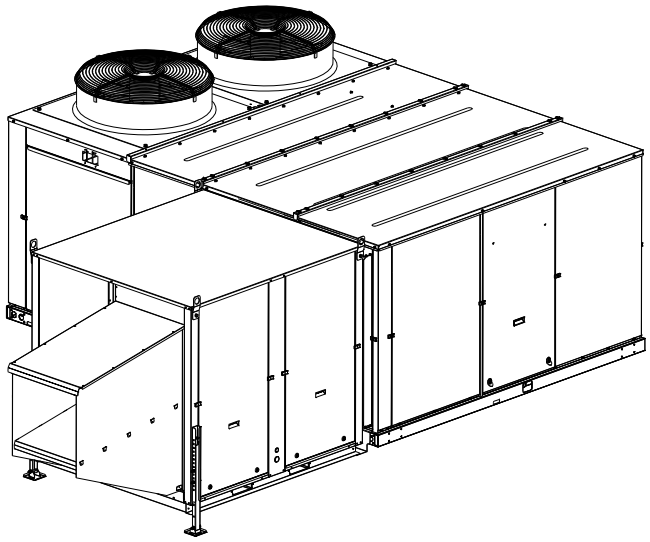
YORK
BY JOHNSON CONTROLS

Energy recovery (vertical enthalpy wheel) system for ROOFTOP ACTIVA 045/090



Options and accessories, Installation manual

Ref.: N-40422_EN 0714

CE

Johnson Controls

Index

1 Energy recovery (vertical enthalpy wheel) system for Roof Top ACTIVA 045/090....1

1.1 General Description....2
1.2 General dimensions....3
1.3 Operation....3
1.3.1 Operating diagram....4
1.4 Assembly....5
1.5 Installation....6
1.6 Electrical connections....11
1.7 Airflows and air filters....12
1.8 Maintenance....12
1.8.1 Enthalpy wheel....13
1.9 Electrical specifications....13
1.10 Wiring diagram....14
1.11 Efficiency and recovered load....15
1.11.1 Efficiency....15
1.11.2 Recovered load at sea level....16
1.11.3 Recovered load correction factor, according to the elevation from sea level....19
1.12 Tempered air (TA) and indoor coil entering air (EA) temperatures....19

1

Energy recovery (vertical enthalpy wheel) system for Roof Top ACTIVA 045/090

1.1 General Description

There are four models of energy recovery system, depending on the size of the Rooftop unit and the renewal airflow required:

Energy recovery system model	Product code	ROOFTOP Model	Renewal airflow (1) [m^3/h]
045 / 060 Q3000	S611994512	045 / 060	3000
045 / 060 Q6000	S611994511	045 / 060	6000
075 / 090 Q4500	S611997512	075 / 090	4500
075 / 090 Q9000	S611997511	075 / 090	7200

(1) See section *Airflows and air filters, see on page 12*

These installation instructions correspond to the models of energy recovery system, for which the product codes are indicated in the table (with the enthalpy wheel fitted on a vertical plane).

The energy recovery system is used directly coupled to the side of the Rooftop Activa units and includes the Economiser and indoor air quality probe options.

NOTE

Only the vertical air duct can be connected, at the bottom of the Rooftop unit

Features:

- Rotating sectorised enthalpy wheel energy recovery system.
- Centrifuge fan, pulley and belt transmission on the air intake and air exhaust sides.
- Rain protection (Rainhood) with drip filters on the air intake.
- Barometric damper on the exhaust air.
- G4 air filters, as standard on both sides of the enthalpy wheel. F6 and F7 optional.
- Height-adjustable support legs.
- All cabinet panels are fitted with heat insulation on the inside.

The enthalpy wheel provides substantial savings by reducing the demand for energy. It is ideal for areas with high or low temperatures and areas with a high level of humidity. Also for areas with a very low level of humidity, in buildings with a humidifying system, as the humidity is recovered from the exhaust air and re-introduced into the building.

Air leakage and bleed sector

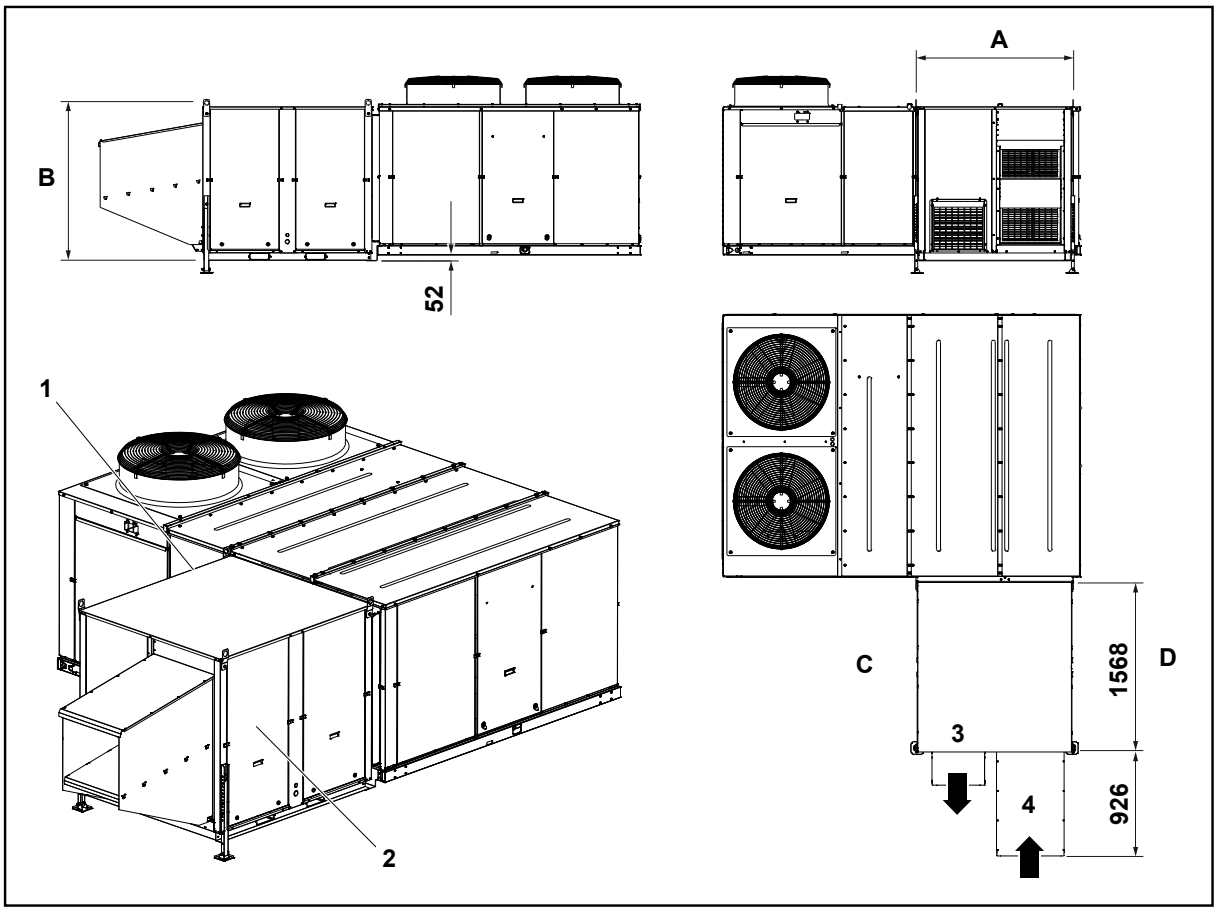
Many rotating recovery systems are fitted with a bleed sector when this is often not necessary. The bleed sector minimises leaks between the exhaust airflow to that of the intake airflow by diverting a portion of the latter to the exhaust flow through the separator between the two.

This is only necessary in cases of industrial applications where the exhaust air carries contaminants. As a result, the air volume to be moved is 15-20% higher to ensure the required renewal flow, with the subsequent increase in power required in the fan motor.

In residential air conditioning, the renewal air maintains an acceptable air quality and there are no concentrated contaminants to be taken into account.

The exhaust air leakage to that of the intake air in this energy recovery system is at a value of less than 5%. The resulting cost of moving this volume of air is much lower than in the case of a bleed sector. Do not use this energy recovery system in industrial applications with concentrated contaminants.

1.2 General dimensions



1. Exhaust side filter access
2. Intake side filter access
3. Exhaust
4. Intake

A. See table
B. See table
C. 900 mm clearance
D. 1525 mm clearance

Model	A	B	Weight [kg]
045/060	1368	1366	610
075/090	1525	1525	690

1.3 Operation

The enthalpy wheel is centred between the outdoor intake airflow and the exhaust airflow. It is the only truly self-cleaning system, as during rotation the airflow moves in opposite directions over each half of the wheel surface.

When the rotation movement at 60 r.p.m., the wheel surface absorbs the sensible and latent energy from the side with the highest temperature and transfers it to the side with the lowest temperature, thus making the exchange of airflow between both sides. During a summer cycle, the rotation of the wheel transfers heat and outdoor air humidity (renewal) to the exhaust air.

During a winter cycle, the process is the opposite, transferring heat and exhaust air humidity to the renewal air.

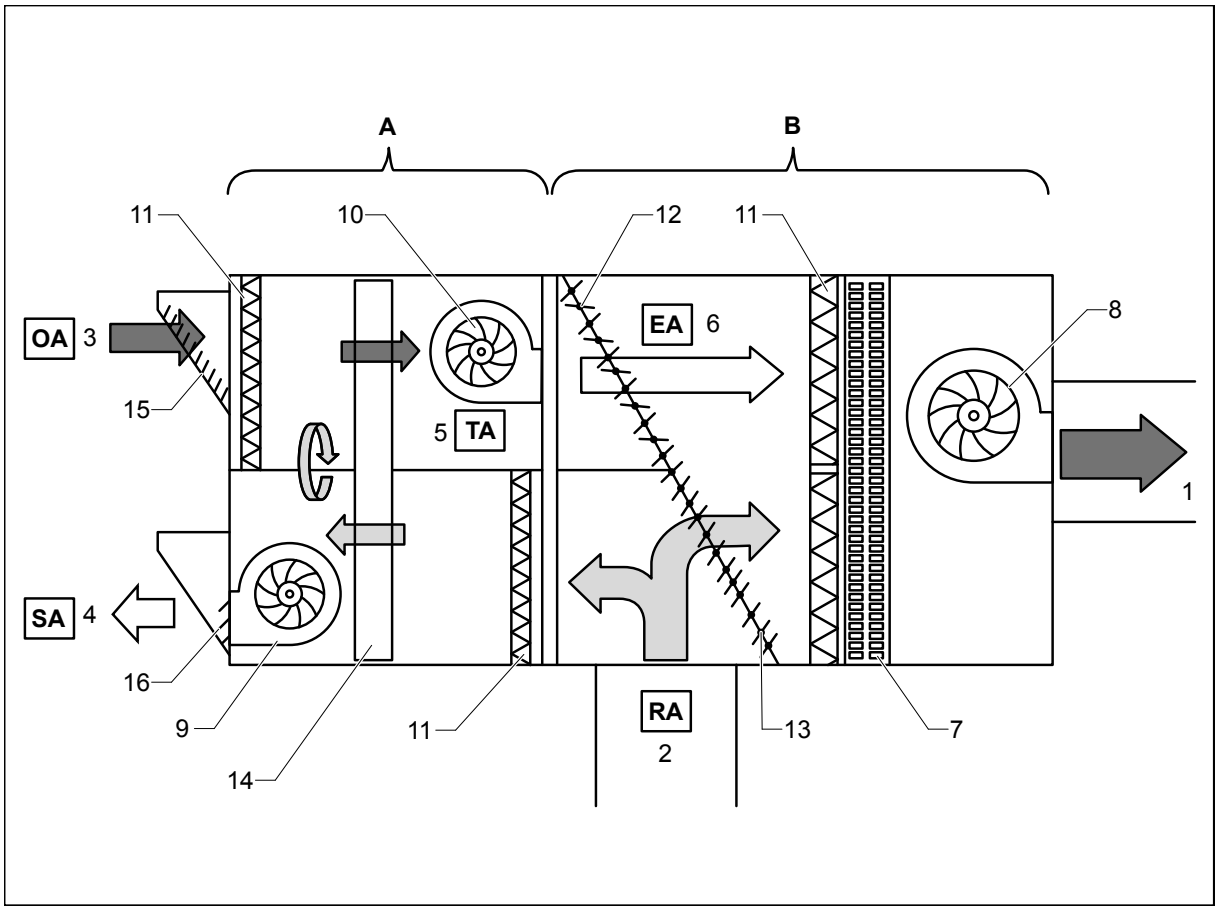
Where there is no kind of demand (HVAC or ventilation) and the air quality is correct, the unit is at a standstill.

If continuous ventilation mode is selected and the air renewal selected is less than 30%, only the indoor fan will run. If air renewal of over 30% is selected, the three fans (indoor, exhaust and renewal) will run and the enthalpy wheel will turn. When the air quality is incorrect, air renewal will be 100%.

When there is a demand for cold (outdoor air not favourable) or a demand for heat and the air quality is correct, the compressors or heat support and the indoor fan will start up. If air renewal of over 30% is selected, the exhaust and renewal fans and the enthalpy wheel will also run. When the air quality is incorrect, air renewal will be 100%.

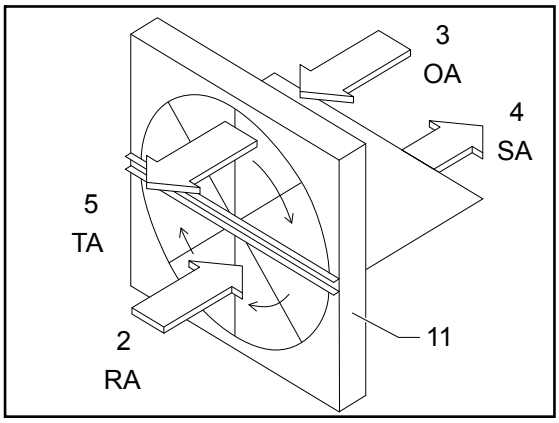
During operations in economiser mode (Free cooling), the enthalpy wheel will stop turning and there will be no exchange, the fans continuing to run to maintain the flow of renewal and exhaust air. If the outdoor air intake is insufficient to meet the demand, a compressor will start.

1.3.1 Operating diagram



A	Energy recovery system	8	Indoor supply fan
B	Rooftop	9	Exhaust fan
1	Supply air, side or down ducted	10	Outdoor air inlet fan
2	Return air, downflow (RA)	11	Air filters
3	Outdoor air (OA)	12	Economiser, outdoor air damper
4	Exhaust air (SA)	13	Economiser, return air damper
5	Tempered air (TA)	14	Enthalpy wheel
6	Indoor coil entering air (EA)	15	Aluminium mesh filter
7	Indoor coil	16	Barometric damper

2	Return air (RA)	5	Tempered air (TA)
3	Outdoor air (OA)	11	Enthalpy wheel
4	Exhaust air (SA)		

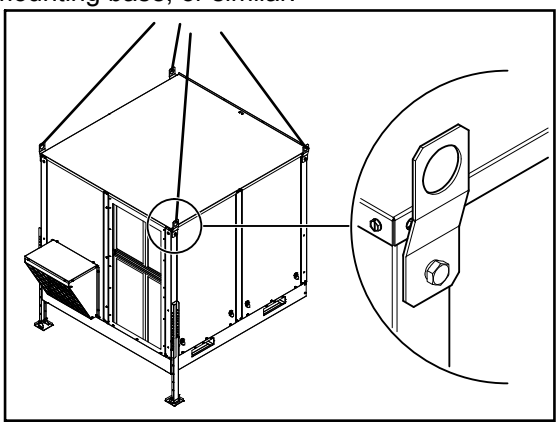


1.4 Assembly

The Rooftop unit must be installed on a Roofcurb type mounting base, or similar.

The energy recovery system is fitted with lugs for hoisting and handling during the fitting process. To do so:

1. Loosen the screw slightly.
2. Turn the lug to the correct position.
3. Tighten the screw.

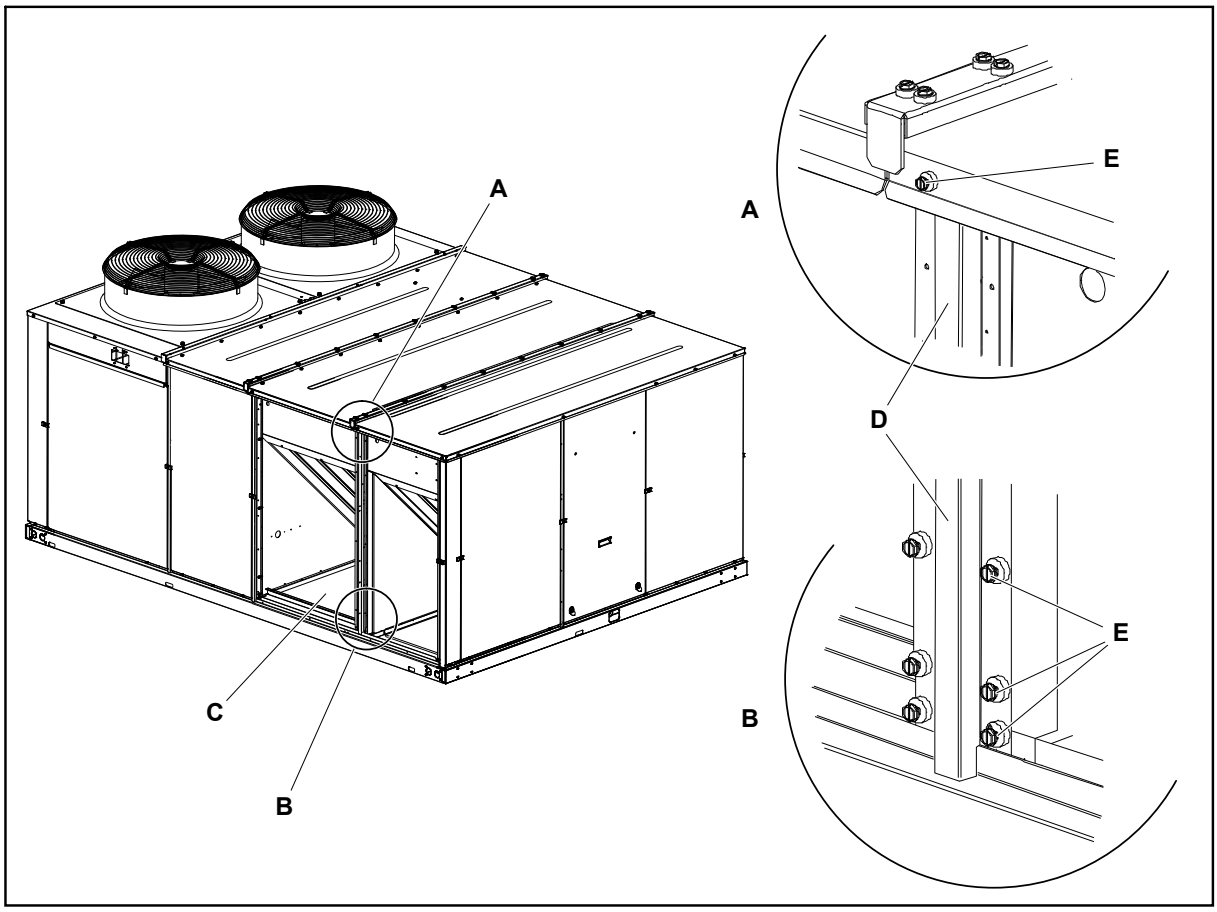


1.5 Installation

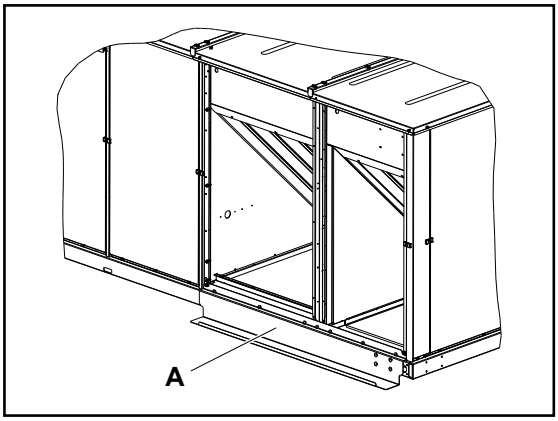
Installation process

(First make sure the Economiser and air quality probe options are installed in the Rooftop unit)

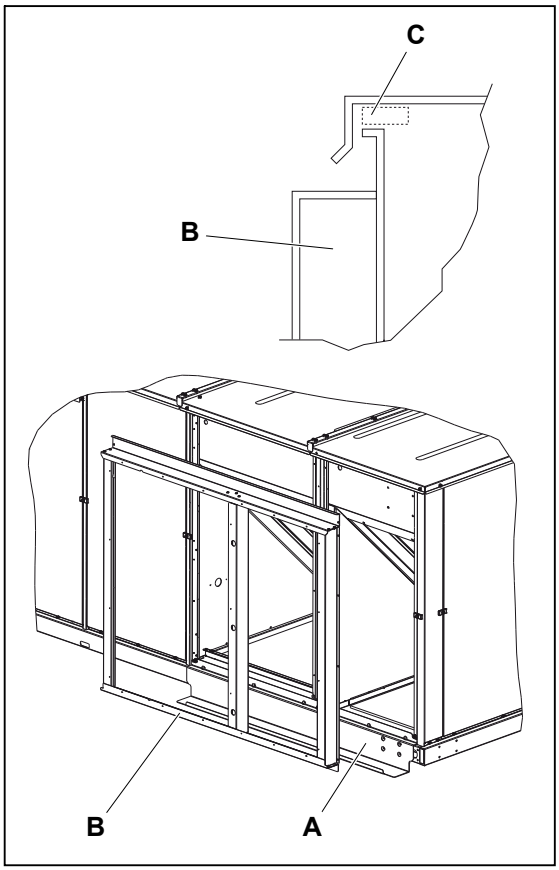
1. Disconnect the power supply to the Rooftop unit.
2. Remove the return air and outdoor air side panels (three bolts on each panel).
3. Remove the return air cover on the base -**C**-.
4. Remove the support -**D**-. To do so, loosen and dispose of all the bolts -**E**- that attach it to the unit structure.



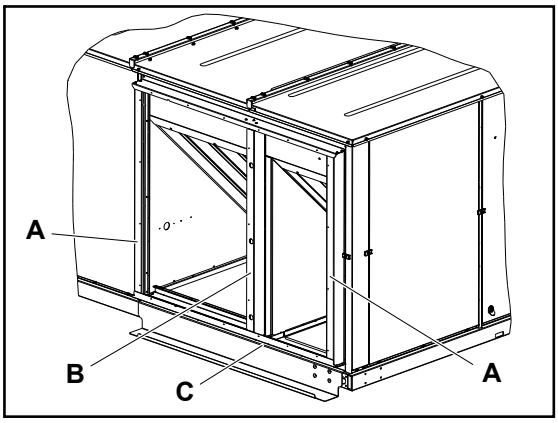
5. Place the support rail -**A**- in position, aligning the mounting holes with the panel securing holes. Do not install the bolts yet.



6. Place the frame of the support -**B**- in the opening on the side of the unit.
7. Insert the upper profile of the frame in the lower part of the roof -**C**- and place the frame assembly into its position.



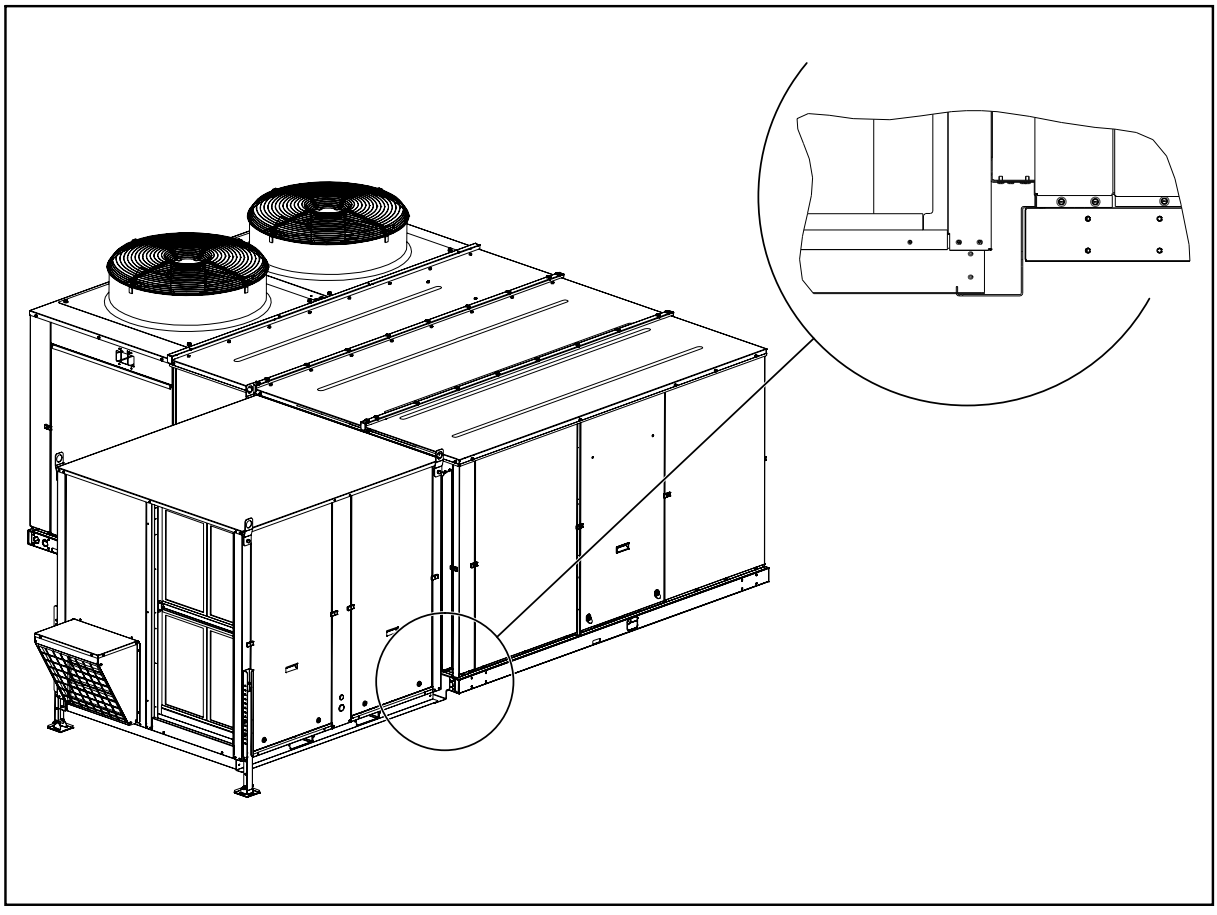
8. Fix the frame to the unit structure (the holes may be hidden under the seal).
   - Five bolts in the left and right supports -**A**-.
   - Six bolts in the central support -**B**-.
   - Eight bolts in the lower profile -**C**-, that simultaneously fix the supporting rail, previously put in place.
9. Using the handling lugs, slightly lift the recovery system assembly and release the telescopic legs until they are flat on the ground. Put the bolts in place again but do not tighten.
10. Lift the recovery system assembly and rest it on the supporting rail, facing away from the frame of the mount.



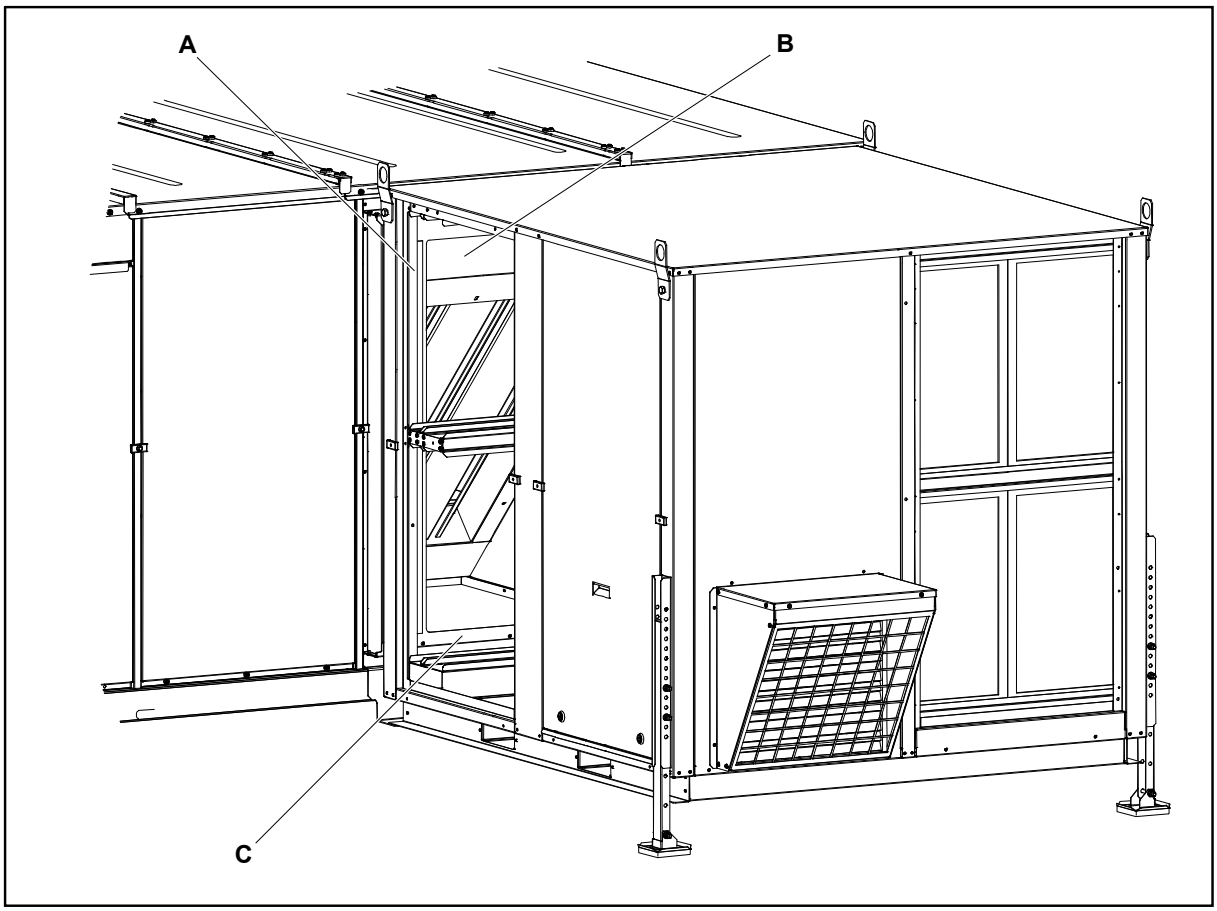
11. Adjust the legs to the required height and tighten the bolts.

NOTE

It is recommended to place a treated piece of wood measuring approximately 50 mm thick x 350 x 350 below each leg to avoid damaging the roof of the building.

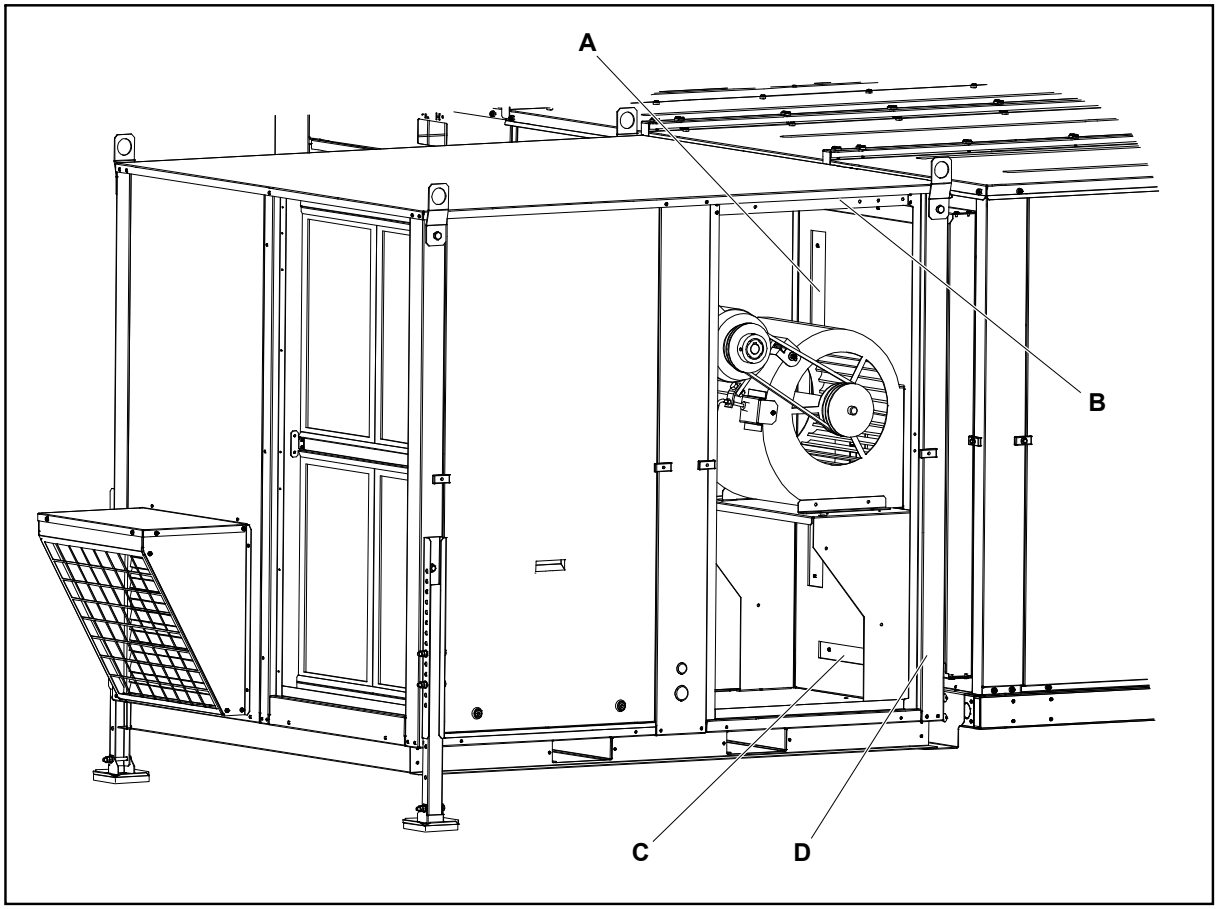


12. Remove the access panel from the exhaust side.
13. Remove the air filters.
14. Secure the frame with bolts and seal washers (supplied). No bolts must be left without being inserted:



A Edge area, three bolts.
B Panel upper area, three bolts.
C Panel upper area, three bolts.

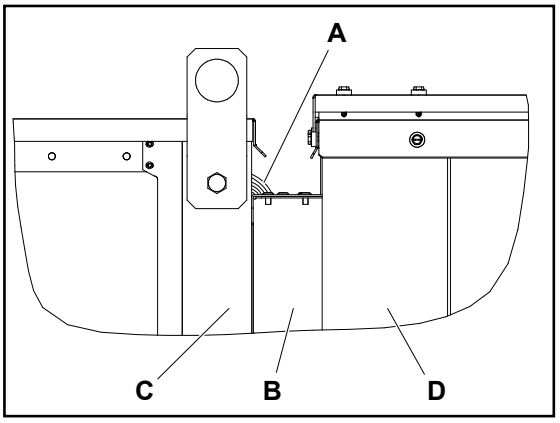
15. Remove the access panel from the side of the renewal fan.
16. Secure the frame with bolts and seal washers (supplied). No bolts must be left without being inserted.



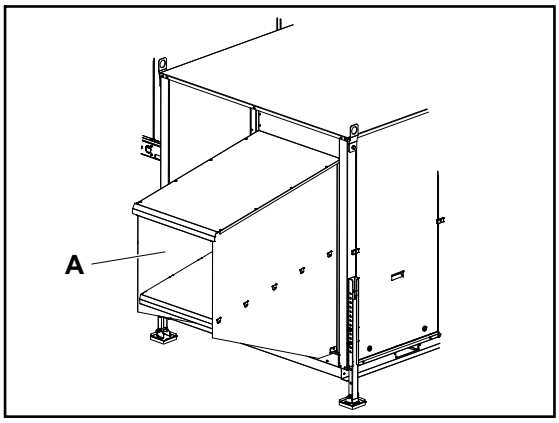
A Panel vertical area, three bolts.
B Panel upper area, three bolts.
C Panel upper area, three bolts.
D Edge area, four bolts.

17. Apply silicone bead (supplied) to seal the joint of the recovery system with the upper profile of the frame of mount -**A**-.

B Frame of the mount.
C Energy recovery system.
D RoofTop unit.



18. Install the rain protection assembly -**A**- (supplied dismantled in separate packaging), in the renewal-air intake opening of the recovery system. Follow the instructions included with its packaging. Use the bolts and seal washers supplied. The screw holes are hidden under the seal.



1.6 Electrical connections

CAUTION

Loose connection terminals produce overheating of cables and terminals. The unit will work incorrectly and there is a risk of fire.

1. The national regulations established must be followed in all cases.
2. The power supply to the energy recovery system must be independent to the general power supply to the unit and must be fitted with its own circuit breaker (not supplied).
3. Fit the thermal magnetic and residual current circuit breaker in the installation according to the instructions of the electrical specifications table and the wiring diagram.
4. Remove the side access panel to the renewal fan in order to access the electric box. Remove the protective cover and connect the power supply cable (H05 RN-F or H07 RN-F type) to terminal strip X1.
5. Connect the telephone cable from connector J2 or J3 on the board A13 to connector J15 on economiser board A4, which is on the economiser side of the Rooftop.
6. Connect the 24 VA (red / white) power supply cable to connector J4 on board A13 and connect with the power cables (580 and 581) on economiser board A4.

   ATTENTION

   If the enthalpy probe accessory is fitted, do not connect the B17 outdoor probe
7. Connect outdoor probe B17 to connector J3 on economiser board A4.
8. Energy recovery system control board configuration. Once the accessory has been fitted, reconnect the power to the Rooftop and the accessory. Check that the green LED (V2) on the control board (A13) remains lit. To search for and configure accessories, press the test button on the YKN2 Open board (A1) located in the electric box of the Rooftop until the red LED lights up. When the search and configuration process starts, the red LED on the board will light up and will remain on until the operation is completed. Once it has switched off, check that the green LED (V2) on the energy recovery system board is flashing to indicate that the accessory has been configured.
9. There is a potentiometer, P1, on the economiser board (A4) that allows for the damper to be modulated by hand. If the position is over 30%, the three fans (indoor, exhaust and renewal) will run and the enthalpy wheel will turn. The economiser dampers and the motors will return to their operating position after 30 sec.

ATTENTION

Once the fitting is complete and the electrical connections in place, fit all the access panels that were previously removed, making sure that they are sealed. Make sure the 1/4-turn locks and pressure devices on each panel are correctly closed.

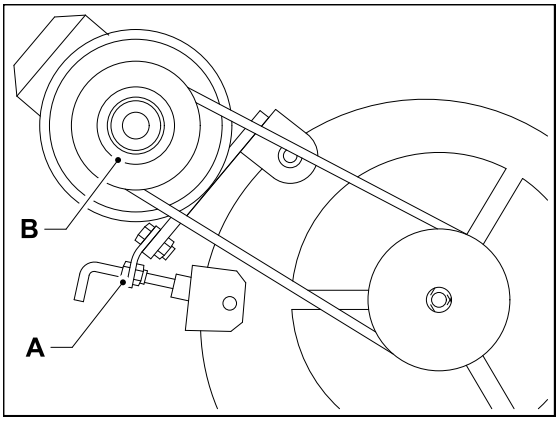
1.7 Airflows and air filters

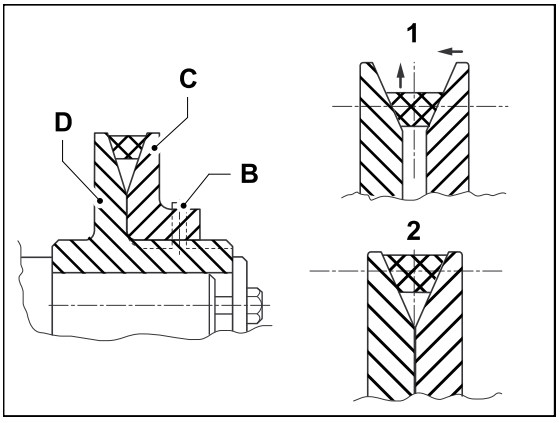
The motor pulley is regulated for the airflows indicated in the table of section 1.1, with the energy recovery system equipped with standard G4 air filters.

In the event of using optional F6 or F7 air filters, in order to maintain these airflows. adjust the pulley regulation to "0" open turns (fully closed) of both fans, the outdoor air intake and exhaust.

Follow this procedure:

1. Loosen the belt, by loosening the nut and tensor bolt **-A-**.
2. Loosen the set bolts **-B-** to release the mobile rim **-C-**.
3. Turn the mobile rim **-C-** clockwise on the thread of the fixed core until reaching the limit of the fixed rim **-D-**.
4. Apply sealant to the threads of the set bolts **-B-** and fully tighten, checking that they match up to their housing in the core of the pulley.
5. Finally, tighten the belt using tensor **-A-**.





1 Start position (open 2 turns)

2 Position finally set to "0" turns (completely closed)

1.8 Maintenance

See *General dimensions, see on page 3* for measurements, accesses and minimum clearances.

Check the condition of the air filters on the air intake and exhaust sides once a month.

SIZES AND QUANTITY OF G4 (STANDARD) AND F6 / F7 (OPTIONAL) FILTERS		
Model	**Dimensions**	**Quantity**
045/060 G4 Filters (Standard)	48x330x554	8
075/090 G4 Filters (Standard)	48x365x620	8
045/060 F6/F7 Filters (Optional)	97x330x554	8
075/090 F6/F7 Filters (Optional)	97x365x620	8

Check the condition of the aluminium mesh filters inside the rain protector once a month. Wash with water and a mild detergent if required.

The motors require no maintenance.

Check the condition and tightness of the belts every two months.

1.8.1 Enthalpy wheel

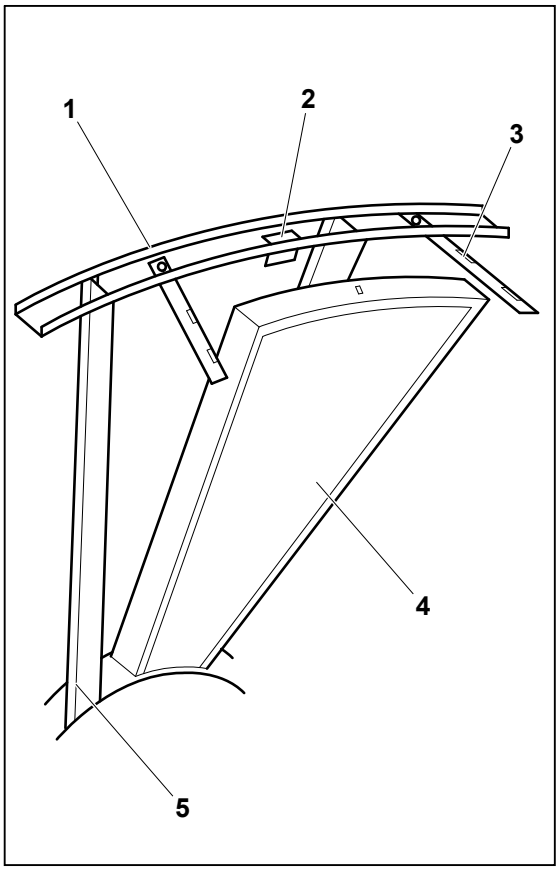
An annual inspection of the enthalpy wheel is recommended.

To do so, disconnect the power supply and open the access panels on the intake air side.

The wheel surface is divided into eight segments.

1. Wheel frame.
2. Segment fixture.
3. Segment retainer.
4. Segment.
5. Separator.

Where cleaning is required, remove the segments according to the Figure and wash with water and a mild detergent.



CAUTION

Disconnect the power supply.

To remove the segments:

1. Remove the first segment.
2. Turn the wheel slowly 180º by hand and remove the second.
3. Turn 90º and remove the third.
4. Turn 180º and remove the fourth.
5. Continue with the sequence until the eight segments have been removed.

Use the same method to refit the segments.

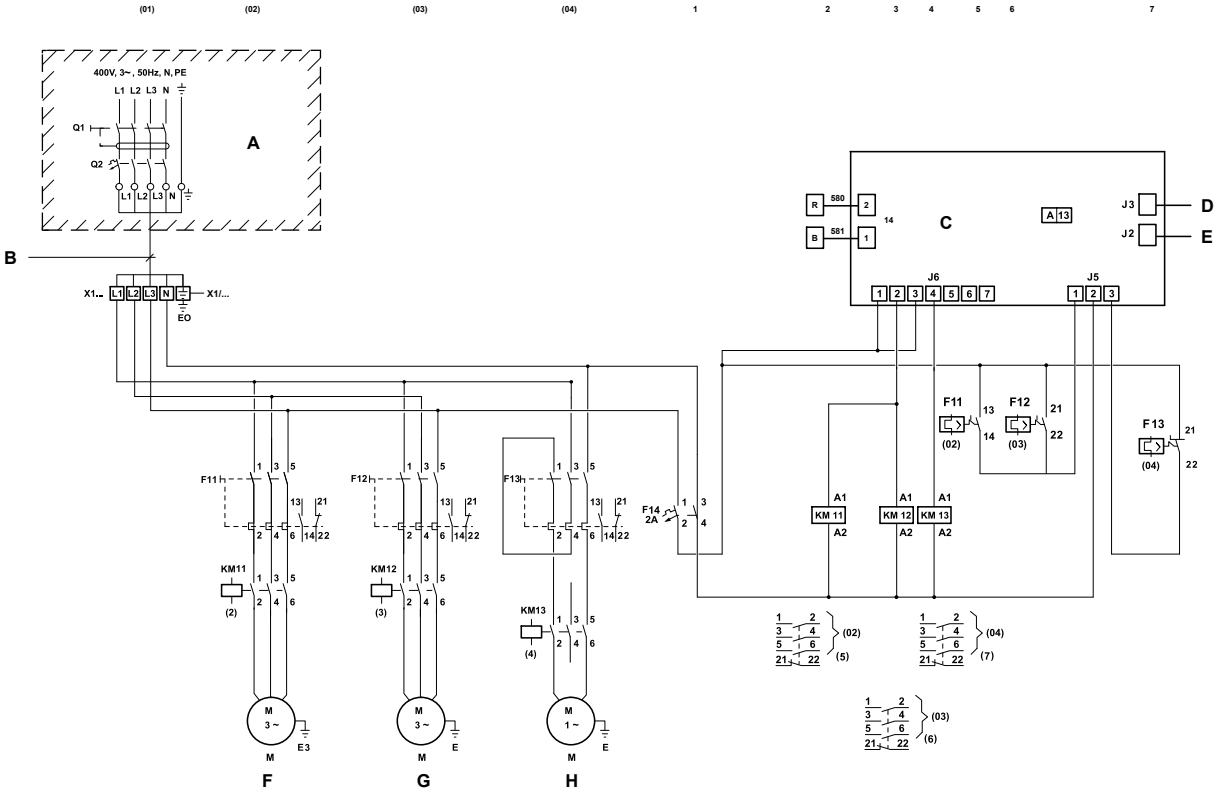
1.9 Electrical specifications

Model	Power supply	Standard rating	Rated current	Circuit breaker (1)	Minimum cable cross-section (2)
(Units)	(V.ph.Hz)	(kW)	(A)	(K Curve)	(mm^2)
045/060 Q3000	400.3.50	2.4	6	10	2.5
045/060 Q6000	400.3.50	4.6	11.6	16	2.5
075/090 Q4500	400.3.50	6.2	14.6	20	4
075/090 Q9000	400.3.50	8.2	19.2	25	4

(1) K Curve (DIN, VDE 0660-104).

(2) Based on copper conductors of the type H05 RN-F or H07 RN-F or H07 RN-F.

1.10 Wiring diagram



NOTE

- *The components for on-site installation are not supplied by the manufacturer*

A		On-site installation
B		Cross-section B [mm^2]
C		Electronic board
D	J3	
E	J2	Accessories
F	M	Exhaust fan
G	M	Renewal fan
H	M	Wheel motor

Model	Q2 [A]	Cross-section B [mm^2]	F11 [A] REG.	F12 [A] REG	F13 [A] REG
045/060 Q3000	10	5 x 2.5	3	3	1.4
045/060 Q6000	16	5 x 2.5	5.6	5.6	1.4
075/090 Q4500	20	5 x 4	7.3	7.3	1.4
075/090 Q9000	25	5 x 4	9	9	1.4

1.11 Efficiency and recovered load

1.11.1 Efficiency

Energy recovery 045/060

Recovery airflow [m^3/h]	Efficiency [%]	
	EFFL (Latent)	EFFS (Sensible)
3000	74	80
6000	65	69

Energy recovery 075/090

Recovery airflow [m^3/h]	Efficiency [%]	
	EFFL (Latent)	EFFS (Sensible)
4500	73	79
7200	63	68

1.11.2 Recovered load at sea level

Energy recovery 045/060 – Cooling mode (Summer) – Sensible recovered load at sea level

		AR-045 / 060															
		Outdoor temperature (OA) DB / WB															
		27 / 17				35 / 24				40 / 27				46 / 32			
		Airflow rate [m³/h]				Airflow rate [m³/h]				Airflow rate [m³/h]				Airflow rate [m³/h]			
		3000		6000		3000		6000		3000		6000		3000		6000	
Indoor temperature [RA]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]	
DB	WB	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**
22	17	—	3	—	5.2	7.7	9.1	13.6	16	12.9	13	22.7	22.6	26	14.1	45	30.4
	19	—		—		3.7		6.5		9		15.7		22		38	
	21	—		—		—		—		3.8		6.8		17		29	
24	17	—	1.4	—	2.5	9.3	7.6	16.4	13.2	14.5	11.4	25.5	19.9	27.5	12.8	48	27.7
	19	—		—		4.7		8.4		10		17.5		23		40	
	21	—		—		—		—		5.2		9.2		18.3		32	
	23	—		—		—		—		—		—		13.1		23	
27	17					11.4	5.2	20	9.1	16.6	9.1	29	15.7	29.5	10.8	51	23.5
	19					7.1		12.4		12.2		21.5		25		44	
	21					2.1		3.8		7.3		13		20.3		35	
	23					—		—		2.2		4		15.3		27	
	25					—		—		—		—		9.7		17	
30	17					13.5	2.9	23.8	5.1	18.6	6.7	32.7	11.7	31.4	9	55	19.5
	19					9.2		16		14.3		25		27		47	
	21					4.2		7.5		9.4		16.5		22.3		39	
	23					—		—		5.4		9.6		18.4		32	
	25					—		—		—		—		11.7		20.7	
	27					—		—		—		—		5.8		10.3	

Net sensible recovered load: Total sensible recovered load – Fan motor heat

L*	Latent
S**	Sensible
Recovered load (M)	Recovered load at sea level

Energy recovery 075/090 – Cooling mode (Summer) – Sensible recovered load at sea level

		AR-075 / 090															
		Outdoor temperature (OA) DB / WB															
		27 / 17				35 / 24				40 / 27				46 / 32			
		Airflow rate [m^3/h]				Airflow rate [m^3/h]				Airflow rate [m^3/h]				Airflow rate [m^3/h]			
		4500		7200		4500		7200		4500		7200		4500		7200	
Indoor temperature [RA]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]		Recovered load (M) Net [kW]	
DB	WB	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**	L*	S**
22	17	—	3.9	—	6	11.5	13.1	16.8	19.6	19.2	18.8	28	28	38	25.5	56	38
	19	—		—		5.5		8		13.2		19.4		32.6		48	
	21	—		—		—		—		5.7		8.4		25		37	
24	17	—	1.5	—	2.4	13.8	10.8	20.3	16.1	21.5	16.4	31.5	24.5	40.7	23.1	60	34.4
	19	—		—		7.1		10.4		14.7		21.7		34		50	
	21	—		—		—		—		7.8		11.4		27		40	
	23	—		—		—		—		—		—		19.4		28.5	
27	17					16.8	7.2	25	10.9	24.5	12.9	36	19.2	43.6	19.6	64	29
	19					10.4		15.4		18		26.5		37		55	
	21					3.2		4.7		10.8		16		30		44	
	23					—		—		3.4		5		22.6		33	
	25					—		—		—		—		14.4		21.2	
30	17					20	3.7	29	5.7	27.6	9.4	40	14.1	46.5	16.1	68	24
	19					13.6		20		21		31		40		59	
	21					6.3		9.3		14		20.5		33		48	
	23					—		—		8.1		11.8		27		40	
	25					—		—		—		—		17.4		25.6	
	27					—		—		—		—		8.7		12.7	

Net sensible recovered load: Total sensible recovered load – Fan motor heat

L*	Latent
S**	Sensible
Recovered load (M)	Recovered load at sea level

Energy recovery 045/060 – Heating mode (Winter) – Sensible recovered load at sea level

Indoor temperature (RA)	Airflow rate	Fan motor heat	Outdoor temperature (OA) DB							
DB	[m³/h]	[kW]	20	15	10	7	5	0	-5	-10
14	3000	1			3.3	5.8	7.5	11.8	16.2	20.7
	6000	1.6			5.7	10	13	20.5	28	35
17	3000	1		1.6	5.8	8.3	10	14.3	18.7	23.2
	6000	1.6		2.8	10	14.3	17.3	24.7	32.3	40
20	3000	1		4.1	8.2	10.7	12.4	16.8	21	25.7
	6000	1.6		7	14.2	18.6	21.5	29	36	44
23	3000	1	2.4	6.5	10.6	13.2	14.8	19.2	23.6	28
	6000	1.6	4.1	11.2	18.4	22.7	25.7	33	40	48
25	3000	1	4	8.1	12.2	14.8	16.5	20.8	25.2	29.7
	6000	1.6	6.9	14	21	25.5	28.4	36	43	51

NOTE

Add the fan motor heat to the sensible recovered load.

Energy recovery 075/090 – Heating mode (Winter) – Sensible recovered load at sea level

Indoor temperature (RA)	Airflow rate	Fan motor heat	Outdoor temperature (OA) DB							
DB	[m³/h]	[kW]	20	15	10	7	5	0	-5	-10
14	4500	2			4.9	8.6	11.2	17.6	24	30.7
	7200	2.8			7.3	12.8	16.5	26	35.6	45
17	4500	2		2.4	8.6	12.3	14.8	21.2	27.7	34.4
	7200	2.8		3.6	12.7	18.2	22	31.4	41	50
20	4500	2		6	12.2	15.9	18.5	24.9	31.4	38
	7200	2.8		9	18	23.6	27.3	36.8	46	56
23	4500	2	3.5	9.6	15.8	19.5	22	28.4	35	41
	7200	2.8	5.3	14.2	23.3	29	32.6	42	51.7	61
25	4500	2	6	12	18	21.9	24.4	30.8	37	44
	7200	2.8	8.8	17.7	26.8	32.4	36	45	55	65

NOTE

Add the fan motor heat to the sensible recovered load.

1.11.3 Recovered load correction factor, according to the elevation from sea level

Elevation [m]	FR
100	0.987
200	0.976
300	0.963
400	0.952
500	0.938
600	0.926
700	0.915
800	0.903
900	0.892
1000	0.884

Recovered load correction:

Recovered load (at m elevation) = Recovered load (at sea level) x FR

1.12 Tempered air (TA) and indoor coil entering air (EA) temperatures

NOTE

See the Operating diagram, see on page 4.

Calculation of the temperature of the tempered air (TA)
Cooling Mode (Summer)

DB Temperature ..... TA DB = OA DB – EFFS % X (OA DB – RA DB)
WB Temperature ..... TA WB = OA WB – EFFL % X (OA WB – RA WB)

Heating Mode (Winter)

DB Temperature ..... TA DB=OA DB + EFFS % X (RA DB – OA DB)

TA	Tempered air	DB	Dry bulb temp. [C°]
OA	Outdoor air	WB	Wet bulb temp. [C°]
RA	Return air	EFFS	Sensible efficiency (see *Efficiency, see on page 15*)
EA	Indoor coil entering air	EFFL	Latent efficiency (see *Efficiency, see on page 15*)

Calculation of the temperature of indoor coil entering air (EA)

Energy recovery 045/060

Recovery airflow m^3/h	Fresh air %					
	AR - 045 airflow m^3/h			AR - 060 airflow m^3/h		
	Minimum 7000	Nominal 8500	Maximum 10000	Minimum 9500	Nominal 11500	Maximum 13500
3000	43	35	30	32	26	22
6000	86	71	60	63	52	44

Energy recovery 075/090

Recovery airflow m^3/h	Fresh air %					
	AR - 045 airflow m^3/h			AR - 060 airflow m^3/h		
	Minimum 11500	Nominal 13500	Maximum 16000	Minimum 13000	Nominal 16000	Maximum 18000
4500	39	33	28	35	28	25
7200	63	53	45	55	45	40

Cooling Mode (Summer) and Heating Mode (Winter)

DB Temperature ..... EA DB = (RA % X RA DB) + (TA % X TA DB)

WB Temperature ..... EA WB= (RA % X RA WB) + (TA % X TA WB)

TA	Tempered air	DB	Dry bulb temp. [C°]
OA	Outdoor air	WB	Wet bulb temp. [C°]
RA	Return air	EFFS	Sensible efficiency (see *Efficiency, see on page 15*)
EA	Indoor coil entering air	EFFL	Latent efficiency (see *Efficiency, see on page 15*)

Limits in rooftop indoor coil entering air temperature

MODE	DB Temperature Minimum / Maximum [C°]	WB Temperature Minimum / Maximum [C°]
Cooling (Summer)	20 / 32	15 / 23
Heating (Winter)	10 / 25	—