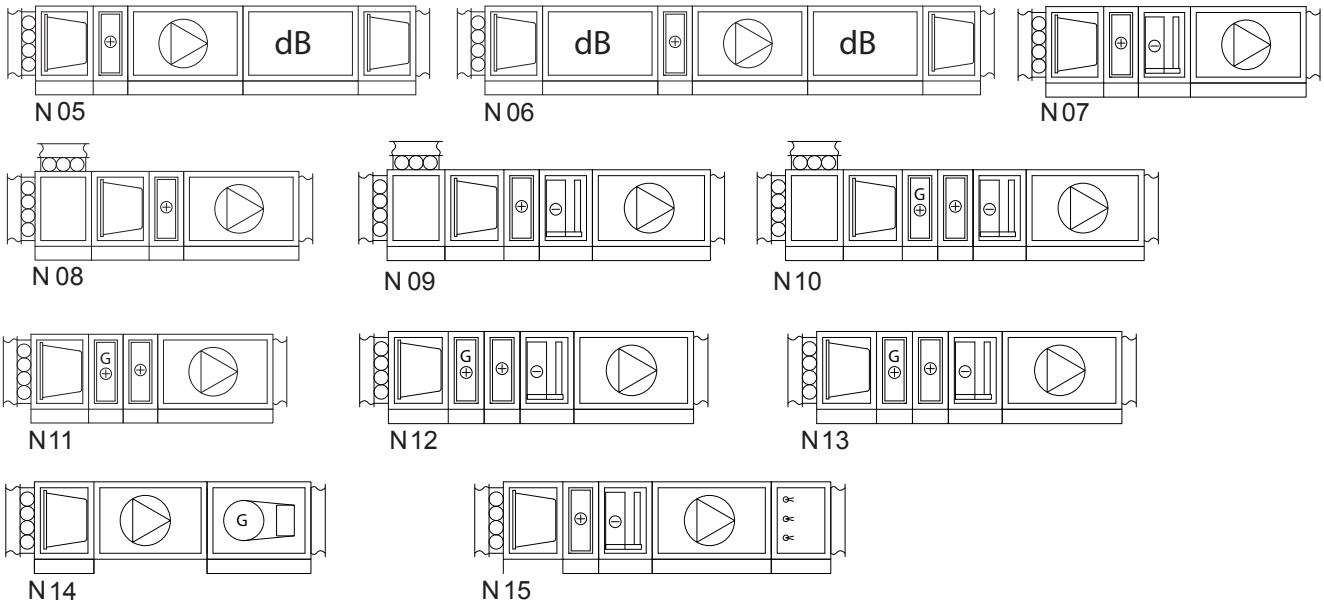
Type of AHU	Example of unit –scheme number	
Exhaust	W	01-05
Supply	N	01-15
Supply and exhaust	NW	01-12
Supply and exhaust	NW	21-27
Supply and exhaust with a rotary exchanger	NW	31-41
Supply and exhaust with a cross flow exchanger	NW	51-63
Supply and exhaust with a heat pipe	NW	71-79
Supply and exhaust with a heat pump	NW	81-83

EXHAUST AIR HANDLING UNITS

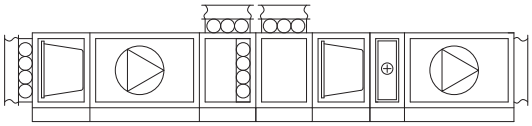


SUPPLY AIR HANDLING UNITS





SUPPLY AND EXHAUST AIR HANDLING UNITS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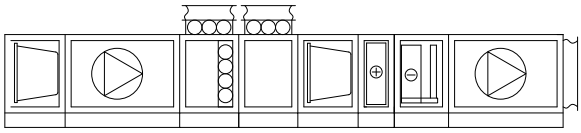
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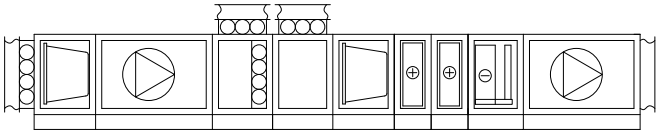
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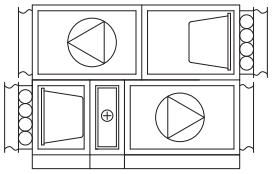
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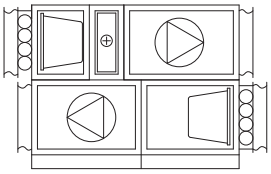
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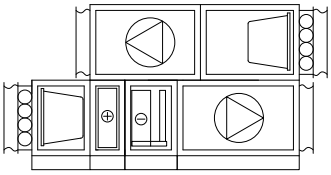
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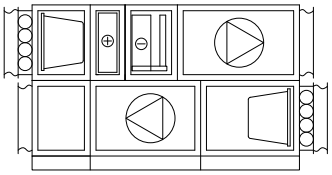
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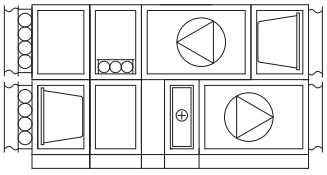
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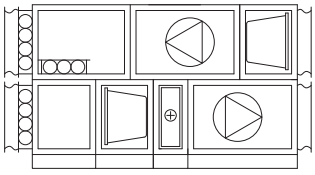
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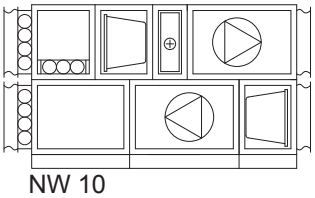
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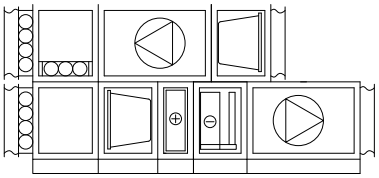
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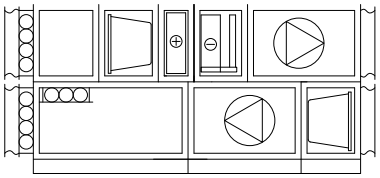
NW 12

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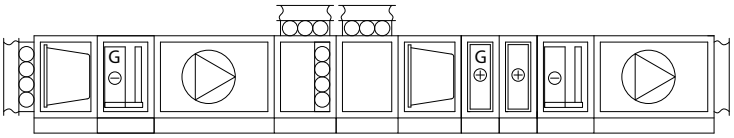
SUPPLY AND EXHAUST AIR HANDLING UNITS WITH RUN AROUND GLYCOL SYSTEM



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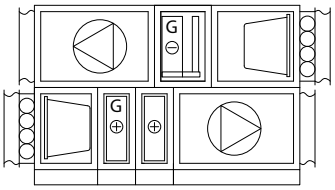

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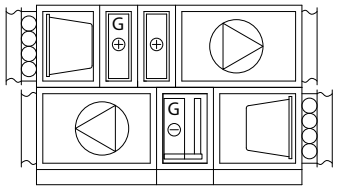

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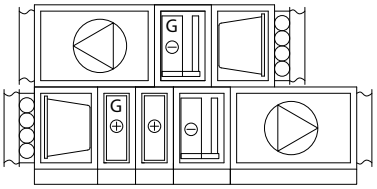

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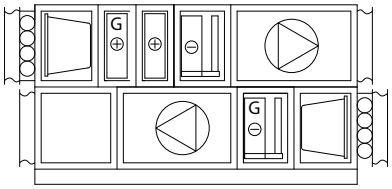

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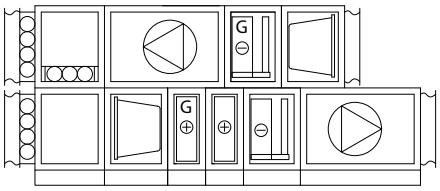

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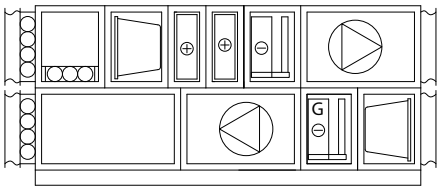
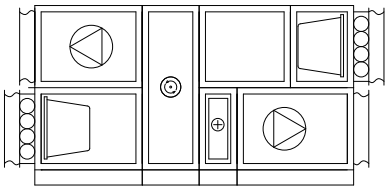


NW 27

SUPPLY AND EXHAUST AIR HANDLING UNITS WITH ROTARY EXCHANGER



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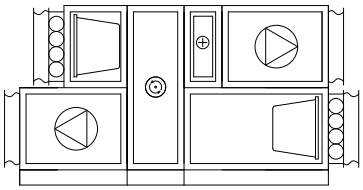

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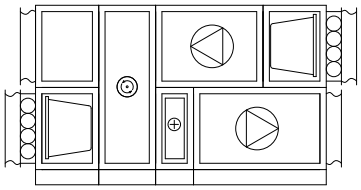

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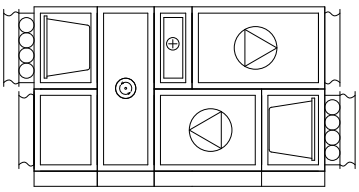

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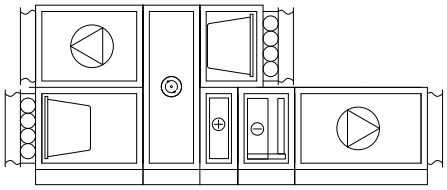

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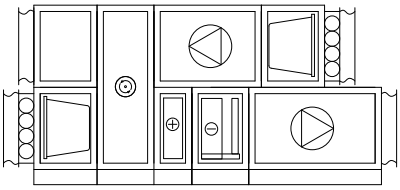

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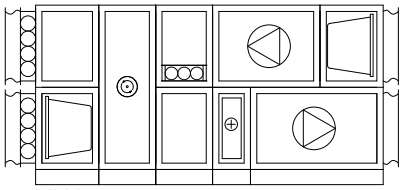

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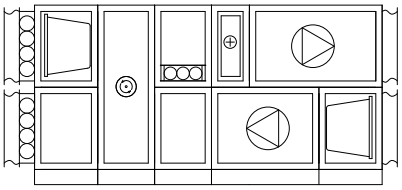

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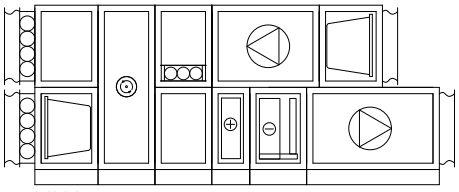

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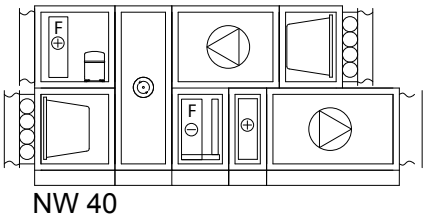

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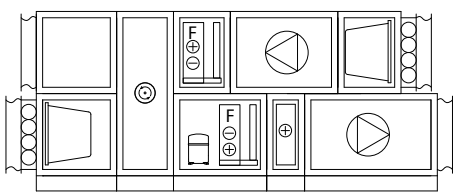

NW 41

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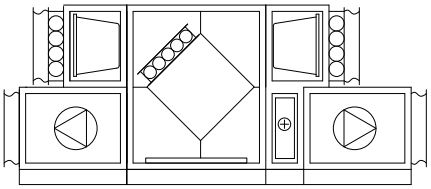
SUPPLY AND EXHAUST AIR HANDLING UNITS WITH CROSS FLOW EXCHANGER



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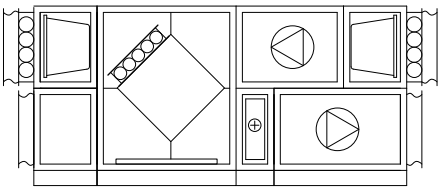

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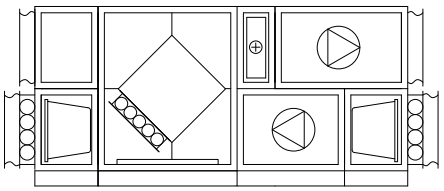

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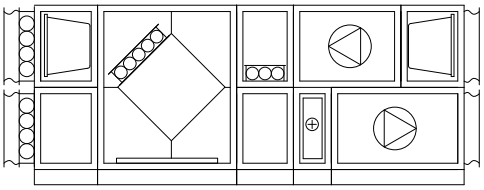

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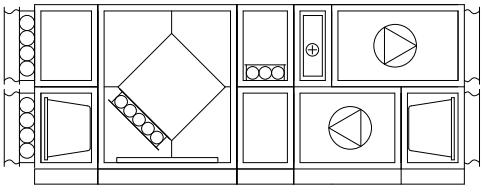

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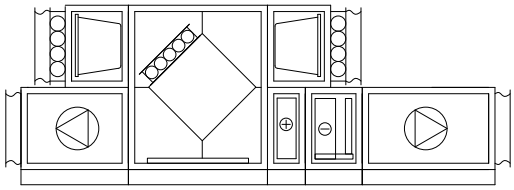

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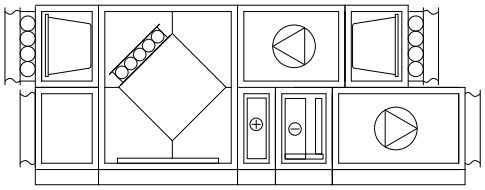

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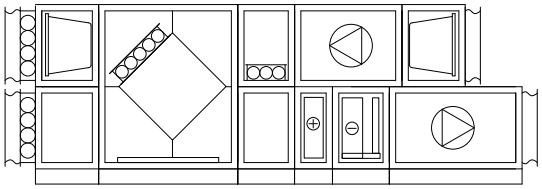

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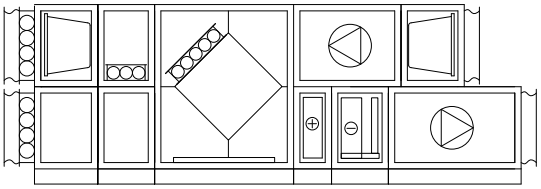

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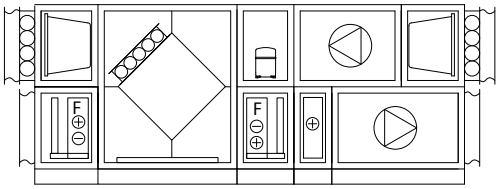

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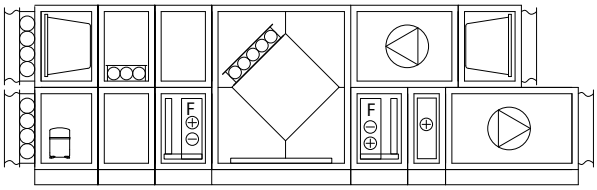

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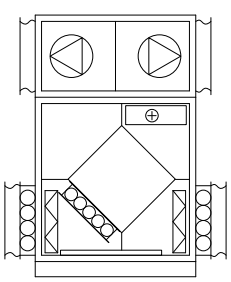

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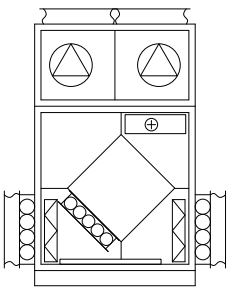

NW63

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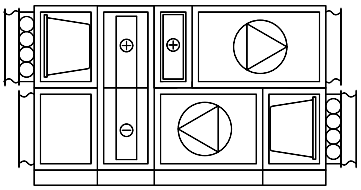
SUPPLY AND EXHAUST AIR HANDLING UNITS WITH A HEAT PIPE



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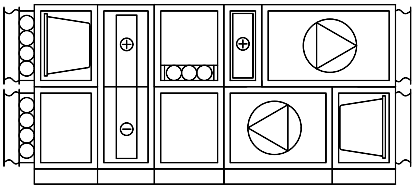

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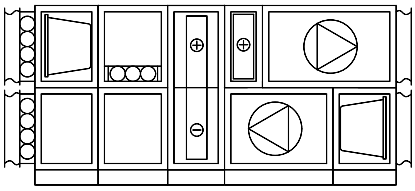

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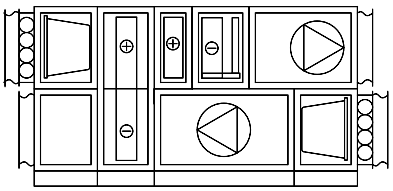

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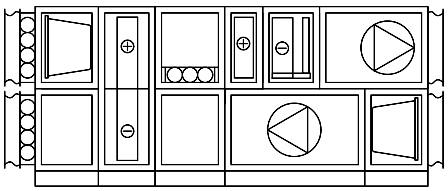

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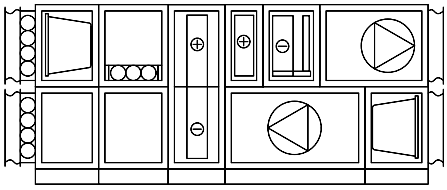

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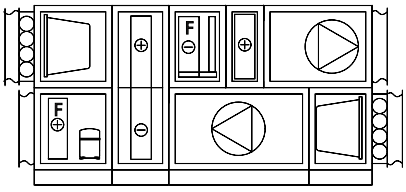

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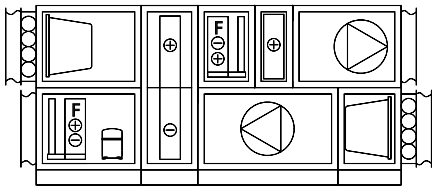

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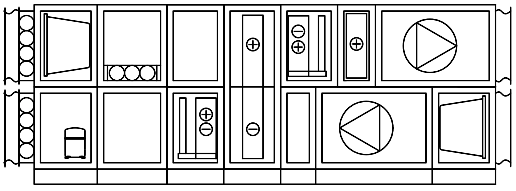
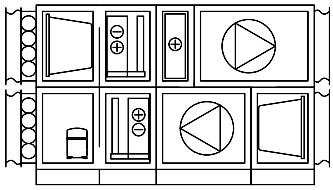


NW79

SUPPLY AND EXHAUST AIR HANDLING UNITS WITH A HEAT PUMP



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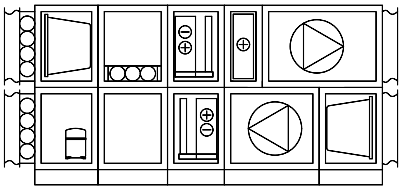

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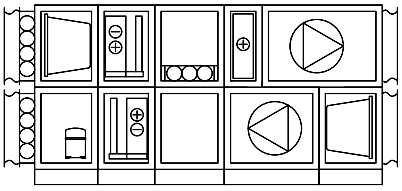

NW83

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9. OPAL Suspended Air Handling Units

9.1. General description

OPAL suspended air handling units have been designed for assembly in the ceiling zone (e.g. in the ceiling void). They can be also mounted in other places, such as: on the walls, in underfloor channels. Due to their hanging function the suspended air handling units have small dimensions and mass.

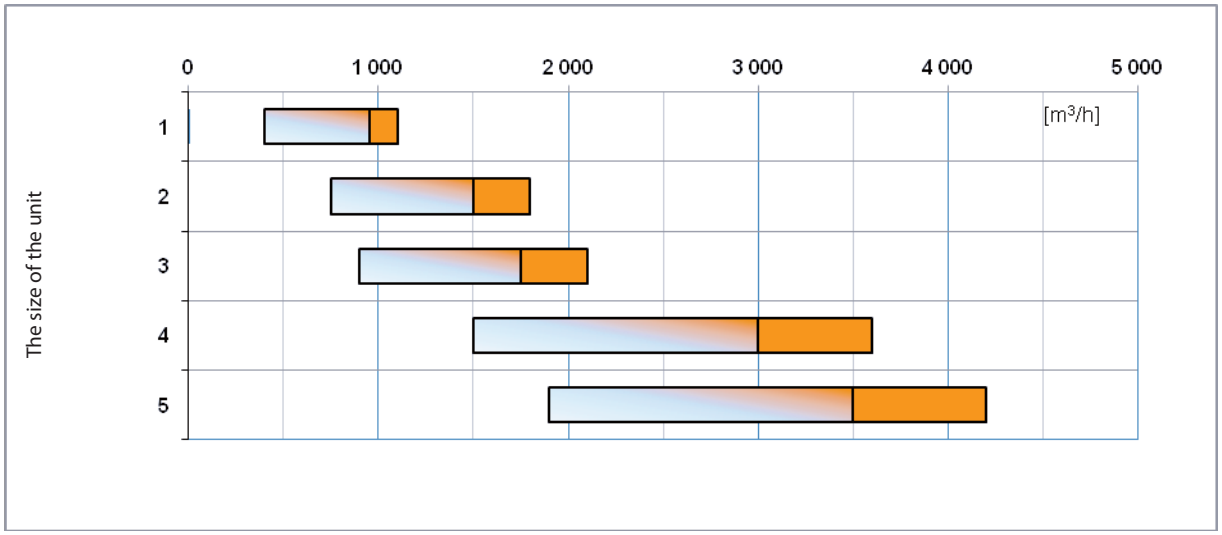
Housing finishing option:

- Compact (in one housing)
- Section structure.

Functional options:

- Supply air handling units
- Exhaust air handling units
- Supply and exhaust air handling units

OPAL capacity range: 400 to 4200 m³/h



Five sizes of units are available in OPAL range.

Size	Air capacity		Height	Width
	from	to	H	B
	m³/h		mm	mm
1	400	1100	435	610
2	750	1800	435	740
3	900	2100	495	740
4	1500	3600	495	1100
5	1900	4200	495	1250

Maximum air capacity for air handling units with cooling
m³/h
950
1 500
1 750
3 000
3 500

9.2. Structure and dimensions

The housing of **OPAL** suspended air handling units, both compact and modular units, are built of aluminium profiles and plastic and fixed and movable panels. The structure of a unit can be also self-supporting (without any frame). Depending on the type of the use, the panels are made of either zinced or coated steel and mineral wood filling. The insulation of panels is 50 mm thick.

Inspection covers are mounted on the bottom of the unit in order to provide access for maintenance (top covers option is available). Flexible connections, dampers, section connection elements or assembly suspensions are included in the standard finishing of **OPAL** units.

These units are manufactured in two variants in terms of the operation position: left or right. In the case of supply and exhaust units the operational side of the unit is determined by the supply air flow direction.

The suspended air handling units have a centrifugal fan with air double inlet driven by an electrical induction motor through a belt transmission or a centrifugal plug fan with a impeller fitted directly on the shaft of the inverter controlled electrical motor. Normally, there is one fan in standard units but two fans or one fan with two impellers can also be fitted.

Typical suspended units work in horizontal position. The units are hung by means of assembly bars fixed to originally manufactured suspensions of the unit. Rubber shock absorbers are used between the bars and suspensions to limit the vibration transfer.

Most of the suspended unit configurations can work in vertical position. Using a certain configuration in vertical position needs discussion and approval of Clima Gold Technical Department at the design stage.

Any suspended units can be equipped with all functional sections apart from the rotary exchanger section. There is no possibility of fitting a cooling device inside the unit for any suspended air handling units.

9.3. Dimensions of suspended air handling units

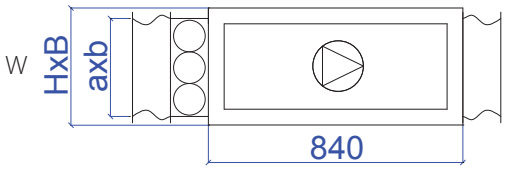
Size	Air capacity		Height	Width
			H	B
	m^3/h	m^3/h	mm	mm
1	400	1 100	435	610
2	750	1 800	435	740
3	900	2 100	495	740
4	1 500	3 600	495	1 100
5	1 900	4 200	495	1 250

Dimensions [mm]

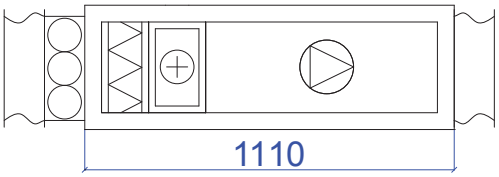
Size	Dampers / Flexible connection	
	a	b
1	315	500
2	315	630
3	400	630
4	400	1 000
5	400	1 150

Filter dimension list for OPAL units

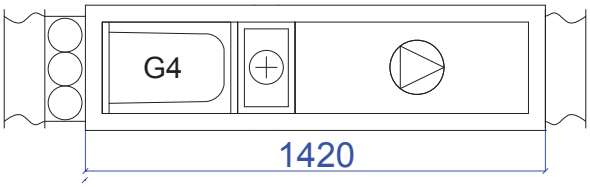
Size	Filter
	Width [mm] x Height [mm] x Length [mm]
1	460 x 335 x50mm
2	590 x 335 x 50mm
3	590 x 395 x 50mm
4	950 x 395 x 50mm
5	1 100 x 395 x 50mm



F (G4 cassette) + Hw +W



F (G4 pocket) + Hw +W



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Section length [mm]

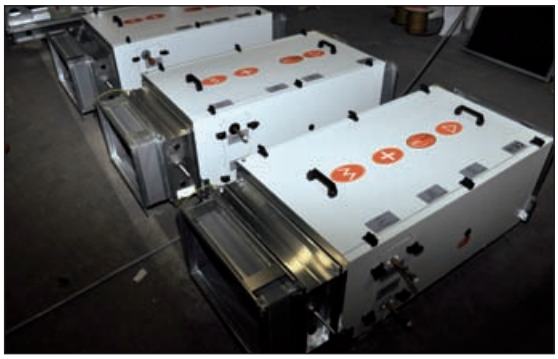
Size	F				Hw		He	CHw		CHf		W	
	Cassette		Pocket										
	G4	G4	F5	F7, F9	from	to		from	to	from	to	from	to
1	210	520	660	750	300	350	460	540	600	540	600	800	850
2	210	520	660	750	300	350	460	540	600	540	600	800	850
3	210	520	660	750	300	350	460	540	600	540	600	800	850
4	210	520	660	750	300	350	460	540	600	540	600	800	850
5	210	520	660	750	300	350	460	540	600	540	600	800	850

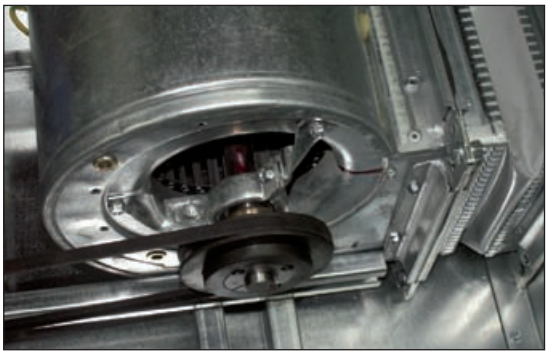
Dimensions [mm]

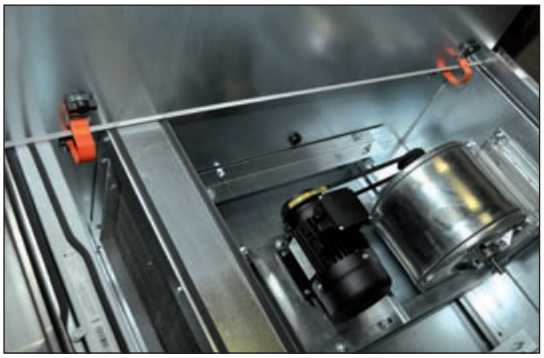
	WK	
Size	from	to
1	890	1310
2	890	1460
3	890	1460
4	1170	2020
5	1170	2300

	T			SP	
Size	dB1	dB2	dB3	min	max
1	780	1180	1380	300	as
2	780	1180	1380	300	you
3	780	1180	1380	300	wish
4	780	1180	1380	300	
5	780	1180	1380	300	

W	Fan set
Hw	Water heater
He	Electric heater
Chw	Water cooler
CHf	Evaporative cooler
WK	Cross flow exchanger
T	Silencer
F	Filter
SP	Empty section







10. TOPAZ Heating and Air handling Units

TOPAZ heating and air handling devices have been designed for air handling and heating of large space rooms, such as: industrial halls, warehouses, workshops, wholesale stores and shops.

These devices are available in 4 sizes. It is possible to manufacture these devices for other air capacities.

Capacity range: from 1500 to 6250 m3/h

Standard devices are designed to work with inner air. Fresh air can be led to the device through ventilation ducts and using the mixing chamber.

The device can be equipped with an adjustable louvre used for the distribution of air in different directions.

These units consist of the following elements:

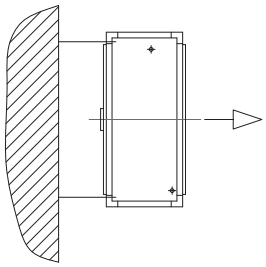
- water heater
- axial fan
- steel sheet housing.

TOPAZ units have suspensions for hanging.

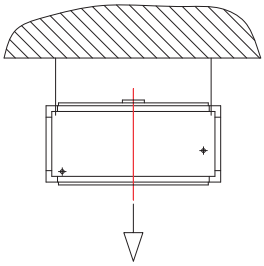
The housing of the device is made of RAL 9006 coloured or zinced steel sheet.
The water heater consists of copper pipes and aluminium fins.
Permissible power supply temperature / max. working pressure: 110OC/ 1,2 MPa

The unit is equipped with a fan motor with the power supply voltage 1 x 230 V/ 50Hz (3 x 400V/ 50Hz is optionally available).

Working position::



Horizontal



Vertical

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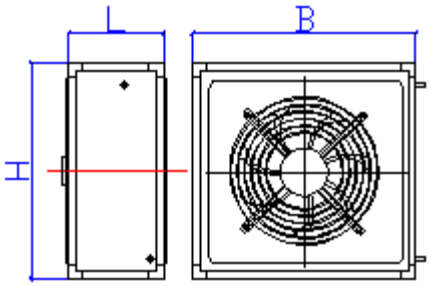
Size	TOPAZ	1	2	3	4
Air capacity[1)]	m^3/h	1500	2800	4100	6250
Heater power[2)]	kW	20.3	37.9	55.5	81.4
Flow stream range[3)]	m	11.5	16	20	26
Maximum temperature of water	°C	110	110	110	110
Maximum working pressure	MPa	1.2	1.2	1.2	1.2
Diameter of coil connections - DN	mm	20	20	20	25
Nominal power	W	140	240	390	750
Power consumption	W	120	210	360	710
Nominal power voltage 230V	A	0.63	1.1	1.75	3.3
400V	A	-	-	-	-
Acoustic pressure level[4)]	dB(A)	46	48	52	52
Weight	kg	18	26	31	48

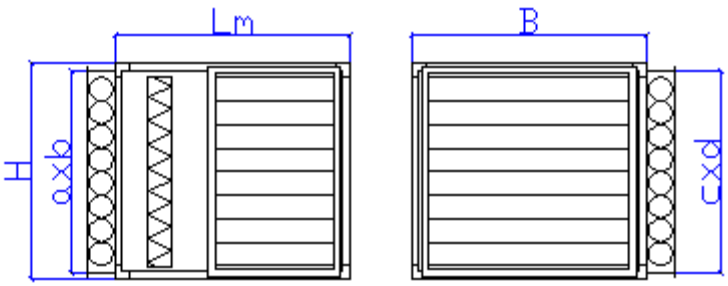
[1)] Capacity only for work on circulated air. In order to determine the air capacity by work with the mixing chamber, please contact our Technical Department.
[2)] For parameters of the heating agent 90/70°C and intake air temperature 0 °C.
[3)] For isothermal flow stream and speed in the axis of the flow stream 0.5 m/s.
[4)] Acoustic pressure level was specified for a room of average sound absorption capability, space volume of $1500m^3$, placed 5m away from the air handling unit.

Size	TOPAZ	1	2	3	4
Height		575	650	750	850
Width		490	660	730	810
Length		290	320	340	350

Mixing chamber – the dimensions are should be determined individually with the Technical Department.

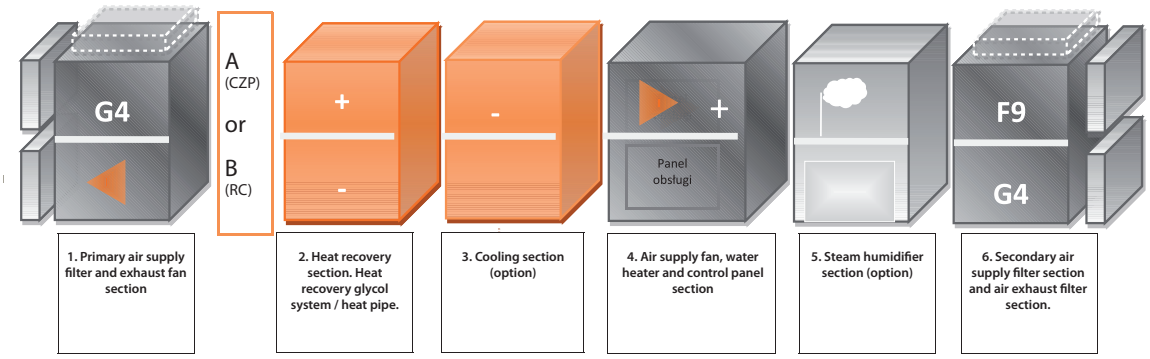


TOPAZ



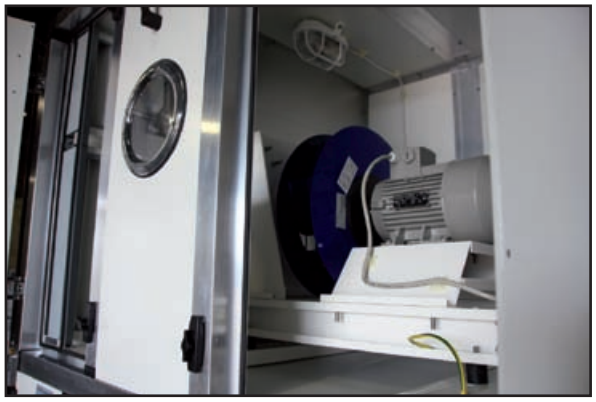
MIXING CHAMBER

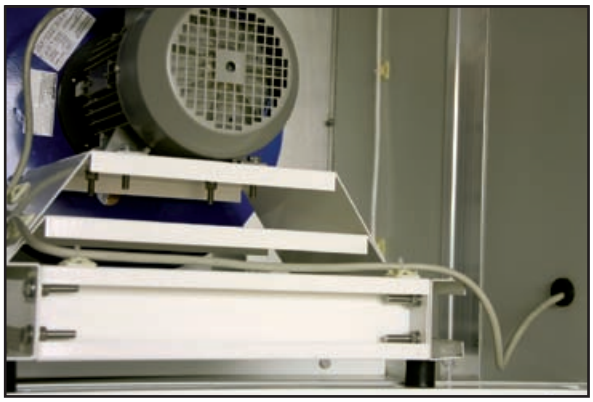
11. PURO Hygienic Modular Air Handling Units



PURO hygienic modular air handling units have been created for the use in the objects like: hospitals, surgeries, laboratories or electronic part production halls. PURO hygienic modular air handling units provide pure air with the possibility of 50-67% heat recovery. Their additional advantage is their simple selection, assembly and maintenance.

PURO module air handling unit is selected in 3 simple steps:
1. Description of parameters – air capacity, external static pressure, type of execution (D-outdoor /W-indoor)
2. Choice of function – type of recovery and air treatment (choice of the single air handling modules).
3. Reading the motor capacity from the chart for the selected unit depending on the available external static pressure.

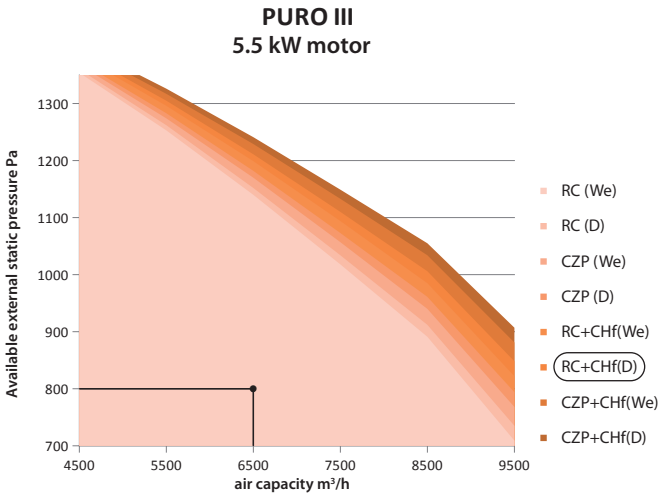




Unit code:
PURO (size of unit) – finishing version – No. of unit modules – power of motors – air capacity.

E.g.
The unit of air capacity 6500 m3/h
(supply and exhaust),
Available external static pressure 800 Pa
(supply and exhaust),
outdoor execution,
recovery – heat pipe(B)
Cooling (3):

PURO III – D – B1/2/3/4/6 – 5.5/4.0 kW – 6500 m3/h.



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PURO	Air capacity	Height	Width	Length					
	[m³/h]	[mm]	[mm]	[mm]					
				1	2	3	4	5	6
I	2500-5500	1500	1090	1000	850	1200	1250	1000	770
II	3500-7500	2100	1090	1100	850	1200	1350	1000	770
III	4500-9500	2100	1290	1100	850	1200	1350	1000	770

Units on 120 mm frame (option: 80 mm).

PURO	Dimensions of dampers and flexible connections Height x width
	[mm x mm]
I	650 x 990
II	950 x 990
III	950 x 1190

PURO	Maximum power of heater[1)]	Maximum power of cooler[2)]	Recovery	Maximum efficiency of humidifier
	[KW]	[KW]	[%]	[kg/h]
I	44,6	35	50-66	48
II	60,8	39	50-67	72
III	73,8	49	52-66	96

[1)] Heater power for maximum air capacity. For heating agent parameters 80/60°C. Assumed temperature behind the unit is +24 OC.
[2)] Cooler power for maximum air capacity by vaporization temperature 6 °C, condensation 45 °C. Cooling agent R410A.

PURO	Power of supply fan	Power of exhaust fan
	[kW]	[kW]
I	3,0;4.0	3,0
II	4.0;5.5	4,0
III	4.0;5.5	4;5,5

Fan motor supply power voltage 3~400V.

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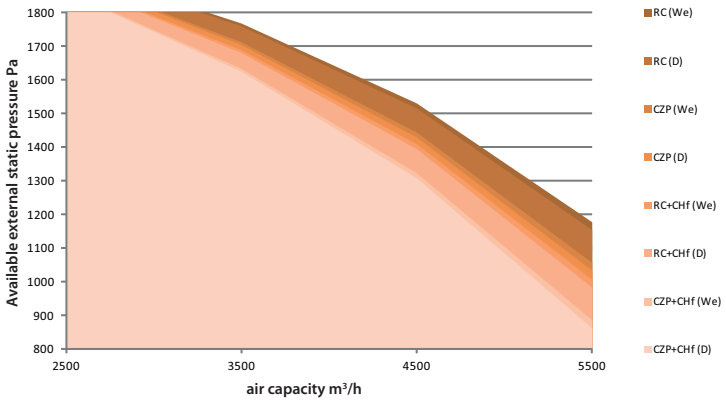
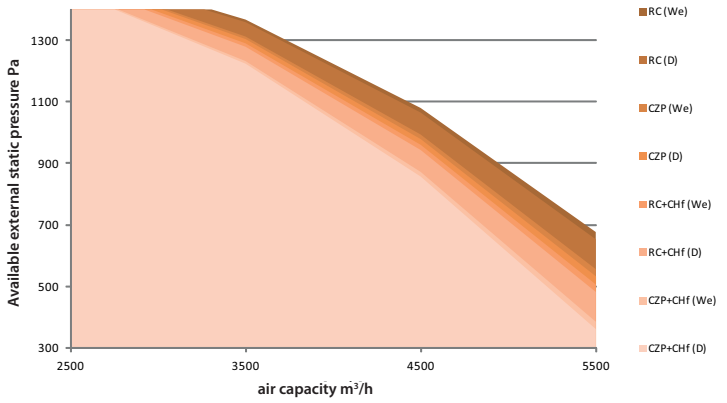
Modular hygienic air handling units are available in 3 sizes:

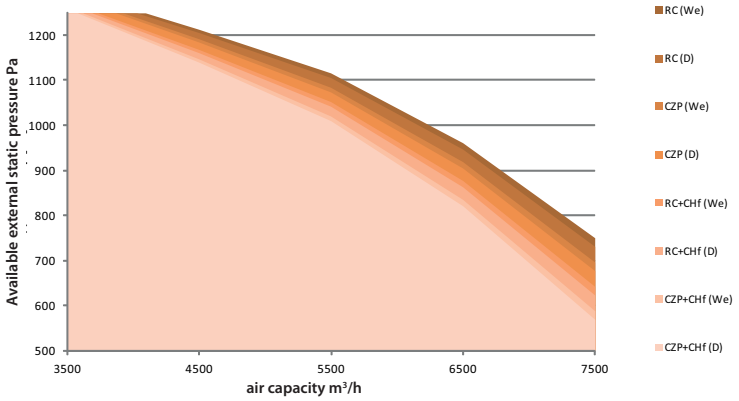
PURO I
4.0 Kw motor



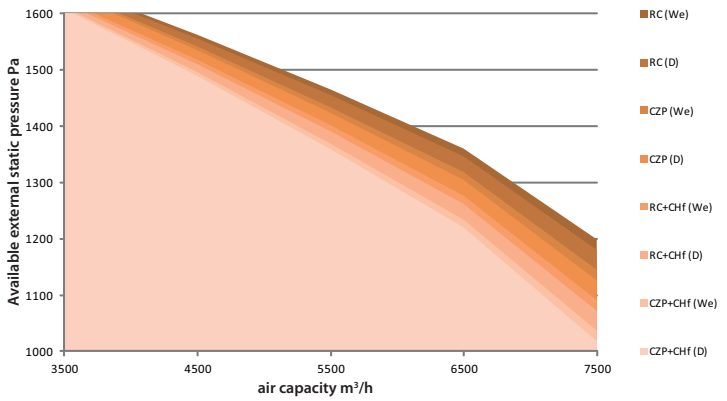
PURO I
PURO I – 3.0 Kw motor



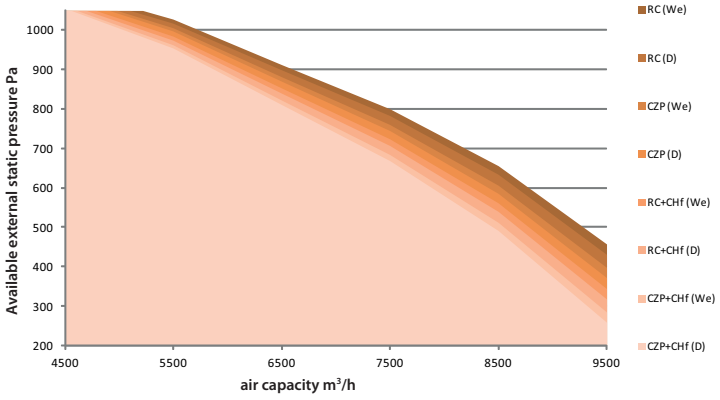
PURO II
4.0 Kw motor



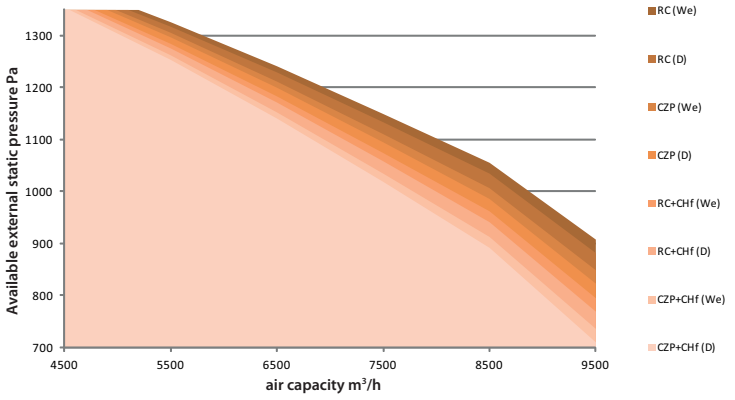
PURO II
5.5 Kw motor



PURO III
4.0 Kw motor



PURO III
5.5 Kw motor



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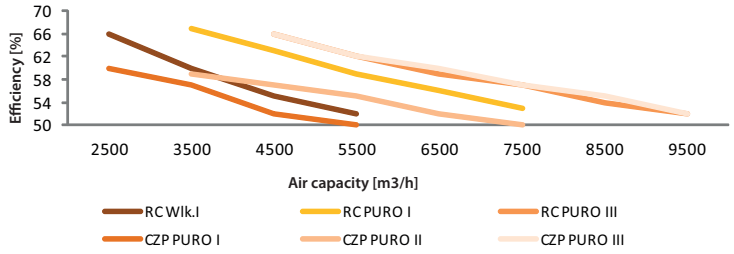
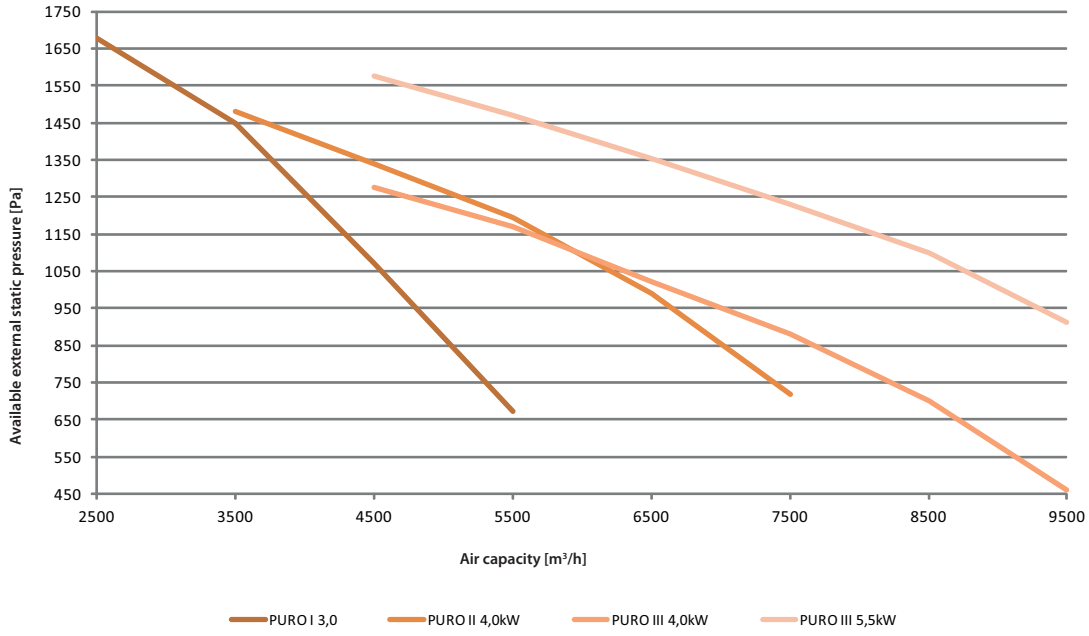
In order to make the operation as easy as possible and to achieve the purity of air we have introduced the following solutions:
- the structure which guarantees an effective thermal and acoustic insulation, based on aluminium profile frame with coated steel covers and filled with mineral wool, with the cleaning friendly interior,
- filters can be replaced with the whole sealing, additionally, each filter has a contamination level indicator.
- enough space between the exchangers, which makes the operation and maintenance simple,
- slanting floors,
- large inspection windows and lighting inside the filter sections, fan sections and empty sections,
- unique profiles and assembly elements,
- assembly and wiring made originally by the manufacturer, all electrical connections are led outside the unit,
- An electrode steam humidifier working without water treatment. Steam generator fitted inside the unit,
- compact dimensions,
- control panel fitted including configured control system, ready to use, compatible with ModBus, Ethernet, Lonwork and BACNet protocols.

All modules can be done both in outdoor and inner execution (apart from the modules with inlet/ outlet on the top of unit).

Heat recovery capacity



Exhaust external static pressure



12. Product encoding method

Encoding symbols of **OPTIMA** air handling:

OPTIMA – name of type
CRISTAL, TURQUOISE, TOP SPEC, ECO SILENT

Type of operation
N – supply
W – exhaust
NW – supply and exhaust
R – recirculation (TOP unit)
K – cross flow heat exchanger (TOP unit))

Size of the unit

Access side
(L – left, P – right)

type of heat recovery
BO – no heat recovery
WK – cross flow exchanger
WO – rotary exchanger
RC – heat pipe
RE – recirculation
CZP – heat exchange agent
PC – heat pump
PCR – reverse heat pump

Type of exchanger
(heater/ cooler):
Hw – water heater
He – electric heater
CHw – water cooler
MG – gas module

T1/T2 – silencing section (dB1/dB2)
FW – secondary filter
SP – empty section
NP – steam humidifying
NW – spraying section

additional equipment
T1/T2 – silencer (dB1/dB2)
FW – secondary filter
SP – empty section
NP – steam humidifying section
NW – water humidifying section

unit execution
We – internal
D – external

air volume m3/h
Supply/exhaust

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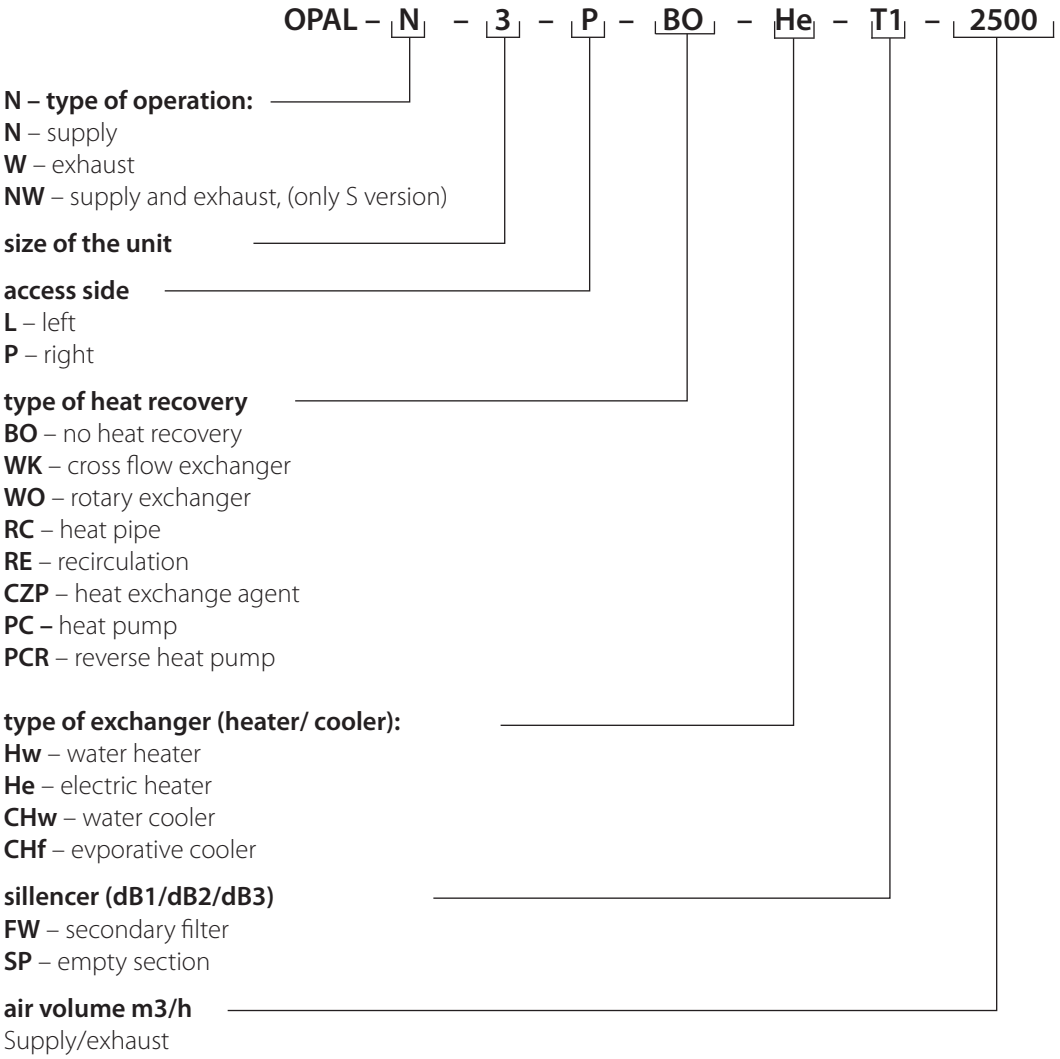
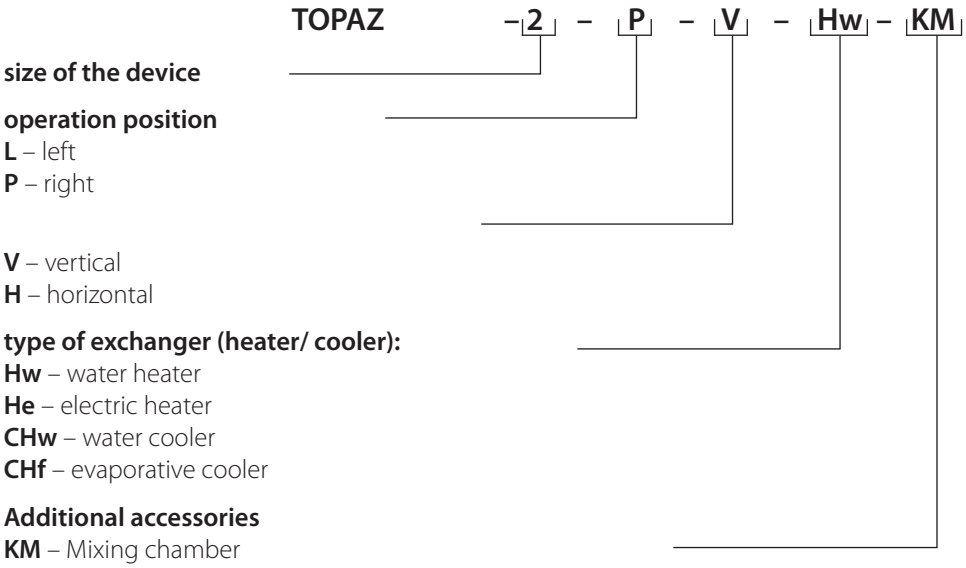
Specification symbols of **OPAL** suspended air handling units:



Specification symbols of **TOPAZ** air handling devices:



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13. Control systems

Functions performed by control systems.

Control systems ensure:

- optimal process of control of any air handling units,
- significantly quickened and simplified launching process of the unit by the manufacturer's original configuration of automatic application,
- supervising of unit components operation, incl. fans, filters, exchangers etc.,
- protection of single unit components against damage,
- access to the current operation parameters, setting temperature and parameters,
- signaling emergencies and failures,
- two daily operation modes: manual (the system can be switched on and off manually) or automatic operation mode (the system works according to the weekly schedule),
- the control panel can be removed 50 m away from the control distribution station
- (option up to 200 m),
- the control system can be made compatible with the superior BMS system,
- other, e.g. control of additional fans.

Temperature control:

- temperature control of the air supplied into the room or of the air inside the room,
- minimum and maximum temperature limits for the air supplied into the room.

Fans:

- operation control of fans equipped in one- and two speed motors and motors powered by frequency converters,
- preventing the fan drive against overloading or shorting
- supervising fan operation by differential pressure controls (belt driven systems)
- alarm signaling of any faulty fan operation (fan alarm)

Filters

- differential pressure controls supervising the filters contamination level,
- signaling when filters are contaminated.

Dampers:

- operation control of external dampers,
- continuous control of dampers position in the systems with a mixing chamber.

Water heater:

- adjusting the opening level of the water heater control valve,
- antifreeze protection of the water heater on the air and water side,
- operation control of the water heater circulation pump.

Electric heater:

- controlling the control levels for each section of the heater (fluent or step)
- compatibility with two level internal heater protection against overheating,
- function of the delayed stop of fans when the system has been switched off for cooling the heater,
- emergency signal when the electric heater temperature is high.

Water cooler:

- adjusting the opening level of the water cooler control valve

Refrigeration unit:

- operation control of one- or two-stage Refrigeration unit (non voltage contact) with taking into account the maximum number of starts and the minimum time of work,
- possibility of fitting in the system a complete set of shorting and overloading protections and control apparatuses controlling the operation of refrigeration unit,
- emergency signaling of refrigeration unit.

Cross flow exchanger:

- control of cross flow exchanger by-pass damper,
- anti-ice protection of the cross flow exchanger provided by the temperature sensor.

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Rotary exchanger:

- control of the rotary exchanger operation by the adjustment of the rotation speed,
- ice protection of the rotary exchanger is performed by the temperature sensor,
- emergency signaling of rotary exchanger.
-

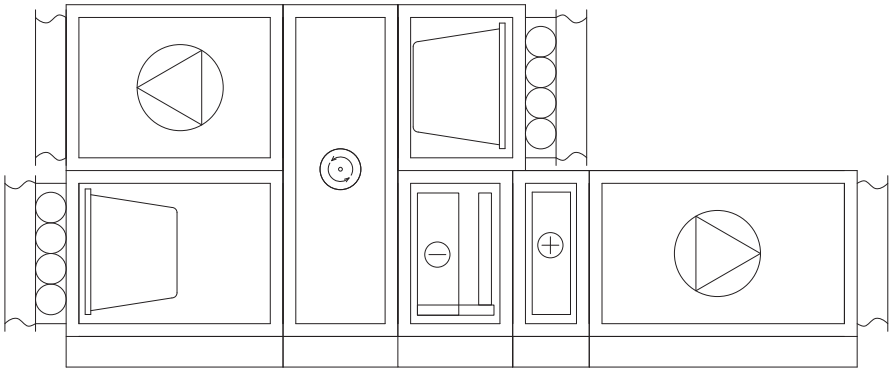
Heat pipe:

- heat pipe by-pass damper operation control,
- anti-ice protection of the heat pipe exchanger is performed by the temperature sensor,

A precise selection of the components of the control system will be adjusted to Your requirements.

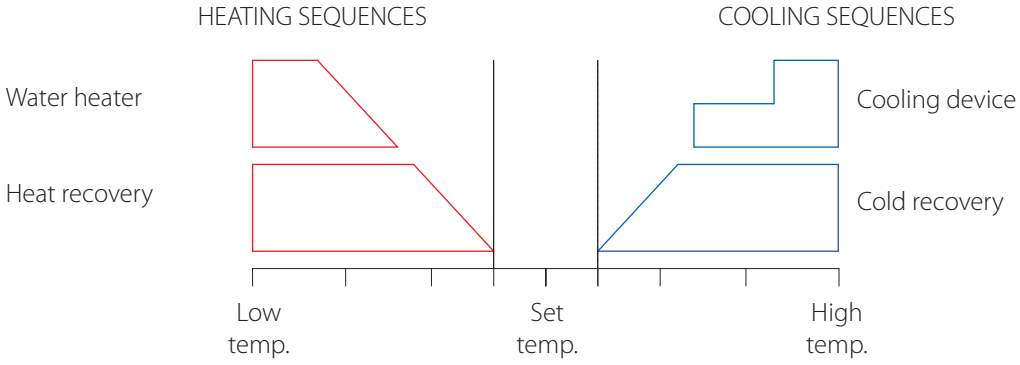
A full description of operation and functions including the certificates will be enclosed to the unit documentation.

An example of temperature control for a unit with a rotary exchanger, freon cooler and water heater.



The temperature in the room or temperature of the supply air is regulated by:

- firstly, the heat/ cold recovery on the rotary exchanger,
- secondly, the water heater is switched on by opening the control valve in wintertime or by
- the cooling device in summertime.



Components of the control system:

Power supply and control switch station (standard):

- control cabinet with cable glands,
- DDC (digital direct control) with originally configured manufacturer's application ready to use,
- main switch located to the wall,
- shorting and overloading protection system,
- apparatuses controlling the unit subsystems,
- terminals for connection cables of the automatic control elements and operating equipment,
- operation and maintenance documentation.

Control panel (option):

- smart and easy to use highlighted display panel with function keys,
- mountable on the wall, it can be mounted 50 m away from the power supply and control distribution station (option 200 m),
- access to all operation parameters of the unit,
- choice of the operation mode, reading and setting temperatures, time zones etc.,
- text message about the unit operation mode, signaling emergencies.

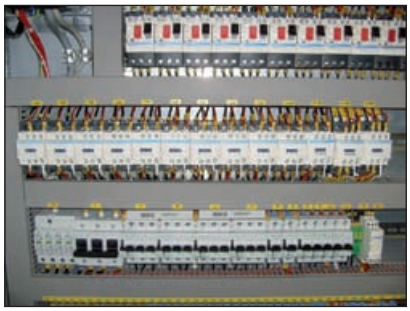
Components of the control system (according to the unit configuration and application):

- temperature sensor of the air (supply, exhaust, outdoor, indoor),
- heater antifreeze temperature sensor,
- dampers actuators (supply, exhaust, recirculation, cross flow exchanger),
- differential pressure controls of filters,
- differential pressure controls of fans (with belt transmission),
- heat exchangers control valves with a actuator,
- humidity sensors,
- CO sensors,
- frequency converters,
- tiristor controls of rotation speed,
- other.

BMS (option):

- Adjustment of the control system in order to enable cooperation with any superior system.



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LIST OF REFERENCE PROJECTS

Selected projects where Clima Gold equipment has been applied:

Hospitals and laboratories:

- Department of Pharmacy of Wrocław Medical University, stage 1 and stage 2,
- Regional Hospital in Kołobrzeg,
- Ursynów Daily Surgery Centre,
- Hospital in Wejherowo,
- St. Anna's Hospital in Piaseczno,
- Hospital in Frombork
- Dialysis Centre in Wrocław,
- Dialysis Centre in Toruń,
- Neonatology Ward of Hospital in Otwock,
- Military Hospital in Wrocław,
- Institute of Marine and Tropical Medicine in Gdynia,
- Clinical Hospital No. 1 in Szczecin,
- Dr Antoni Jurasz's University Hospital in Bydgoszcz,
- Luxmed in Wrocław,
- Medical University of Gdańsk,
- Biomed Vaccines and Serum Production Plant in Lublin,
- Biomed Vaccines and Serum Production Plant in Warsaw,
- Health Care Centre in Libiąż,
- Polfa Warszawa S.A.,
- Outpatient Clinic in Świdnica,
- PATIO Oncology Clinic in Warsaw,
- Neurological Hospital at Banacha Street in Warsaw,
- Radiation Therapy Clinic in Koszalin,
- Natural Medicine Clinic in Nowa Wieś Rzeczna,
- Province Specialist Hospital in Wrocław,
- District Hospital in Mielec,
- Hospital in Gorlice,
- Szajna Laboratory in Gdynia.

Swimming Pools:

- Delfin Hotel in Sevastopol (Ukraine),
- Palace Complex in Wojsław,
- School in Sieradz,
- Private residence in Gdańsk,
- Swimming pool complex in Kombornia,
- Private residence in Baćkowice,
- Swimming pool at Hotel in Polanica,
- Swimming pool in Zgorzelec,
- Swimming pool in Kościerzyna,
- Swimming pool in Krynica,
- Swimming pool in Staniszów (in progress),
- Swimming pool in Rymanów,
- Aquapark in Polkowice,
- Swimming pool at „Wichrowe Wzgórze" Leisure Centre in Chmielno,
- „Bałtyk" Medical SPA in Kołobrzeg.

Industrial plants:

- Zagłębie Lublin Football Stadium,
- Unilever Bydgoszcz,
- Plasticon in Toruń,
- Knauf in Worcław,
- PINI POLONIA abattoir in Kutno,

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LIST OF REFERENCE PROJECTS

- WAMAG in Wałbrzych,
- Dealer Toyota AVES in Zduńska Wola,
- Nidec factory in Niepołomice,
- Saint Gobain factory in Czeladź,
- Saint Gobain in Dąbrowa Górnicza,
- Autoliv plant in Jelcz-Laskowice,
- Kręglewscy Meat Processing Plant,
- Delphi in Gdańsk,
- Argocard in Gdańsk,
- Lamar in Oleśnica,
- Hagmed Plastic Processing Plant in Rawa Mazowiecka,
- 3M OSD in Wrocław,
- Morpak in Gdańsk,
- Coil Manufacturing Plant - Generators Department in Lubliniec,
- Reckitt Benckiser in Nowy Dwór Mazowiecki,
- „AVES" Czechy in Zduńska Wola,
- Mokronos Road Research Laboratory,
- „Organika-Sarzyna" S.A. Chemical Plants,
- Inter Cars S.A. in Cząstków Mazowiecki,
- Sanden Manufacturing Poland Sp. z o.o.,
- IFM Electronic,
- Nauta Shipyard production hall,
- Can-Pack factory in Brzesko,
- Lorenz Bahlsen Snack-World Sp. z o.o. production plant in Stanowice,
- Chemical Warehouse in Wałbrzych,
- Ice Making Plant in Kołobrzeg,
- Volvo production halls,
- Raben Warehouse in Piła,
- Poultry abattoir in Kazakhstan,
- Garage in Lębork,
- „San-Went" production halls in Lębork,
- „Superharma" sales hall in Gdynia,
- Celon FARM BIOMED TROMBINA Lublin industrial halls,
- Galeon production hall in Wiślinka,
- Heitztechnik production hall in Skarszewy,
- Veroni production hall in Wąbrzeźno,
- Alstom Power Sp. z o.o. in Elbląg,
- Galeon Shipyard production halls in Wiślinka,
- „Laguna" production and storage plant in Gdańsk.

Shopping centres and stores:

- Eurocash in Wrocław,
- Biedronka in Siedlce,
- Biedronka in Szczecin Lubieszyn,
- Biedronka in Słupsk,
- Shopping centre in Siedlce,
- Shopping centre in Kiev (Ukraine),
- Shopping centre in Lębork,
- Nadarzyn Shopping Centre in Warsaw,
- ORSAY in Bielany Wrocławskie,
- BRONISZE Warsaw Agricultural and Food Wholesale Marketplace near Ożarów Mazowiecki,
- Market Simply/Auchan Group in Rawa Mazowiecka,
- Złote Tarasy in Warsaw,
- Delikatesy Alma in Łódź,
- Polomarket in Wrocław,
- Lidl in Wrocław,
- Gubin Shopping Centre,

- Hala Kupców Shopping Centre in Wrocław,
- Bawełnianka Shopping Centre in Bełchatów,
- Jantar Shopping Centre in Słupsk.

Banks:

- Deutsche Bank in Katowice,
- EUROBANK in Wrocław,
- PKO in Kudowa Zdrój,
- Bank Spółdzielczy in Grójec,
- Bank PKO B.P. in Mszczonów,
- Bank PKO B.P. S.A. in Słupsk.

Services companies:

- „Zajazd nad wodą" in Międzybrodzie Bielskie,
- LandProp Services - offices in Gdynia,
- Restaurant and entertainment facility in Boguszów-Gorce,
- Proma Printing House in Gdynia,
- Bakery in Gdańsk,
- SOGO Hotel and Offices Complex in Wysoka near Wrocław,
- Vacation centre in Jurata,
- Kasyno Games Arcade in Łódź,
- Dancing club in Warsaw,
- Sports hall in Zawonia, Tarnowiec commune,
- PROLOGIS in Chorzów,
- Toyota Dealer in Zduńska Wola,
- ATLANTIS sport and recreation centre in Poznań,
- Hotel in Murowana Goślina near Poznań,
- Bukowy Park Hotel in Polanica Zdrój,
- Restaurant in Zambrów,
- SZUSZKO Hotel in Suwałki,
- Grobia Hotel,
- Supraśl Hotel,
- Villa Stenoza Hotel in Sopot,
- Hotel with swimming pool in Krynica Górska,
- Hilton Hotel in Warsaw (in progress),
- Jarmax Led in Kościerzyna,
- Children's play centre in Rzeszów,
- SPA in Białystok,
- Meksyk Restaurant in Supraśl,
- Disco club in Berehove (Ukraine),
- „Bałtyk" Hotel and SPA in Kołobrzeg.

Offices:

- Ditta Seria office and storage building,
- SOGO Hotel and Offices Complex in Wysoka near Wrocław,
- Jabłonów Commercial and Office Centre in Warsaw,
- Lecture rooms at Silesian University of Technology,
- Akacjowy Park Business Centre at Rydygiera Street in Warszaw,
- Teofilów Business Park,
- Office building in Wrocław,
- Office facilities of Wrocław University of Environmental and Life Sciences,
- Office building at Spokojna Street in Gdynia,
- Office building of SUEMPOL company in Bielsko Podlaskie,
- Classroom in Otwock,
- Office facilities of Opera Office in Gdańsk,
- Office facilities of sports hall in Poniatówek,
- Grudziądz Industrial Park,

LIST OF REFERENCE PROJECTS

- Office facilities of Metalzbyt in Wejherowo,
- Office facility of Wejherpark in Wejherowo,
- Office building at Spokojna Street in Gdynia, (powtarza się),
- Office facilities of Poltraf in Gdańsk,
- Office facilities of KATS Łódź,
- Lecture theatre in Bytów,
- Office building of Draco in Gdańsk,
- Office buildings of EURO STYL in Gdańsk,

Other projects:

- Karkonosze Museum in Jelenia Góra,
- Optopol in Zawiercie,
- SG in Stanowice,
- Department of Zoology of Medical University of Łódź,
- Music School in Wrocław,
- Secondary Schools Complex No. 3 in Wrocław,
- Pre-school in Kąty Wrocławskie,
- Court House in Gdynia,
- Castle in Biskupiec,
- Pharmacy at Konwent O.O. Bonifratrów in Wrocław,
- Poultry abattoir plant in Wągrowiec,
- City Council in Wejherowo,
- City Council in Łódź,
- ZUS [Social Insurance Company] office in Oleśnica,
- DITTA-SERIA in Zdżary,
- Art Cinema in Kraków,
- School in Jawor,
- Rzeszów University of Technology,
- University of Physical Education in Warsaw,
- St. Mary Magdalene's Roman Catholic Church in Poronin
- Sisters of Staint Elizabeth Chapel in Wrocław,
- Private medical practice rooms in Środa Wielkopolska,
- Deerfos plant in Błonie,
- Rawa Mode building in Rawa Mazowiecka,
- Art Gallery in Gdańsk,
- TAURON building in Wrocław,
- Honda Dealer in Długołęka,
- Sosnowiec Railway Station,
- Gdynia Główna Railway Station,
- Academy of Fine Arts in Łódź,
- School in Ciechanów,
- Sady Wegiliusza housing estate in Warsaw,
- Gardening Institute – Department of Vegetable Farming in Skierniewice,
- Schools and Pre-schools Complex in Bedoń – Andrespol,
- Commune Council in Michałowice, Mazowieckie Province,
- Department of Environment of University of Wrocław,
- Single family house in Piła,
- Pre-school in Suwałki,
- Multi-family residential building in Wieliczka,
- Pepsico Culture and Leisure Park in Chorzów,
- Pre-school in Mielec
- State Schools Complex No. 4 in Wrocław,
- Primary School in Żarnowiec,
- Academy of Physiotherapy,
- Pilgirm's House – Monastery in Czerna,
- Piwnica Romańska exhibition room,
- Military Unit in Siemirowice.

AQUAPARK Polkowice – Regional Recreation and Rehabilitation Centre

Teofilów Business Park in Łódź

Zagłębie Lublin Football Stadium in Lublin

City Council Hall in Wejherowo

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