AHRU-HP AC/EC - CHRU-HP AC/EC

Ceiling Type Heat / Energy Recovery Unit with Heat Pump

VOLTVENT®
VENTILATION SYSTEMS

Voltvent Havalandırma Sistemleri Sanayi Ticaret Limited Şirketi

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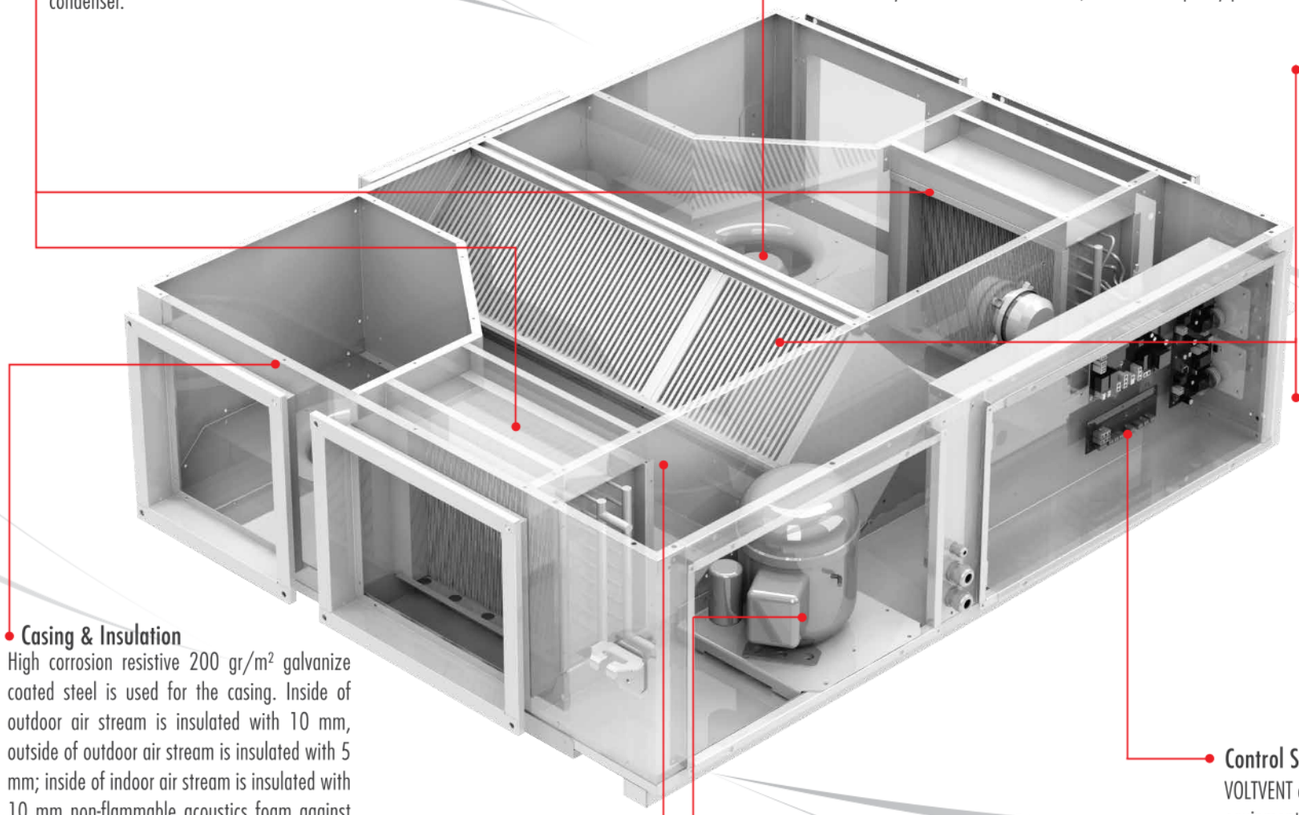
AHRU-HP AC/EC - CHRU-HP AC/EC
Ceiling Type Heat / Energy Recovery Units with Heat Pump
Aluminium Plate / Cellulosic Heat Exchanger

Index

Evaporator & Condenser
Copper tube - aluminum fin type and high efficiency evaporator and condenser are used. At the entrance of the evaporator, refrigerant distributor is used for a uniform distribution. In order to keep the pressure drops on the air side reduced, the air speed of 2.7 m/sec or a lower value is selected for evaporator and condenser. There is a stainless steel drain pan under the evaporator and condenser.

Supply and Exhaust Air Fan (AHRU-HP AC / CHRU-HP AC) - AC PLUG FAN
Backward curved plug fans are used in heat and energy recovery units. Fan blades have high aerodynamic efficient backward curved design. Plug fans are used for high efficiency and low sound levels. With AC Fans, maintenance costs are reduced as the fans are directly connected to the motors; the belt and pulley problems are eliminated.

Supply and Exhaust Air Fan (AHRU-HP EC / CHRU-HP EC) - EC PLUG FAN
The fans in heat and energy recovery units are equipped with innovative Electronically Commutated **EC motor** technology. EC motors have higher efficiency and simple speed control. Fan blades have high aerodynamic efficient backward curved design. EC motors reduce the energy consumption and increase the energy efficiency of the unit. With EC Fans, maintenance costs are reduced as the fans are directly connected to the motors; the belt and pulley problems are eliminated.



Aluminum Cross-flow Heat Exchanger (AHRU-HP AC)
The aluminum plate heat recovery exchanger consists of flat aluminum plates sewed together on the edge. The sewing progress ensures leakage free design. As the edge dimension increases, the efficiency of the heat exchanger increases and pressure loss across the heat exchanger decreases. Increasing plate distance reduces both efficiency and the pressure drop. EVHR AC units include optimized efficiency, pressure drop and cost effectiveness. In extreme climates, to protect the exchanger from freezing, fresh air electric heaters must be used.

Cellulosic Paper Type Crossflow Heat Exchanger (CHRU-HP AC)
CHRU-HP AC energy recovery ventilation units with heat pump have cellulosic crossflow, high efficient plate heat recovery exchangers. The exchanger transfers sensible heat and moisture between supply and exhaust air. Thus, it is also possible to transfer latent heat. With the optimization of heat exchanger, temperature and humidity efficiency is increased, pressure drop is decreased. Cellulosic paper type crossflow Heat Exchanger prevents decreasing moisture in winter time and increasing moisture in summer time.

Casing & Insulation
High corrosion resistive 200 gr/m² galvanize coated steel is used for the casing. Inside of outdoor air stream is insulated with 10 mm, outside of outdoor air stream is insulated with 5 mm; inside of indoor air stream is insulated with 10 mm non-flammable acoustics foam against sound and thermal conduction.

Control System Tak&Çalıştır
VOLTVENT control unit is developed for controlling of heat recovery units' equipments, meeting the demands coming from the customers and is user friendly designed. VOLTVENT is capable of controlling the standard equipments and optional accessories.VOLTVENT Control unit can perform the basic functions. Besides, the control unit can be switched on/off via BMS, gets fault signals and controls all the functions via ModBus. Alternative controllers are listed in "Control System" part.

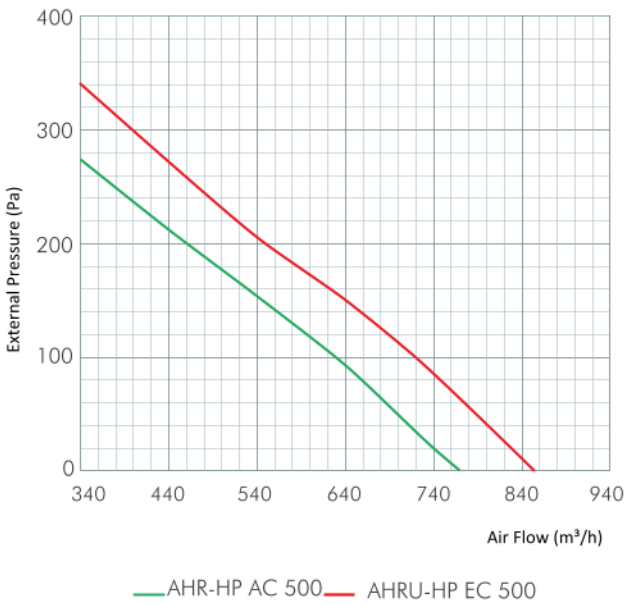
Filter
To increase indoor air quality and to protect the equipments used in unit, G class filters (according to EN 779 standard) are used for both exhaust and supply air streams.

Compressor and Heat Pump Cycle
High efficiency, fully hermetic compressors are used in the heat/energy recovery units with heat pump. Externally balanced thermostatic expansion valve is used in the unit. The system safety is ensured with low and high pressure pressurestats. The system can work in heating or cooling mode depending on the season selection on the control panel. The unit has an automatic free-cooling system which enables further savings in order to reduce operating costs.

Performance Data - AC-EC Fan Series

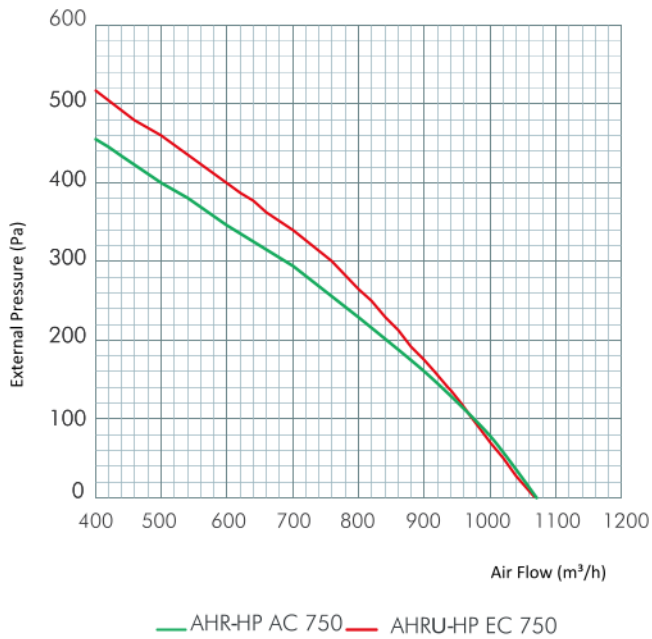
AHR-HP AC / AHR-HP EC 500

Performance Curve



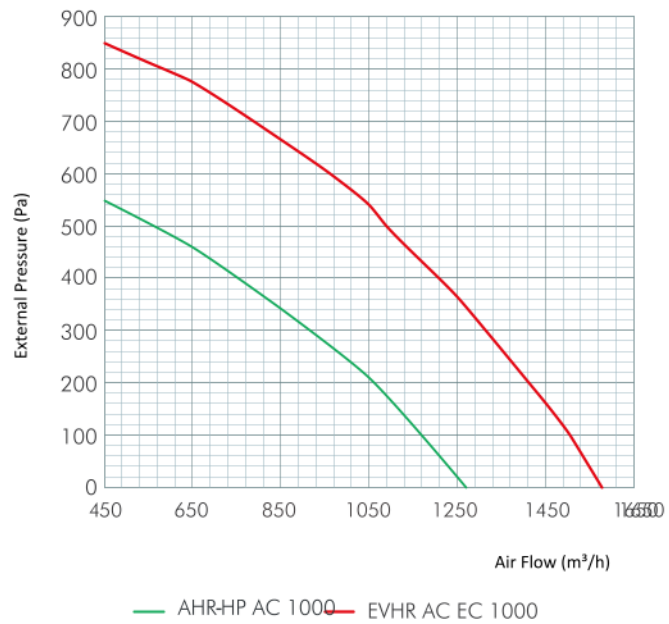
AHR-HP AC / AHR-HP EC 750

Performance Curve



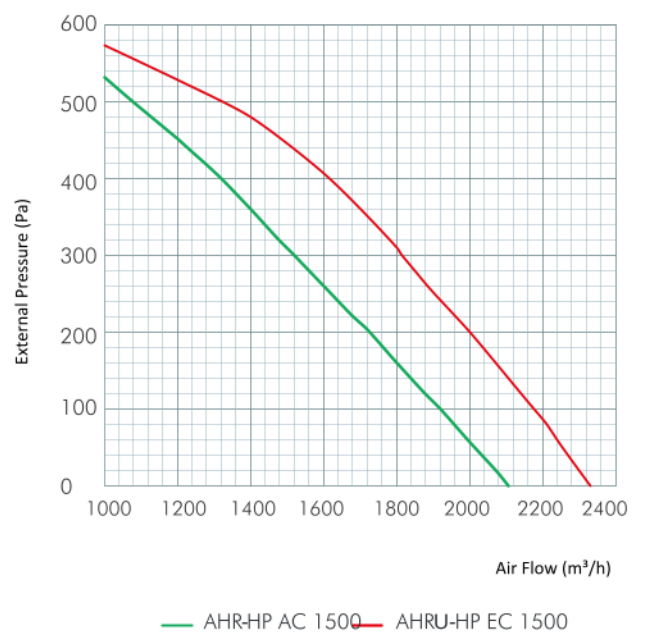
AHR-HP AC / AHR-HP EC 1000

Performance Curve



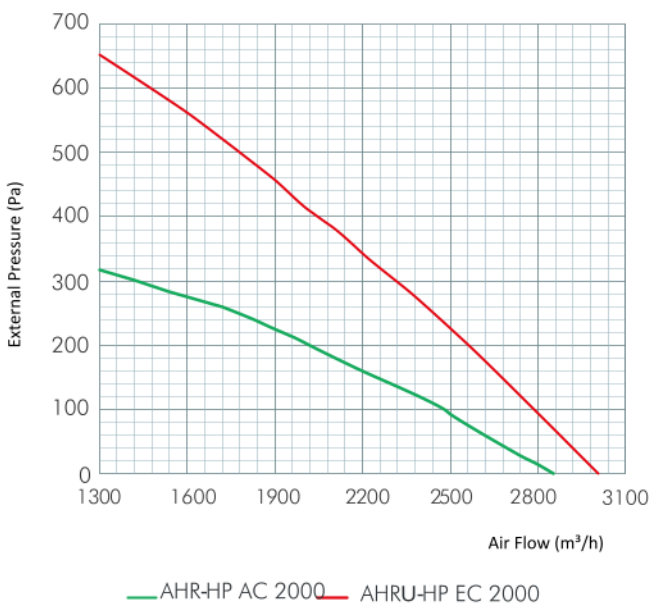
AHR-HP AC / AHR-HP EC 1500

Performance Curve



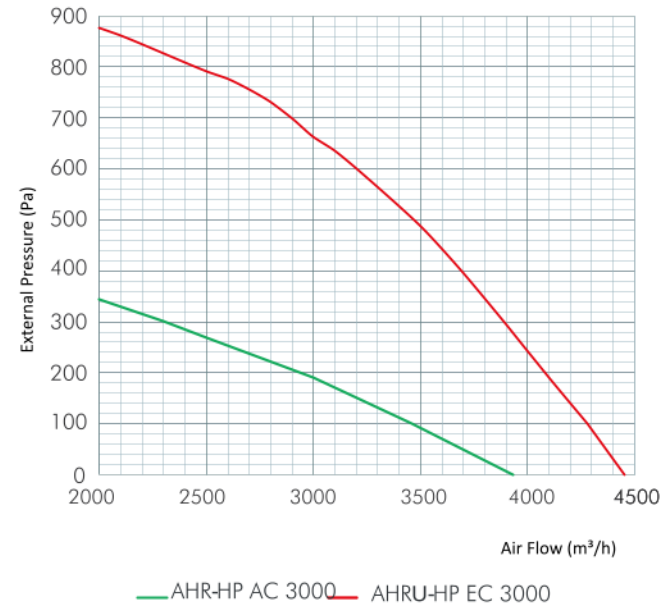
AHR-HP AC / AHR-HP EC 2000

Performance Curve



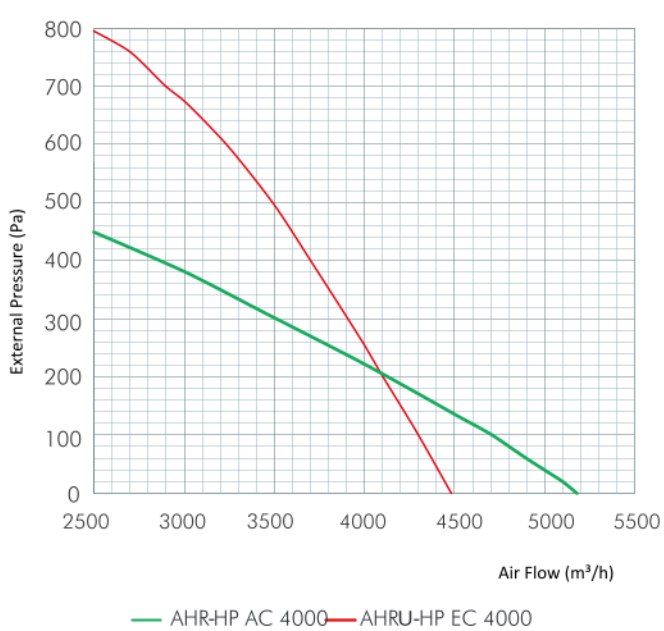
AHR-HP AC / AHR-HP EC 3000

Performance Curve



AHR-HP AC / AHR-HP EC 4000

Performance Curve



Technical Specifications & Unit Dimensions - AC Fan

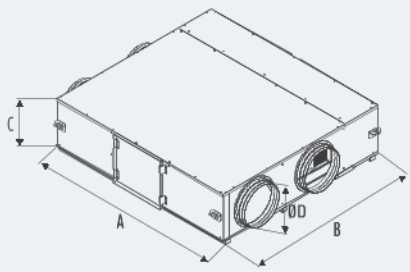
Technical Specifications				AHRU-HP-AC / CHRU-HP -AC						
				500	750	1000	1500	2000	3000	4000
	Air Flow		m^3/h	500	750	1000	1500	2000	3000	4000
	External Static Pressure		Pa	176	265	250	310	205	190	222
	Max. Air Flow [1]		m^3/h	775	1060	1275	2100	2850	3930	4200
	Nominal Voltage		V/Hz/Ph	230/ 50 / 1~				400/ 50 / 3~		
	Cooling	Capacity [2]	kw	3,17	4,20	5,70	9,06	12,20	15,10	24,00
		EER	-	3,07	2,78	3,28	2,91	2,86	3,29	2,93
		Total Power [3]	kw	1,03	1,51	1,74	3,11	4,26	4,59	8,18
	Heating	Capacity [2]	kw	3,80	5,20	6,87	11,30	14,80	18,67	30,70
		CoP	-	4,43	3,88	4,71	4,59	4,42	4,79	4,44
		Total Power [3]	kw	0,86	1,34	1,46	2,46	3,35	3,90	6,92
	Electric Heater Diameter		mm	Ø250	Ø250	Ø300	300x300	400x400	500x400	550x450
	Electric Heater (Optional) [4]		kw	1,50	1,50	2,00	4,00	5,00	10,00	10,00
	Unit Weight		kg	105	110	145	200	295	325	360
	Filter Type			G Class						

Summer Condition: Outdoor air 35°C K.T. %40 rH & Indoor air 25°C K.T. %50 rH
Winter Condition: Outdoor air 0°C K.T. %80 rH & Indoor air 22°C K.T. %40 rH

[1] External static pressure is 0 Pa.
[2] Heat exchanger capacity is added to total heating and cooling capacities.
[3] EN14511-2 conditions with 0(pa) external static pressure.
[4] Electric heaters shall be used before the fresh air inlet of the unit to preheat air where outdoor air is below -5°C and condensation can occur. Also in humid climates return air ducts must also be insulated aganist condensation.

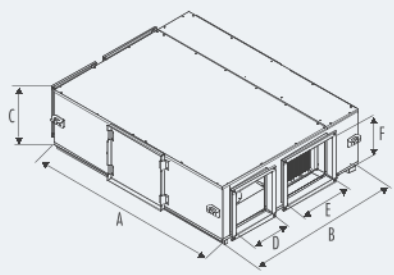
AHRU-HP AC - CHRU-HP AC Unit Dimensions

AUTODESK REVIT



	AHRU-HP AC - CHRU-HP AC		
	500	750	1000
A	1250	1250	1400
B	1000	1000	1300
C	411	411	411
ØD	250	250	300

*All measurement values are mm.

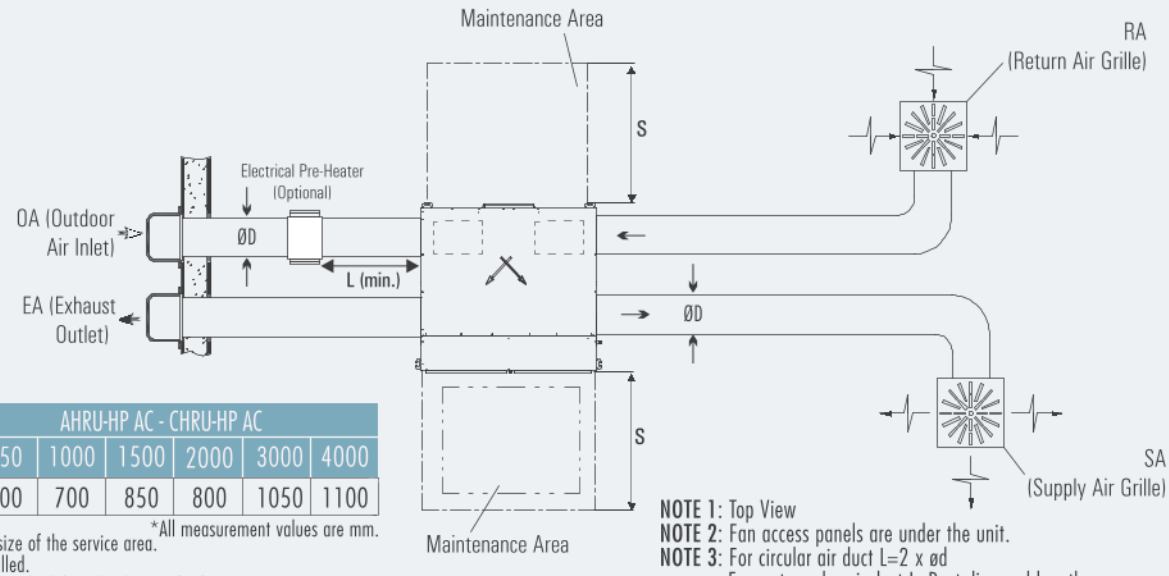


	AHRU-HP AC - CHRU-HP AC			
	1500	2000	3000	4000
A	1650	2100	2200	2200
B	1450	1620	1911	1911
C	470	590	590	655
DxF	300x300	400x400	500x400	550x450
ExF	600x300	550x400	800x400	800x450

*All measurement values are mm.

DxF: Outdoor air and indoor air connection
ExF: Supply air and exhaust air connection

Service Space & Installation



	AHRU-HP AC - CHRU-HP AC						
	500	750	1000	1500	2000	3000	4000
S	600	600	700	850	800	1050	1100

*All measurement values are mm.

"S" values indicate the size of the service area.
Drain pipe must be installed.
A service space of "C" must be left under the unit for fan service.

NOTE 1: Top View
NOTE 2: Fan access panels are under the unit.
NOTE 3: For circular air duct L=2 x ød
For rectangular air duct L=Duct diagonal length

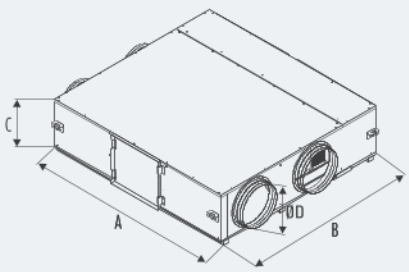
Technical Specifications & Unit Dimensions - EC Fan

				AHRU-HP EC - CHRU-HP EC						
				500	750	1000	1500	2000	3000	4000
Technical Specifications	Air Flow		m^3/h	500	750	1000	1500	2000	3000	4000
	External Static Pressure		Pa	233	305	575	440	420	670	255
	Max. Air Flow[1]		m^3/h	855	1060	1575	2325	2850	4450	4500
	Nominal Voltage		V/Hz/Ph	230/ 50 / 1~				400/ 50 / 3~		
	Cooling	Capacity[2]	kw	3,17	4,20	5,70	9,06	12,20	15,10	24,00
		EER	-	3,25	3,04	3,52	3,29	3,03	3,60	3,38
		Total Power[3]	kw	0,98	1,38	1,62	2,75	4,03	4,19	7,10
	Heating	Capacity[2]	kw	3,80	5,20	6,87	11,30	14,80	18,67	30,70
		CoP	-	4,75	4,30	5,13	5,38	4,74	5,33	5,26
		Total Power[3]	kw	0,80	1,21	1,34	2,10	3,12	3,50	5,84
	Electric Heater Diameter		mm	Ø250	Ø250	Ø300	300x300	400x400	500x400	550x450
	Electric Heater (Optional)[4]		kw	1,50	1,50	2,00	4,00	5,00	10,00	10,00
	Unit Weight		kg	105	110	145	200	295	325	360
	Filter Type			G Class						

Summer Condition: Outdoor air 35°C K.T. %40 rH & Indoor air 25°C K.T.
Winter Condition: Outdoor air 0°C K.T. %80 rH & Indoor air 22°C K.T.

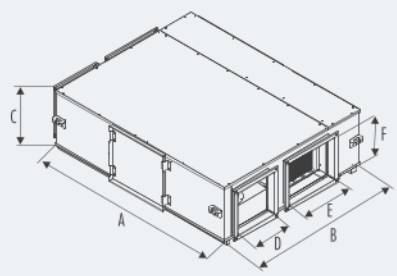
[1] External static pressure is 0 Pa.
[2] Heat exchanger capacity is added to total heating and cooling capacities.
[3] EN14511-2 conditions with 0 Pa external static pressure.
[4] Electric heaters shall be used before the fresh air inlet of the unit to preheat air where outdoor air is below -5°C and condensation can occur. Also in humid climates return air ducts must also be insulated aganist condensation.

AHRU-HP EC - CHRU-HP EC Unit Dimensions



	AHRU-HP / CHRU-HP EC		
	500	750	1000
A	1250	1250	1400
B	1000	1000	1300
C	411	411	411
ØD	250	250	300

*All measurement values are mm.

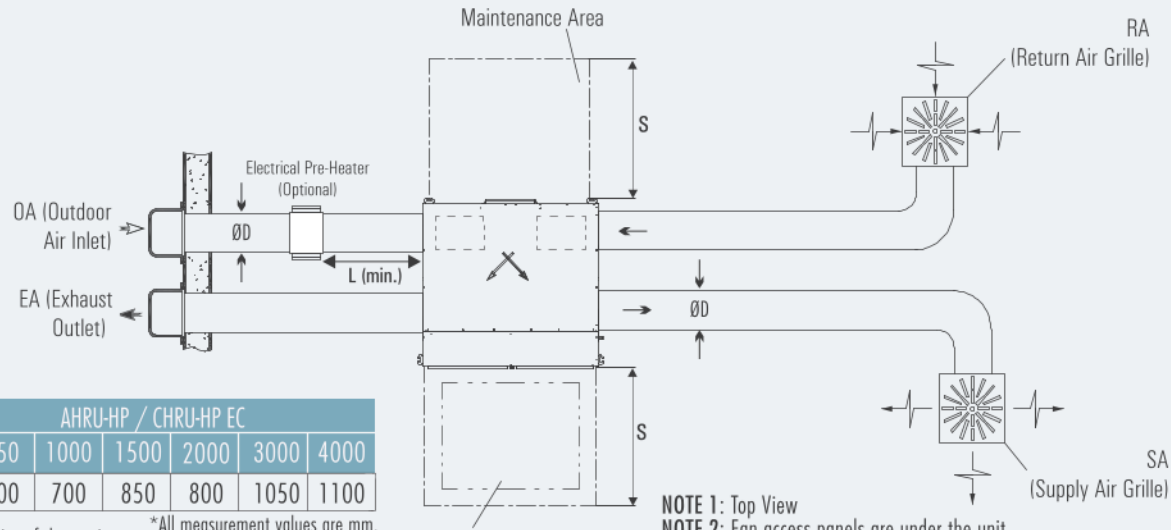


	AHRU-HP / CHRU-HP EC			
	1500	2000	3000	4000
A	1650	2100	2200	2200
B	1450	1620	1911	1911
C	470	590	590	655
DxF	300x300	400x400	500x400	550x450
ExF	600x300	550x400	800x400	800x450

*All measurement values are mm.

DxF: Outdoor air and indoor air connection
ExF: Supply air and exhaust air connection

Service Space & Installation



	AHRU-HP / CHRU-HP EC						
	500	750	1000	1500	2000	3000	4000
S	600	600	700	850	800	1050	1100

*All measurement values are mm.

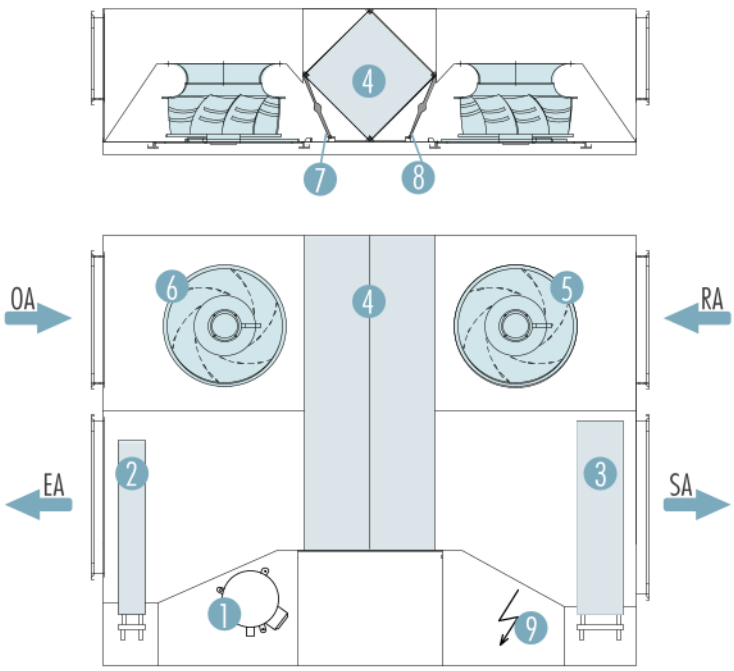
"S" values indicate the size of the service area.
Drain pipe must be installed.
A service space of "C" must be left under the unit for fan service.

NOTE 1: Top View
NOTE 2: Fan access panels are under the unit.
NOTE 3: For circular air duct L=2 x ød
For rectangular air duct L=Duct diagonal length

Unit Components & Working Principle of Unit

Working Principle of the Unit

Outdoor air is cleaned from particles with G type filters and then it passes through the plate heat/energy recovery heat exchanger in AHRU-HP AC/ CHRU-HP AC units. The supply air is preconditioned in the plate type heat/energy exchanger which is a type of heat exchanger that allows heat transfer between two air streams. Although the temperature and humidity of exhaust air is changed in the exchanger, it is still at appropriate temperature and humidity conditions and then it passes through the heat pump and is discarded to outdoor. Meanwhile outdoor air passes through the heat pump till the design temperature is achieved and then it is blown to inside.



Unit Components

1. Compressor
2. Condenser
3. Evaporator
4. Aluminum Cross-flow Exchanger (AHRU-HP AC)/ Cellulosic Paper Type Cross-flow Heat Exchanger (CHRU-HP AC)
5. Exhaust Fan
6. Supply Air Fan
7. Supply Air Filter
8. Exhaust Filter
9. Control Panel

Compressor and Heat Pump Cycle

High efficiency, fully hermetic compressors are used in the heat/ energy recovery units with heat pump. Externally balanced thermostatic expansion valve is used in the unit. The system safety is ensured with low and high pressure pressurestats. The system can work in heating or cooling mode depending on the season selection on the control panel. The unit has an automatic free-cooling system which enables further savings in order to reduce operating costs.

Evaporator & Condenser

Copper tube- aluminum fin type and high efficiency evaporator and condenser are used. At the entrance of the evaporator, refrigerant distributor is used for a uniform distribution. In order to keep the pressure drops on the air side reduced, the air speed of 2.7 m/sec or a lower value is selected for evaporator and condenser. There is a stainless steel drain pan under the evaporator and condenser.

AHRU-HP AC/EC - CHRU-HP AC/EC

Automation Options		Control Cards		
Standard	Optional	Standard - Pro	Alternative	
			Type 1	Type 2
OA Temperature Sensor		✓	✓	✓
RA Temperature Sensor		✓	✓	✓
SA Temperature Sensor		✓	✓	✓
SA Fan Control		✓	✓	✓
RA Fan Control		✓	✓	✓
Compressor Control		✓	✓	✓
4 Way Control		✓	✓	✓
Modbus RTU		✓	✓	✓
Weekly Timer		✓	✓	✓
Filter Contamination Info (DPS)		✓	✓	✓
	On/Off Damper Control	✓	✓	✓
	Proportional Damper Control	⊗	✓	✓
	On/Off Heating Coil	⊗	✓	✓
	Proportional Heating Coil	⊗	✓	✓
	On/Off Cooling Coil	⊗	✓	✓
	Proportional Cooling Coil	⊗	✓	✓
	Electrical Pre-Heater	✓	✓	✓
	BacNET	⊗	✓	✓
	Web Browser (TCP/IP)	⊗	✓	✓

Only one of them the defined functions is selectable for this control card.

The optional features in the table vary according to the product.

Control Panel			Control Cards		
Panel Type		Panel Descriptions	Standard - Pro	Alternative	
				Type 1	Type 2
	Standard-Pro	Wall-mounted type, Max:50 m communication ability	✓	⊗	⊗
	Alternative-1.1	**Hand Panel 1:** Wall-mounted type, IP 65 protection class for only front side of panel, Max:50 m communication ability **Hand Panel 2:** Magnet type, IP 65 protection class for whole panel, Max:50 m communication ability	⊗	✓	⊗
	Alternative-1.2	Magnet type, IP 31 protection class, Max:700 m communication ability	⊗	⊗	✓

Selection of Electrical Cable Cross-Section (AHRU-HP AC/CHRU-HP AC)

Unit Model AHRU-HP/CHRU-HP AC	Unit Voltage (V)	Unit Power Input (kW)	Current (A)	Fuse (A)	Cable Cross-Section(mm²) for 50M and PF=0.8
500	230	1.12	5.08	2x6	4.00
750	230	1.76	8.14	2x10	4.00
1000	230	1.84	8.48	2x10	4.00
1500	230	3.54	16.78	2x20	6.00
2000	400	3.54	11.14	3x16	2.50
3000	400	4.37	14.08	3x16	2.50
4000	400	8.21	21.38	3x25	2.50

The data in the table shows the maximum power/current values. Please check unit label for updated values.

Cable Cross-Section Formulas

1

$$I_{current} = \frac{P}{U.CosQ}$$

$$I_{cable} > I_{current}$$

2

$$\%e = \frac{100.P.L}{k.S.U^2} \quad , \quad S = \frac{100.P.L}{k.\%e.U^2}$$

$$\%e = \%3$$

3

$$I_{cable} > I_{fuse} \geq I_{current}$$

Cable Cross-Section S = Max (S1, S2, S3, 1.5mm²)

* It is suitable for units with 230V supply voltage.

P : Power
I : Current
U : Voltage
S : Conductor cross section
k : Conductor coefficient
L : Conductor length
%e : The voltage drop

Example of Cable Cross-Section Calculation

P : 1,23 kW **L** : 50m
U : 230V **%e** : %3
CosQ : 0,8 **k** : 56m / Ω

1

$$I_{current} = \frac{1230\ W}{230.0,8} = 6.68\ A$$

The cable will be used, is selected from the cable cross-section table so that the equivalent ampere value in the table should be higher than calculated "$I_{current}$" value.

$S1 = 0.5\ mm^2$

2

$\%e = \%3$

$$S = \frac{100.1230.50}{56.3.230^2} = 0.76\ mm^2$$

$S2 \geq 0.69\ mm^2 \geq 0.75\ mm^2$

$S2 = 0.75mm^2$

3

$I_{cable} > I_{fuse} \geq I_{current}$

$I_{cable} > 10A \geq 6.68A$

"I_{fuse}", which will be higher than "$I_{current}$", is selected.

The cable will be used, is selected from the cable cross-section table so that the equivalent ampere value in the table should be higher than selected "I_{fuse}" value.

$I_{cable} = 12A$

$S3 = 0.5\ mm^2$

Cable cross-section S = Max (S1, S2, S3, 1.5 mm²)

S = Max (0.5, 0.75, 0.5, 1.5)

$S = 1.5\ mm^2$

Selection of Electrical Cable Cross-Section (AHRU-HP EC/CHRU-HP EC)

Unit Model AHRU-HP / CHRU-HP EC	Unit Voltage (V)	Unit Power Input (kW)	Current (A)	Fuse (A)	Cable Cross-Section (mm^2) for 50M and PF=0.8
500	230	1.10	5.68	2x6	2.50
750	230	1.68	9.08	2x10	2.50
1000	230	2.11	11.28	2x16	2.50
1500	230	3.33	18.48	2x25	4.00
2000	400	3.61	10.88	3x16	4.00
3000	400	5.21	10.18	3x16	4.00
4000	400	7.81	13.18	3x16	4.00

The data in the table shows the maximum power/current values. Please check unit label for updated values.

Cable Cross-Section Formulas

1

$$I_{current} = \frac{P}{\sqrt{3}.U.CosQ}$$

$$I_{cable} > I_{current}$$

2

$$\%e = \frac{100.P.L}{k.S.U^2} \quad , \quad S = \frac{100.P.L}{k.\%e.U^2}$$

$$\%e = \%3$$

3

$$I_{cable} > I_{fuse} \geq I_{current}$$

Cable Cross-Section S = Max (S1, S2, S3, 1.5mm^2)

* It is suitable for units with 400V supply voltage.

P : Power
I : Current
U : Voltage
S : Conductor cross section
k : Conductor coefficient
L : Conductor length
%e : The voltage drop

Example of Cable Cross-Section Calculation

P : 4,9 kW **L** : 50m
U : 400V **%e** : %3
CosQ : 0,8 **k** : 56m / Ω

1

$$I_{current} = \frac{4900\ W}{\sqrt{3}.400.0,8} = 8.85\ A$$

The cable will be used, is selected from the cable cross-section table so that the equivalent ampere value in the table should be higher than calculated "$I_{current}$" value.

$S1 = 0.5\ mm^2$

2

$\%e = \%3$

$$S = \frac{100.4900.50}{56.3.400^2}$$

$S2 \geq 0.91\ mm^2$

$S2 = 1\ mm^2$

3

$I_{cable} > I_{fuse} \geq I_{current}$

$I_{cable} > 10A \geq 8.85A$

"I_{fuse}" which will be higher than "$I_{current}$", is selected.

The cable will be used, is selected from the cable cross-section table so that the equivalent ampere value in the table should be higher than selected "I_{fuse}" value.

$I_{cable} = 15A$

$S3 = 0.75\ mm^2$

Cable cross-section S = Max (S1, S2, S3, 1.5 mm^2)

S = Max (0.5, 1, 0.75, 1.5)

$S = 1.5\ mm^2$

Duct Type Electric Heaters

Electric heaters are optionally supplied in cold climates for supply air. Electric heaters are manufactured according to circular or rectangular duct systems. Standard types are produced of stainless steel heating elements and galvanized metal casing. Stainless steel casing is also avaliable.

Electric heaters are equipped with two excessive temperature protection. When inside of the electric heater's temperature is 70°C, "automatic excessive temperature protection" enables and electric heater disables automatically.

The electrical heaters, designed as maximum 3 steps, step automatically according to temperature that is set on room control pa nel with control panel. Voltvent electric heaters are connected in YREH connection in standard models.

Heating Capacity Calculation

$$Q = 0{,}33 \times V \times (T_2 - T_1)$$

Q : Heating Capacity (W)
V : Air Flow through electric heater (m^3/h)
T_1 : Fresh air temperature before the heater (°C)
T_2 : Supply air temperature after the heater (°C)

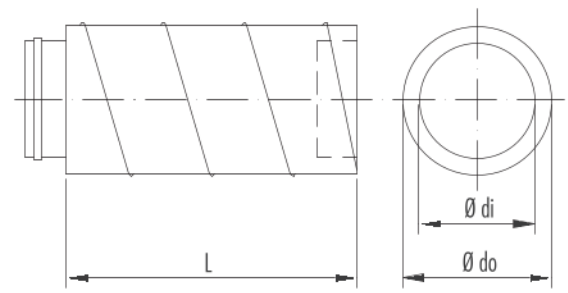
Sound Attenuator For Circular Ducts

Sound attenuators are designed for standard duct dimensions. Various lenghts are avaliable accoring to attenuation demand. Sound attenuation capacities are given in the table. For better performance sound attenautors can be used in series. For the best result the sound attenuators shall be installed just after the unit.

Notation

SLT ---- ----

Sound Attenuator
Diameter (mm)
Lenght(mm)(mm)



Sound Attenuator Capacity [dB]

SLT	63	125	250	500	1k	2k	4k	8k
200-300	1	2	3	6	10	14	12	14
200-600	2	3	6	7	13	17	18	20
200-900	3	4	7	10	16	18	21	22
250-300	1	2	6	6	13	16	14	15
250-600	2	3	7	7	18	21	20	22
250-900	3	4	9	8	21	24	21	23
300-300	1	2	4	4	10	12	12	15
300-600	1	3	6	7	13	15	17	19
300-900	2	4	7	8	15	17	18	21
355-600	1	3	8	8	9	6	5	7
355-900	4	4	13	13	11	7	6	8

Sound Attenuator Dimensions [mm]

SLT	long	Ø di	Ø do
200-300	300	200	260
200-600	600	200	260
200-900	900	200	260
250-300	300	250	310
250-600	600	250	310
250-900	900	250	310
300-300	300	300	360
300-600	600	300	360
300-900	900	300	360
355-600	600	355	415
355-900	900	355	415

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Notes