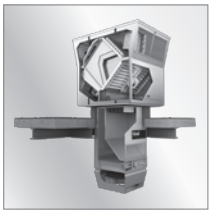
RoofVent®
Design Handbook

Hoval

Responsibility for energy and environment

Supply and Extract Air Handling Units for Heating and Cooling High Spaces

RoofVent® RH | RC | RHC | R



RoofVent® RH

Supply and extract air handling unit with energy recovery
for heating high spaces

A

1 Use

1.1 Intended use

RoofVent® RH units are supply and extract air handling units for use in tall, single-floor halls. They have the following functions:

- Fresh air supply
- Extract air removal
- Heating (with connection to a hot water supply)
- Energy recovery with highly efficient plate heat exchanger
- Filtering of the fresh air and the extract air
- Air distribution with adjustable Air-Injector

RoofVent® RH units are used in production halls, logistics centres, maintenance halls, shopping centres, sports halls, trade show halls, etc. A system usually consists of several RoofVent® units. These are installed distributed throughout the hall roof. The individual units are regulated individually and controlled based on zones. The system flexibly adjusts to local requirements.

RoofVent® RH units comply with all the requirements of the Ecodesign Directive relating to environmentally friendly design of ventilation systems. They are systems of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Intended use also includes compliance with the operating instructions.
Any usage over and above this use is considered to be not as intended. The manufacturer can accept no liability for damage resulting from improper use.

1.2 User group

The units are only allowed to be installed, operated and maintained by authorised and instructed personnel who are well acquainted with the units and are informed about possible dangers.

The operating instructions are for operating engineers and technicians as well as specialists in building, heating and ventilation technology.

2 Construction and operation

2.1 Construction

The RoofVent® RH unit consists of the following components:

Roof unit with energy recovery
Self-supporting casing for mounting on the roof frame; the double-shell design guarantees good thermal insulation and high stability.

Below-roof unit
The below-roof unit comprises the following components:

- Connection module:
  Available in 4 lengths per unit size for adapting the unit to local installation conditions
- Heating section:
  For heating the supply air
- Air-Injector:
  Patented, automatically adjustable vortex air distributor for draught-free air distribution over a large area

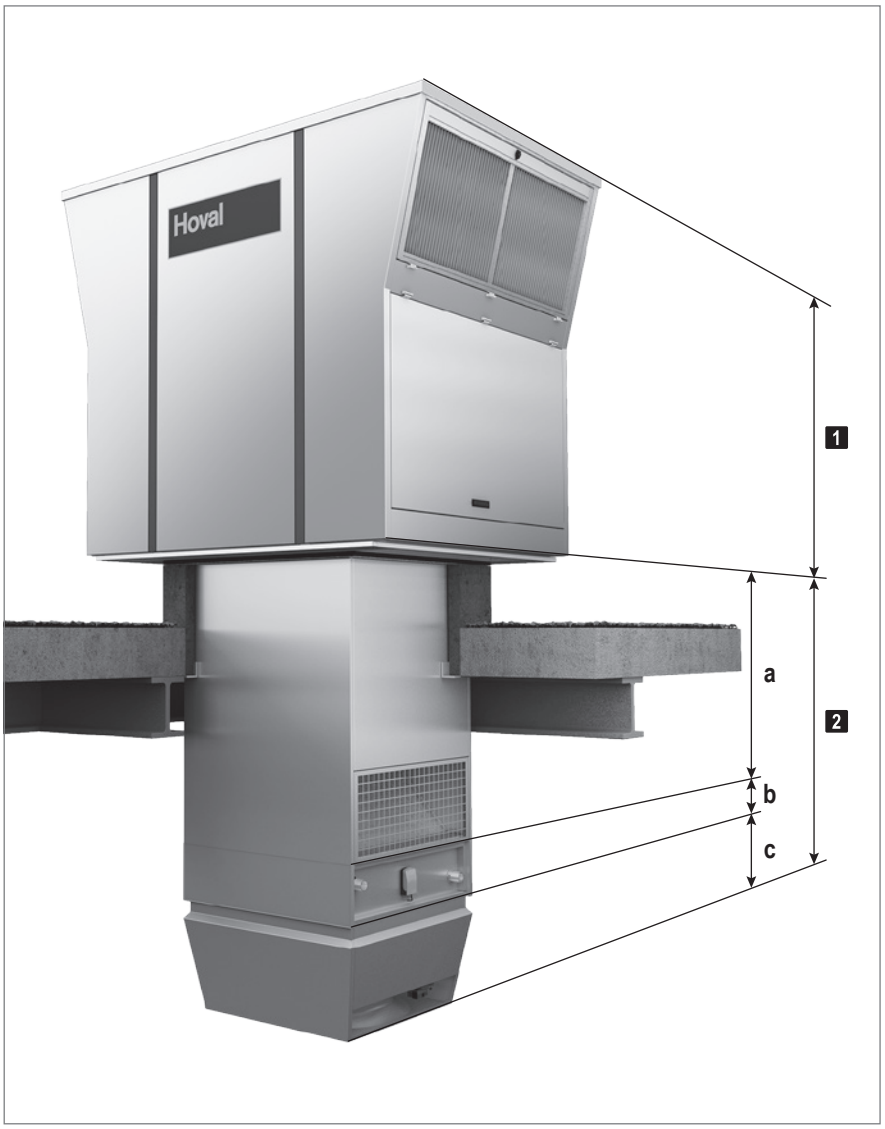
The components are bolted together and can be dismantled. The connections of the coil are located under the extract air grille as standard. The heating section can also be mounted on the connection module turned round.

Thanks to their high capability and efficient air distribution, RoofVent® units cover a large area. Therefore, compared to other systems, fewer units are needed to achieve the required conditions. Various units sizes and versions as well as a range of optional equipment offer great flexibility in adjustment to the specific project.

2.2 Air distribution with the Air-Injector

The patented air distributor – called the Air-Injector – is the core element. The air discharge angle is set by means of the infinitely variable guide vanes. It depends on the air flow rate, the mounting height and the temperature difference between the supply air and room air. The air is therefore blown into the room vertically downward, conically or horizontally. This ensures that:

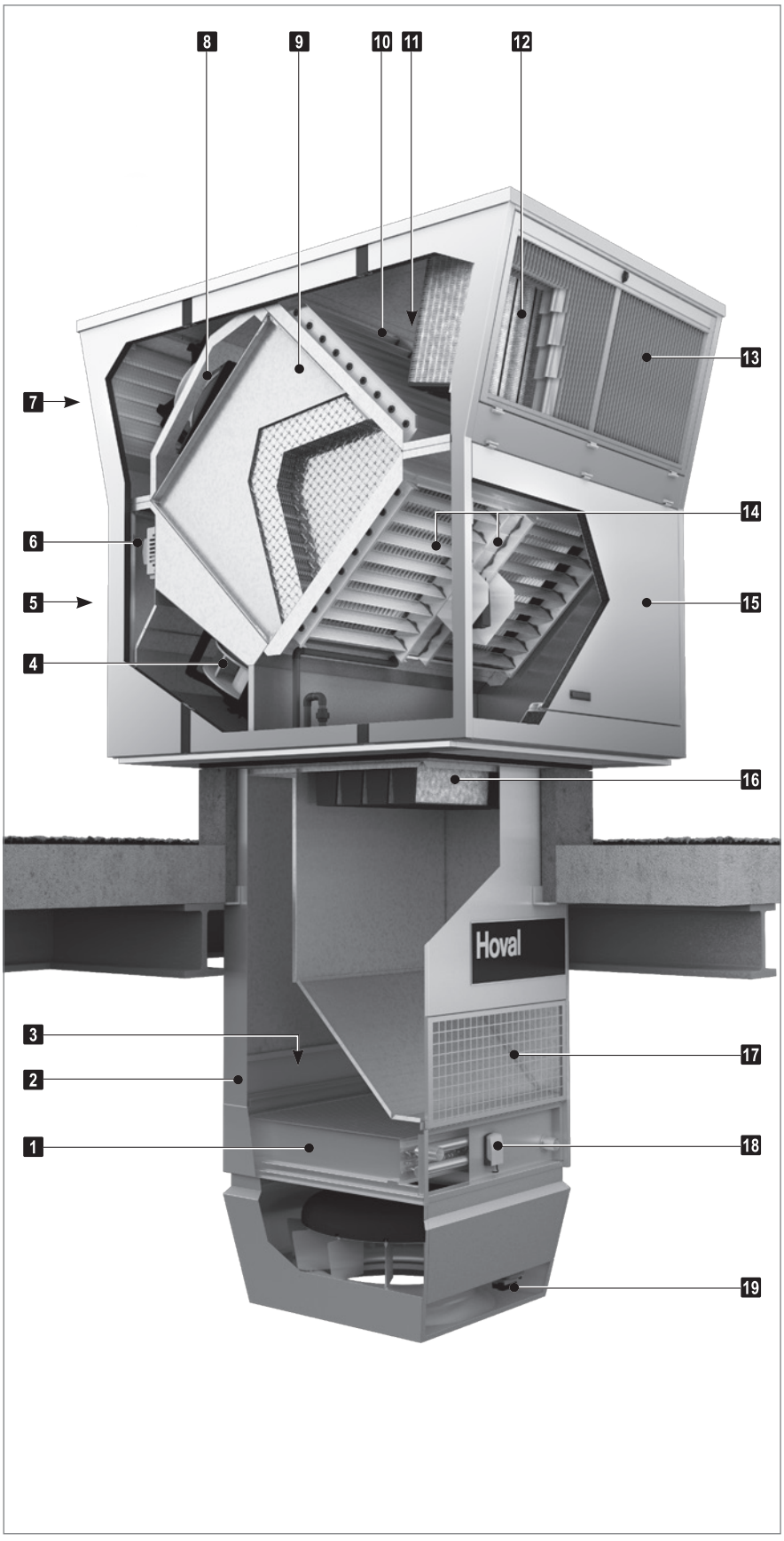
- with each RoofVent® unit a large area of the hall can be reached,
- the occupied area is draught-free,
- the temperature stratification in the room is reduced, thus saving energy.



1 Roof unit with energy recovery

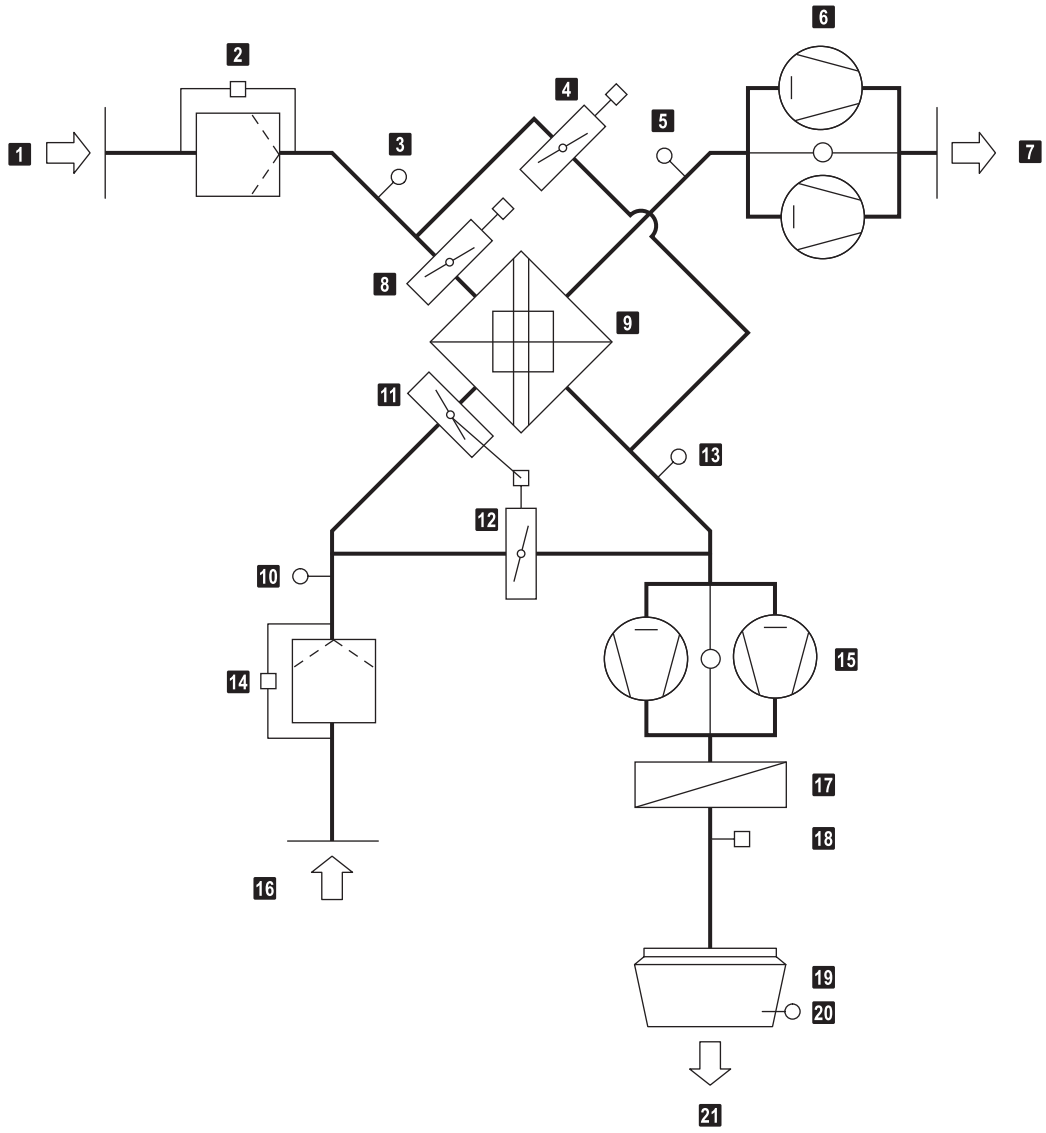
2 Below-roof unit
- **a** Connection module
- **b** Heating section
- **c** Air-Injector

Fig. A1: Components of the RoofVent® RH



1 Heating coil
2 Access panel, coil
3 Access panel, connection box
4 Supply air fans
5 Supply air access door
6 Control block
7 Exhaust air access door
8 Exhaust air fans
9 Plate heat exchanger with bypass (for performance control and as recirculation bypass)
10 Fresh air damper with actuator
11 Bypass damper with actuator
12 Fresh air filter
13 Fresh air access door
14 Extract air and recirculation dampers with actuator
15 Extract air access door
16 Extract air filter
17 Extract air grille
18 Frost controller
19 Actuator of the Air-Injector

Fig. A2: Structure of the RoofVent® RH



1	Fresh air	12	Recirculation damper (opposed to the extract air damper)
2	Fresh air filter with differential pressure switch	13	Temperature sensor air outlet ER (optional)
3	Temperature sensor air inlet ER (optional)	14	Extract air filter with differential pressure switch
4	Bypass damper with actuator	15	Supply air fans with flow rate monitoring
5	Exhaust air temperature sensor	16	Extract air
6	Exhaust air fans with flow rate monitoring	17	Heating coil
7	Exhaust air	18	Frost controller
8	Fresh air damper with actuator	19	Air-Injector with actuator
9	Plate heat exchanger	20	Supply air sensor
10	Extract air temperature sensor	21	Supply air
11	Extract air damper with actuator		

Fig. A3: Function diagram for RoofVent® RH

2.3 Operating modes

The RoofVent® RH has the following operating modes:

- Ventilation
- Ventilation (reduced)
- Air quality
- Recirculation
- Exhaust air
- Supply air
- Standby
- Forced heating

The TopTronic® C control system regulates these operating modes automatically for each control zone in accordance with the specifications in the calendar. The following points also apply:

- The operating mode of a control zone can be switched over manually.
- Each RoofVent® unit can operate individually in a local operating mode: Off, Recirculation, Supply air, Exhaust air, Ventilation.

You will find a detailed description of the TopTronic® C control system in section G 'Control systems' of this handbook.

Code	Operating mode	Description
VE	**Ventilation** The unit blows fresh air into the room and exhausts polluted room air. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating ..... 0-100 % *) Adjustable flow rate
VEL	**Ventilation (reduced)** As VE, but the unit only operates with the set minimum values for the supply and exhaust air volumes	Supply air fan ..... MIN Exhaust air fan ..... MIN Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating ..... 0-100 %
AQ	**Air quality** This is the operating mode for demand-controlled ventilation of the room. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating Depending on the room air quality, the system operates in one of the following operating states:	
AQ_REC	■ Air quality Recirculation: When air quality is good, the unit heats the room in recirculation operation.	Like REC
AQ_ECO	■ Air quality Mixed air: When ventilation requirements are medium, the unit heats in mixed air operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... 50 % Recirculation damper ..... 50 % Heating ..... 0-100 %
AQ_VE	■ Air quality Ventilation: When ventilation requirements are high, the unit heats in pure ventilation operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating ..... 0-100 %

Code	Operating mode	Description
REC	**Recirculation** On/Off recirculation operation with TempTronic algorithm: during heat demand, the unit draws in room air, heats it and blows it back into the room. The room temperature set value day is active. The flow rate is controlled in 2 stages.	Supply air fan ..... 0 / Speed 1 / Speed 2 *) Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... on *) *) Depending on heat demand
EA	**Exhaust air** The unit extracts spent room air. There is no room temperature control. Unfiltered fresh air enters the room through open windows and doors or another system provides air supply.	Supply air fan ..... Off Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating ..... off *) Adjustable flow rate
SA	**Supply air** The unit blows fresh air into the room. The room temperature set value day is active. Depending on the temperature conditions, the system controls the heating. Spent room air passes through open windows and doors or another system provides extraction.	Supply air fan ..... on *) Exhaust air fan ..... off Energy recovery ..... 0 % **) Extract air damper ..... open Recirculation damper ..... closed Heating ..... 0-100 % *) Adjustable flow rate **) Fresh air and bypass dampers are open
ST	**Standby** The unit is normally switched off. The following functions remain active:	
CPR	■ Cooling protection: If the room temperature drops below the set value for cooling protection, the unit heats up the room in recirculation operation.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... on
NCS	■ Night cooling: If the room temperature exceeds the set value for night cooling and the current fresh air temperature permits it, the unit blows cool fresh air into the room and extracts warmer room air.	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating ..... off *) Adjustable flow rate
L_OFF	**Off** (local operating mode) The unit is switched off. Frost protection remains active.	Supply air fan ..... Off Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... off
–	**Forced heating** The unit draws in room air, warms it and blows it back into the room. Forced heating is activated by inserting a wire jumper in the control block. For example, it is suitable for heating the hall before taking the control system into operation or if the controller fails during the heating period. Connecting a room thermostat makes it possible to specify a room temperature set value.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... on

Table A1: Operating modes of the RoofVent® RH

3 Technical data

3.1 Unit type reference

RH - 6 B - - ...

Unit type
RoofVent® RH

Unit size
6 or 9

Heating section
B with coil type B
C with coil type C
D with coil type D

Further options
See section E 'Options'

Table A2: Unit type reference

3.2 Application limits

Extract air temperature		max.	50	°C
Extract air relative humidity		max.	60	%
Moisture content of extract air		max.	12.5	g/kg
Fresh air temperature		min.	-30	°C
Temperature of the heating medium [1)]		max.	90	°C
Pressure of the heating medium		max.	800	kPa
Supply air temperature		max.	60	°C
Air flow rate	Size 6: Size 9:	min. min.	3100 5000	m³/h m³/h

1) Design for higher temperatures on request

Table A3: Application limits

Notice
Use units in the design for high extract air humidity if the humidity in the room increases by more than 2 g/kg (see section E 'Options').

3.3 Heat recovery system (HRS)

Unit type		RH-6	RH-9
Temperature efficiency, dry	%	77	78
Temperature efficiency, wet	%	89	90

Table A4: Thermal transfer level of the plate heat exchanger

3.4 Air filtration

Filter	Fresh air	Extract air
Class acc. to ISO 16890	ePM_1 55 %	ePM_{10} 65 %
Class acc. to EN 779	F7	M5
Factory setting of differential pressure switches	250 Pa	250 Pa

Table A5: Air filtration

3.5 Flow rate, product parameters

Unit type			RH-6		RH-9		
Nominal air flow rate		m^3/h	5500		8000		
		m^3/s	1.53		2.22		
Floor area reached		m^2	480		797		
Specific fan power SFP_{int}		W/(m^3/s)	920		940		
Face velocity		m/s	2.69		2.98		
Static efficiency of the fans		%	62		63		
Internal pressure drop of ventilation components							
	Fresh air/supply air	Pa	270		268		
	Extract air/exhaust air	Pa	300		316		
Maximum leakage rate							
	External	%	0.45		0.25		
	Internal	%	1.50		1.20		
Coil type			**B**	**C**	**B**	**C**	**D**
Nominal external pressure							
	Supply air	Pa	220	180	300	260	230
	Extract air	Pa	190	190	300	300	300
Effective electric power input		kW	2.01	2.09	3.10	3.24	3.34

Table A6: Technical data of the RoofVent® RH

3.6 Heat output

Notice
The performance data listed here applies to the most frequent design conditions. Use the selection program 'HK-Select' to calculate the performance data for other design data. You can download 'HK-Select' free of charge on the Internet.

Heating medium temperature			80/60 °C						60/40 °C					
Unit		t_F	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W
Size	Type	°C	kW	kW	m	°C	kPa	l/h	kW	kW	m	°C	kPa	l/h
RH-6	B	-5	47.4	40.5	11.4	39.9	13	2038	28.6	21.7	15.3	29.7	5	1231
		-15	49.1	38.5	11.7	38.8	14	2108	30.3	19.7	16.0	28.7	5	1300
	C	-5	76.2	69.3	9.0	55.4	15	3273	47.5	40.5	11.4	39.9	6	2040
		-15	78.7	68.2	9.0	54.8	16	3383	50.0	39.5	11.6	39.3	6	2150
RH-9	B	-5	68.9	59.5	11.7	40.1	10	2962	40.9	31.5	15.8	29.7	3	1758
		-15	71.2	56.8	12.0	39.1	10	3059	43.2	28.8	16.4	28.7	4	1856
	C	-5	113.1	103.7	9.1	56.5	14	4860	70.2	60.7	11.6	40.6	5	3014
		-15	116.8	102.4	9.2	56.0	15	5017	73.8	59.5	11.7	40.1	6	3172
	D	-5	–	–	–	–	–	–	86.7	77.3	10.4	46.7	5	3725
		-15	–	–	–	–	–	–	91.0	76.6	10.5	46.4	6	3908

Legend:
Type = Type of coil
t_F = Fresh air temperature
Q = Coil heat output
Q_{TG} = Output to cover fabric heat losses
H_{max} = Maximum mounting height
t_S = Supply air temperature
Δp_W = Water pressure drop
m_W = Water quantity

Reference: Room air 18 °C, extract air 20 °C / 20 % rel. humidity

– These operating conditions are not permissible, because the maximum supply air temperature of 60 °C is exceeded.

Table A7: Heat output of the RoofVent® RH

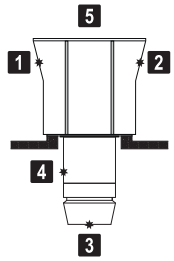
Notice
The output for coverage of the fabric heat losses (Q_{TG}) allows for the ventilation heat requirement (Q_V) and the energy recovery output (Q_{ER}) under the respective air conditions. The following applies:

$$Q + Q_{ER} = Q_V + Q_{TG}$$

3.7 Sound data

Operating mode				VE				REC
Item				1	2	3	4	5
RH-6	Sound pressure level (at a distance of 5 m) [1]		dB(A)	43	56	51	44	51
	Total sound power level		dB(A)	65	78	73	66	73
	Octave sound power level	63 Hz	dB(A)	43	46	44	43	44
		125 Hz	dB(A)	54	61	59	54	59
		250 Hz	dB(A)	59	67	63	60	63
		500 Hz	dB(A)	61	71	67	62	67
		1000 Hz	dB(A)	56	74	69	57	69
		2000 Hz	dB(A)	54	70	64	55	64
		4000 Hz	dB(A)	51	66	60	51	60
		8000 Hz	dB(A)	49	64	58	49	58
RH-9	Sound pressure level (at a distance of 5 m) [1]		dB(A)	42	55	50	42	50
	Total sound power level		dB(A)	63	77	72	64	72
	Octave sound power level	63 Hz	dB(A)	42	45	42	42	42
		125 Hz	dB(A)	54	62	59	54	59
		250 Hz	dB(A)	56	65	61	57	61
		500 Hz	dB(A)	58	70	65	59	65
		1000 Hz	dB(A)	55	73	68	56	68
		2000 Hz	dB(A)	54	70	65	55	65
		4000 Hz	dB(A)	48	64	58	48	58
		8000 Hz	dB(A)	41	59	52	42	52

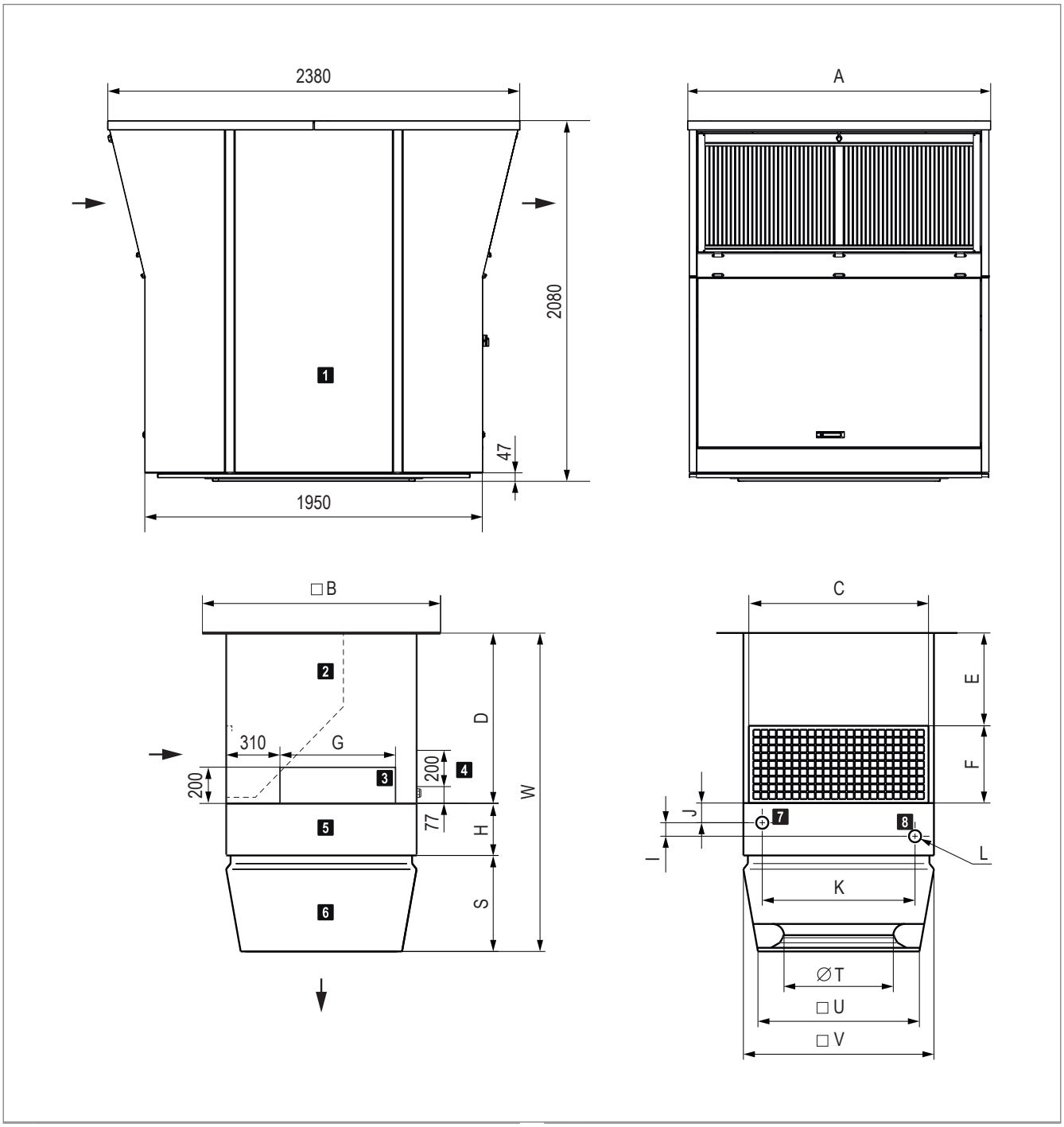
1) with hemispherical radiation in a low-reflection environment



1 Fresh air
2 Exhaust air
3 Supply air
4 Extract air
5 Outdoors (roof unit)

Table A8: Sound data of the RoofVent® RH

3.8 Dimensions and weights



1	Roof unit with energy recovery	5	Heating section
2	Connection module	6	Air-Injector
3	Access panel, coil	7	Return
4	Access panel, connection box	8	Flow

Fig. A4: Dimensional drawing for RoofVent® RH (dimensions in mm)

Unit type		RH-6				RH-9			
A	mm	1400				1750			
B	mm	1040				1240			
C	mm	848				1048			
F	mm	410				450			
G	mm	470				670			
H	mm	270				300			
S	mm	490				570			
T	mm	500				630			
U	mm	767				937			
V	mm	900				1100			
Connection module		**V0**	**V1**	**V2**	**V3**	**V0**	**V1**	**V2**	**V3**
D	mm	940	1190	1440	1940	980	1230	1480	1980
E	mm	530	780	1030	1530	530	780	1030	1530
W	mm	1700	1950	2200	2700	1850	2100	2350	2850

Table A9: Dimensions of the RoofVent® RH

Unit type		RH-6B	RH-6C	RH-9B	RH-9C	RH-9D
I	mm	78	78	78	78	95
J	mm	101	101	111	111	102
K	mm	758	758	882	882	882
L (internal thread)	"	Rp 1¼	Rp 1¼	Rp 1½	Rp 1½	Rp 2
Water content of the coil	l	3.1	6.2	4.7	9.4	14.2

Table A10: Dimensions for hydraulic connection

Unit type		RH-6B	RH-6C	RH-9B	RH-9C	RH-9D
Total	**kg**	**842**	**849**	**1094**	**1104**	**1123**
Roof unit	kg	700	700	900	900	900
Below-roof unit	kg	142	149	194	204	223
Air-Injector	kg	37	37	56	56	56
Heating section	kg	30	37	44	54	73
Connection module V0	kg	75		94		
Additional weight V1	kg	+ 11		+ 13		
Additional weight V2	kg	+ 22		+ 26		
Additional weight V3	kg	+ 44		+ 52		

Table A11: Weights of the RoofVent® RH

4 Specification texts

4.1 RoofVent® RH

Supply and extract air handling unit with energy recovery for heating high spaces
The unit consists of the following components:
- Roof unit with energy recovery
- Below-roof unit:
  - Connection module
  - Heating section
  - Air-Injector
- Control components
- Optional components

The RoofVent® RH unit complies with all the requirements of the Ecodesign Directive 2009/125/EC relating to environmentally friendly design of ventilation systems. It is a system of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Roof unit with energy recovery

Self-supporting housing, made of aluminium (outside) and aluzinc sheet and aluminium (inside):
- Weatherproof, corrosion resistant, impact resistant, air-tight
- Low flammability, double-shelled, without heat bridges, with highly efficient insulation made of closed-pore polyurethane
- Hygienic and easy to maintain because of smooth interior surfaces and large access doors with ageing-resistant, silicone-free sealing materials

The roof unit with energy recovery includes:

Supply air and exhaust air fans:
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motor, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; inflow nozzle with optimised flow; infinitely variable speed; with active pressure registration for constant volumetric flow control and/or demand-controlled volumetric flow adjustment; low-noise; with integrated overload protection.

Fresh air filter:
Designed as highly efficient compact filter elements, class F7 (ISO ePM_1 55 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Extract air filter:
Designed as highly efficient compact filter elements, class M5 (ISO ePM_{10} 65 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Plate heat exchanger:
Cross-flow plate heat exchanger made of high-quality aluminium as a highly efficient, recuperative heat recovery system, certified by Eurovent, zero-maintenance, without moving parts, failsafe, hygienically harmless, no cross-contamination of impurities and odours. Equipped with bypass, recirculation bypass, condensate drain and condensation trap to the roof. The following dampers are arranged on the exchanger package:
- Fresh air and bypass dampers, each with their own actuator, for infinitely variable control of the heat recovery; with shut-off function by spring return.
- Extract air and recirculation dampers, interlinked in a counter-rotating arrangement with a common actuator, for controlling the recirculation and mixed air operation; with shut-off function by spring return.

All dampers correspond to seal integrity class 2 according to EN 1751.

Access openings:
- Fresh air access door: large access opening with integrated weather and bird protection, configured with quick locking system for easy access to the fresh air filter, the plate heat exchanger as well as the fresh air and bypass dampers.
- Exhaust air access door: large, lockable access opening with integrated weather and bird protection for easy access to the exhaust air filter.
- Extract air access door: large access opening, configured with quick locking system and telescopic support for easy access to the extract air filter, the plate heat exchanger, the condensation trap as well as the extract air and recirculation dampers.
- Supply air access door: large, lockable access opening, configured with telescopic support for easy access to the supply air fans, the control block and the condensate collecting channel.

Control block:
Compact design on an easily accessible mounting plate, comprising:
- Unit controller as part of the TopTronic® C control system:
  - Fully wired to the electrical components of the roof unit (fans, actuators, temperature sensors, filter monitoring, differential pressure sensor)
  - Pluggable wiring to the control box in the connection module

- High-voltage section:
  - Mains power terminals
  - Isolation switch
  - Button for stopping the fans during filter change
- Low-voltage section:
  - Transformer for actuators, sensors and the unit controller
  - Externally switchable forced heating
  - Externally switchable forced off
- Circuit board with further electronic components for unit control (differential pressure measurement, fuses for the transformer, fuses for low voltage, ...)

Connection module

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of smooth interior surfaces and ageing-resistant, silicone-free sealing materials; configured with extract air grille and access panel for easy access to the coil for maintenance. The connection module contains:

- Laced wiring harness protected in a sheet metal duct, with direct plug connection to the control block in the roof unit
- Connection box made of galvanised sheet steel, configured with circuit board, screw-on cover and cable lead-ins with splash water protection and strain relief; for connection of:
  - Power supply
  - Zone bus
  - All sensors and actuators of the below-roof unit (ready-to-connect): frost controller, supply air temperature sensor, Air-Injector actuator
  - Peripheral components (e.g. mixing valves, pumps, …)
  - Optional components as required

Connection module V1 / V2 / V3:

The connection module is extended for adapting to the local installation situation.

Heating section

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials. The heating section contains:

- The highly efficient heating coil consisting of seamless copper pipes with pressed-on, optimised and profiled aluminium fins and manifolds made of copper; for connection to the hot water supply
- Frost controller

Air-Injector

1 Air-Injector

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor

2 Air-Injectors

2x Air-Injectors, supplied loose; supply air duct for connecting the RoofVent® unit to the Air-Injectors on site. Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor (supplied in the connection module)

Without Air-Injector

Unit configured without vortex air distributor for connection to an on-site supply air duct and air distribution within the building, supply air temperature sensor supplied in the connection module.

Options for the unit

Oil-proof design:

- Oil-proof materials
- Special extract air filter for oil and dust separation in the connection module, class M5 (ISO ePM$_{10}$ 50 %)
- Plate heat exchanger additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Connection module in oil-tight design with integrated oil/condensate drip tray and drain connection

Design for high extract air humidity:

- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Plate heat exchanger with condensate separator; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection

Corrosion-protected design:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger for high corrosion resistance; additionally sealed; leak test according to works standard
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Corrosion-protected design for high extract air humidity:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger with condensate separator for high corrosion resistance; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Paint finish of below-roof unit:
Choice of external paint finish in RAL colour

Fresh air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and acoustic insulation lining, for reducing sound emissions on the fresh air side, insertion loss _____ dB

Exhaust air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and easily accessible sound attenuation splitters, optimised flow, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover for reducing sound emissions on the exhaust air side, insertion loss _____ dB

Supply air and extract air silencer:
Supply air silencer configured as separated component in the below-roof unit, flow-optimised sound attenuation splitters, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover, extract air silencer configured as acoustic insulation lining in the connection module, for reducing sound emission in the room, insertion loss supply air/extract air _____ dB / _____ dB

Hydraulic assembly diverting system:
Prefabricated assembly for hydraulic diverting system, consisting of mixing valve with modulating rotary actuator, regulating valve, ball valve, automatic air vent and screw connections for connection to the unit and to the distributor circuit; sized for the coil in the unit and the Hoval TopTronic® C control system.

Mixing valves:
Mixing valve with modulating rotary actuator, sized for the coil in the unit.

Socket:
230 V socket installed in the control block for simple supply of external, electrical units.

Energy monitoring:
Consisting of 2 additional temperature sensors for recording the air inlet and air outlet temperatures of the plate heat exchanger. Energy monitoring makes it possible to display the energy saved by heat and cool recovery.

Pump control for mixing or injection system:
Electrical components for controlling a mixing or injection circuit in the load circuit.

Return temperature sensor:
Temperature sensor for monitoring the heating medium. If necessary, it triggers frost pre-control at the heating valve to prevent the system possibly being shut down due to frost.

4.2 TopTronic® C control systems

Freely configurable, zone-based control system ex-works for operation of decentralised Hoval indoor climate systems with optimised use of energy, suitable for demand-driven control of overall systems comprising up to 64 control zones each with up to 15 supply and extract air handling units or supply air units and 10 recirculation units.

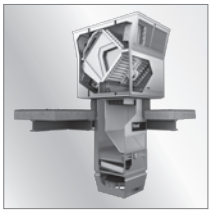
System structure:
- Unit controller: installed in the particular indoor climate unit
- Zone bus: as serial connection of all unit controllers in one control zone with the zone controller; with robust bus protocol via shielded and twisted-pair bus line (bus cables provided by the client)
- Zone control panel with:
  - System operator terminal
  - Fresh air temperature sensor
  - Zone controllers and room air temperature sensors
  - All components for the electrical power supply and protection
- System bus (Ethernet): for connecting all zone controllers to one another and to the system operator terminal (bus cables provided by the client)

Operation:
- TopTronic® C-ST as system operator terminal: touch panel for visualisation and control by web browser via HTML interface, including software for LAN access
- TopTronic® C-ZT as zone operator terminal: for simple on-site operation of a control zone (optional)
- Manual operating selector switch (optional)
- Manual operating selector button (optional)
- Operating of the units via building management system via standardised interfaces (optional):
  - BACnet
  - Modbus IP
  - Modbus RTU

Control functions:
- Control of the supply air temperature using room supply air cascade control via sequential control of the energy recovery and the coils (depending on the unit type)
- Demand-driven control of the room air quality by variation of the supply air and exhaust air volume flows with minimum and maximum limit (for supply and extract air handling units, optional)
- Control of the unit including the air distribution according to the specifications of the zone controller

Alarms, protection:
- Central alarm management with registration of all alarms (timestamp, priority, status) in an alarm list and alarm memory of the last 50 alarms; forwarding via e-mail can be set in the parameters.
- If there is a failure of communication, bus stations, sensor systems or supply media, each part of the system transitions to a protection mode which safeguards operation.
- Frost protection control of the units with constrained control of protection functions to prevent coil icing (for supply air units as well as supply and extract air handling units)
- A maintenance mode implemented in the control algorithm for testing all physical data points and alarms guarantees high reliability.

Options for the zone control panel:
- Design for heating (RH, RC, RHC)
- Design for cooling (RC, RHC)
- Cooling lock switch (RC, RHC)
- Alarm lamp
- Socket
- Additional room air temperature sensors
- Combination sensor room air quality, temperature and humidity
- External sensor values
- External set values
- Load shedding input
- Operating selector switch on terminal
- Operating selector button on terminal
- Power supply for air handling unit
- Safety relay
- Control of distributor pump(s), incl. power supply (RH, RC, RHC)



RoofVent® RC

Supply and extract air handling unit with energy recovery
for heating and cooling high spaces in the 2-pipe system

B

1 Use

1.1 Intended use

RoofVent® RC units are supply and extract air handling units for use in tall, single-floor halls. They have the following functions:

- Fresh air supply
- Extract air removal
- Heating (with connection to a hot water supply)
- Cooling (with connection to a water chiller)
- Energy recovery with highly efficient plate heat exchanger
- Filtering of the fresh air and the extract air
- Air distribution with adjustable Air-Injector

RoofVent® RC units are used in production halls, logistics centres, maintenance halls, shopping centres, sports halls, trade show halls, etc. A system usually consists of several RoofVent® units. These are installed distributed throughout the hall roof. The individual units are regulated individually and controlled based on zones. The system flexibly adjusts to local requirements.

RoofVent® RC units comply with all the requirements of the Ecodesign Directive relating to environmentally friendly design of ventilation systems. They are systems of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Intended use also includes compliance with the operating instructions.
Any usage over and above this use is considered to be not as intended. The manufacturer can accept no liability for damage resulting from improper use.

1.2 User group

The units are only allowed to be installed, operated and maintained by authorised and instructed personnel who are well acquainted with the units and are informed about possible dangers.

The operating instructions are for operating engineers and technicians as well as specialists in building, heating and ventilation technology.

2 Construction and operation

2.1 Construction

The RoofVent® RC unit consists of the following components:

Roof unit with energy recovery
Self-supporting casing for mounting on the roof frame; the double-shell design guarantees good thermal insulation and high stability.

Below-roof unit
The below-roof unit comprises the following components:

- Connection module:
  Available in 4 lengths per unit size for adapting the unit to local installation conditions
- Heating/cooling section:
  For heating and cooling the supply air in the 2-pipe system
- Air-Injector:
  Patented, automatically adjustable vortex air distributor for draught-free air distribution over a large area

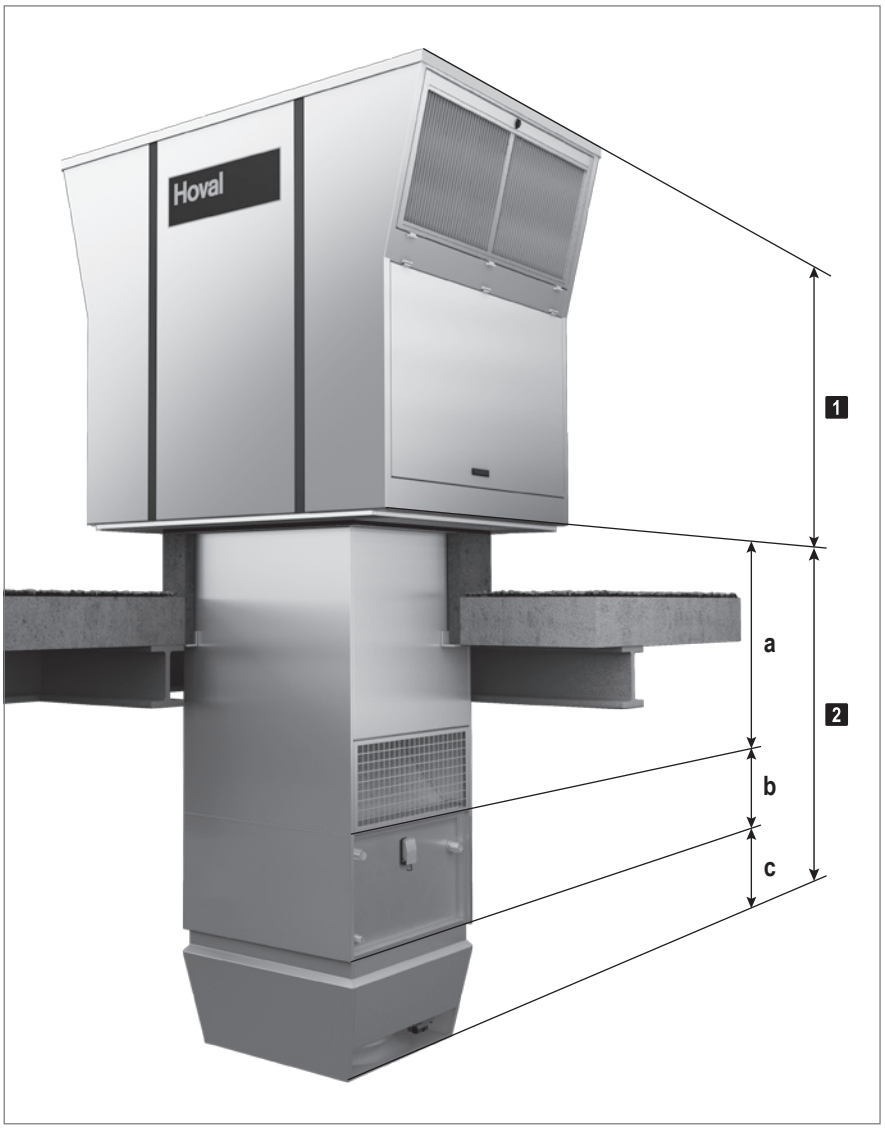
The components are bolted together and can be dismantled. The connections of the coil are located under the extract air grille as standard. The heating/cooling section can also be mounted on the connection module turned round.

Thanks to their high capability and efficient air distribution, RoofVent® units cover a large area. Therefore, compared to other systems, fewer units are needed to achieve the required conditions. Various units sizes and versions as well as a range of optional equipment offer great flexibility in adjustment to the specific project.

2.2 Air distribution with the Air-Injector

The patented air distributor – called the Air-Injector – is the core element. The air discharge angle is set by means of the infinitely variable guide vanes. It depends on the air flow rate, the mounting height and the temperature difference between the supply air and room air. The air is therefore blown into the room vertically downward, conically or horizontally. This ensures that:

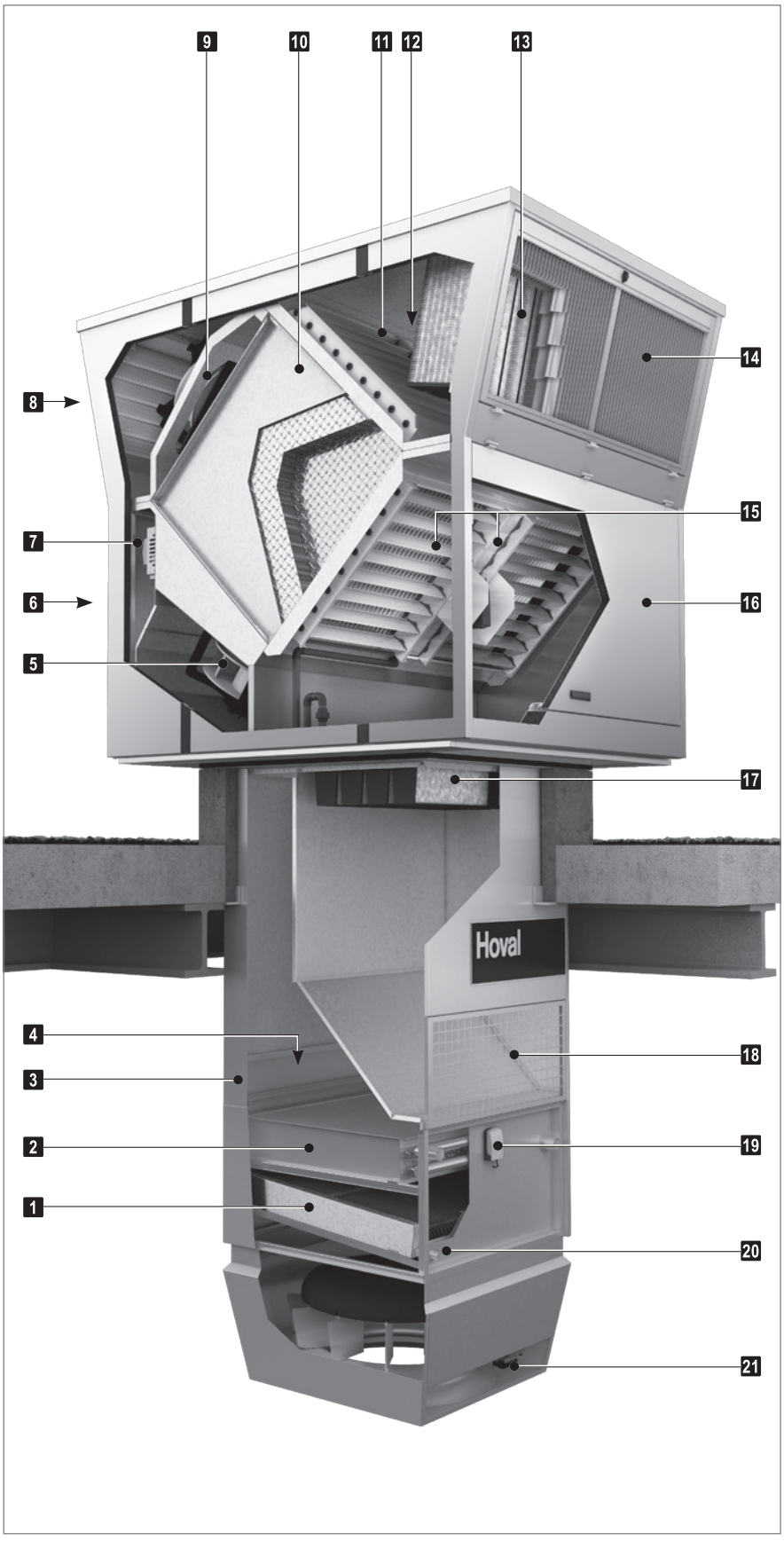
- with each RoofVent® unit a large area of the hall can be reached,
- the occupied area is draught-free,
- the temperature stratification in the room is reduced, thus saving energy.



1 Roof unit with energy recovery

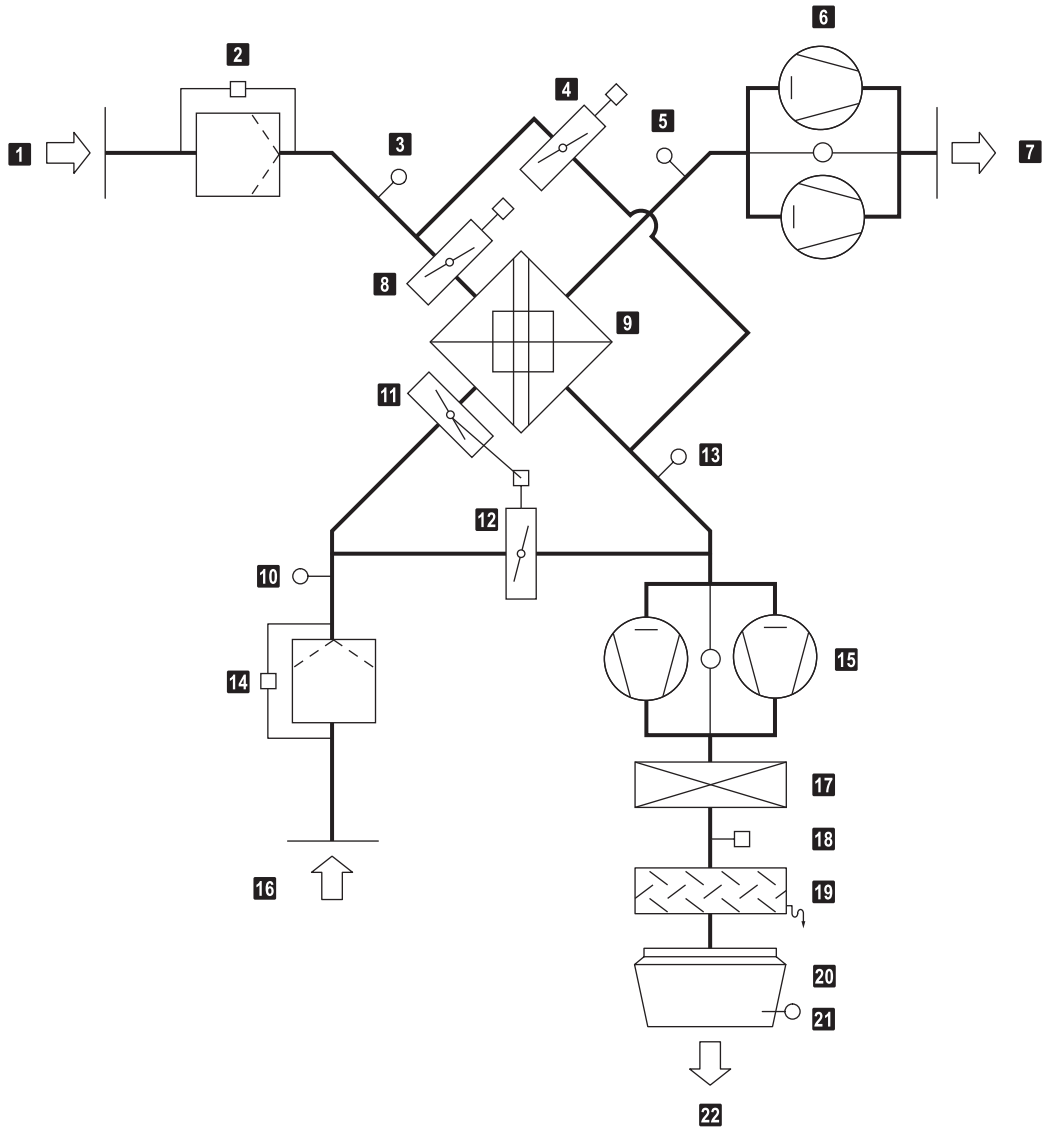
2 Below-roof unit
- **a** Connection module
- **b** Heating/cooling section
- **c** Air-Injector

Fig. B1: Components of the RoofVent® RC



1 Condensate separator
2 Heating/cooling coil
3 Access panel, coil
4 Access panel, connection box
5 Supply air fans
6 Supply air access door
7 Control block
8 Exhaust air access door
9 Exhaust air fans
10 Plate heat exchanger with bypass (for performance control and as recirculation bypass)
11 Fresh air damper with actuator
12 Bypass damper with actuator
13 Fresh air filter
14 Fresh air access door
15 Extract air and recirculation dampers with actuator
16 Extract air access door
17 Extract air filter
18 Extract air grille
19 Frost controller
20 Condensate connection
21 Actuator of the Air-Injector

Fig. B2: Structure of the RoofVent® RC



1	Fresh air	12	Recirculation damper (opposed to the extract air damper)
2	Fresh air filter with differential pressure switch	13	Temperature sensor air outlet ER (optional)
3	Temperature sensor air inlet ER (optional)	14	Extract air filter with differential pressure switch
4	Bypass damper with actuator	15	Supply air fans with flow rate monitoring
5	Exhaust air temperature sensor	16	Extract air
6	Exhaust air fans with flow rate monitoring	17	Heating/cooling coil
7	Exhaust air	18	Frost controller
8	Fresh air damper with actuator	19	Condensate separator
9	Plate heat exchanger	20	Air-Injector with actuator
10	Extract air temperature sensor	21	Supply air sensor
11	Extract air damper with actuator	22	Supply air

Fig. B3: Function diagram for RoofVent® RC

2.3 Operating modes

The RoofVent® RC has the following operating modes:

- Ventilation
- Ventilation (reduced)
- Air quality
- Recirculation
- Exhaust air
- Supply air
- Standby
- Forced heating

The TopTronic® C control system regulates these operating modes automatically for each control zone in accordance with the specifications in the calendar. The following points also apply:

- The operating mode of a control zone can be switched over manually.
- Each RoofVent® unit can operate individually in a local operating mode: Off, Recirculation, Supply air, Exhaust air, Ventilation.

You will find a detailed description of the TopTronic® C control system in section G 'Control systems' of this handbook.

Code	Operating mode	Description
VE	**Ventilation** The unit blows fresh air into the room and exhausts polluted room air. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating/cooling	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 % *) Adjustable flow rate
VEL	**Ventilation (reduced)** As VE, but the unit only operates with the set minimum values for the supply and exhaust air volumes	Supply air fan ..... MIN Exhaust air fan ..... MIN Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 %
AQ	**Air quality** This is the operating mode for demand-controlled ventilation of the room. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating/cooling Depending on the room air quality, the system operates in one of the following operating states:	
AQ_REC	■ Air quality Recirculation: When air quality is good, the unit heats or cools in recirculation operation.	Like REC
AQ_ECO	■ Air quality Mixed air: When ventilation requirements are medium, the unit heats or cools in mixed air operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... 50 % Recirculation damper ..... 50 % Heating/cooling ..... 0-100 %
AQ_VE	■ Air quality Ventilation: When ventilation requirements are high, the unit heats or cools in pure ventilation operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 %

Code	Operating mode	Description
REC	**Recirculation** On/Off recirculation operation with TempTronic algorithm: During heat or cool demand, the unit draws in room air, heats or cools it and blows it back into the room. The room temperature set value day is active. The flow rate is controlled in 2 stages.	Supply air fan ..... 0 / Speed 1 / Speed 2 *) Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... on *) *) Depending on heat or cool demand
EA	**Exhaust air** The unit extracts spent room air. There is no room temperature control. Unfiltered fresh air enters the room through open windows and doors or another system provides air supply.	Supply air fan ..... Off Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... off *) Adjustable flow rate
SA	**Supply air** The unit blows fresh air into the room. The room temperature set value day is active. Depending on the temperature conditions, the system controls the heating/cooling. Spent room air passes through open windows and doors or another system provides extraction.	Supply air fan ..... on *) Exhaust air fan ..... off Energy recovery ..... 0 % **) Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 % *) Adjustable flow rate **) Fresh air and bypass dampers are open
ST	**Standby** The unit is normally switched off. The following functions remain active:	
CPR	■ Cooling protection: If the room temperature drops below the set value for cooling protection, the unit heats up the room in recirculation operation.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... on
OPR	■ Overheating protection: If the room temperature rises above the set value for overheating protection, the unit cools down the room in recirculation operation. If the temperatures also permit fresh air cooling, the units automatically switches to night cooling (NCS) to save energy.	
NCS	■ Night cooling: If the room temperature exceeds the set value for night cooling and the current fresh air temperature permits it, the unit blows cool fresh air into the room and extracts warmer room air.	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... off *) Adjustable flow rate
L_OFF	**Off** (local operating mode) The unit is switched off. Frost protection remains active.	Supply air fan ..... Off Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... off
–	**Forced heating** The unit draws in room air, warms it and blows it back into the room. Forced heating is activated by inserting a wire jumper in the control block. For example, it is suitable for heating the hall before taking the control system into operation or if the controller fails during the heating period. Connecting a room thermostat makes it possible to specify a room temperature set value.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... on

Table B1: Operating modes of the RoofVent® RC

3 Technical data

3.1 Unit type reference

RC - 9 - C - ...

Unit type
RoofVent® RC

Unit size
6 or 9

Heating/cooling section
C with coil type C
D with coil type D

Further options
See section E 'Options'

Table B2: Unit type reference

3.2 Application limits

Extract air temperature		max.	50	°C
Extract air relative humidity		max.	60	%
Moisture content of extract air		max.	12.5	g/kg
Fresh air temperature		min.	-30	°C
Temperature of the heating medium 1)		max.	90	°C
Pressure of the heating/cooling medium		max.	800	kPa
Supply air temperature		max.	60	°C
Air flow rate	Size 6: Size 9:	min. min.	3100 5000	m³/h m³/h
Condensate quantity	Size 6: Size 9:	max. max.	90 150	kg/h kg/h

1) Design for higher temperatures on request

Table B3: Application limits

Notice
Use units in the design for high extract air humidity if the humidity in the room increases by more than 2 g/kg (see section E 'Options').

3.3 Heat recovery system (HRS)

Unit type		RC-6	RC-9
Temperature efficiency, dry	%	77	78
Temperature efficiency, wet	%	89	90

Table B4: Thermal transfer level of the plate heat exchanger

3.4 Air filtration

Filter	Fresh air	Extract air
Class acc. to ISO 16890	ePM_1 55 %	ePM_{10} 65 %
Class acc. to EN 779	F7	M5
Factory setting of differential pressure switches	250 Pa	250 Pa

Table B5: Air filtration

3.5 Flow rate, product parameters

Unit type			RC-6	RC-9	
Nominal air flow rate		m³/h	5500	8000	
		m³/s	1.53	2.22	
Floor area reached		m²	480	797	
Specific fan power SFP_{int}		W/(m³/s)	920	940	
Face velocity		m/s	2.69	2.98	
Static efficiency of the fans		%	62	63	
Internal pressure drop of ventilation components					
	Fresh air/supply air	Pa	270	268	
	Extract air/exhaust air	Pa	300	316	
Maximum leakage rate					
	External	%	0.45	0.25	
	Internal	%	1.50	1.20	
Coil type			**C**	**C**	**D**
Nominal external pressure					
	Supply air	Pa	110	220	190
	Extract air	Pa	190	300	300
Effective electric power input		kW	2.18	3.38	3.49

Table B6: Technical data of the RoofVent® RC

B

3.6 Heat output

Notice
The performance data listed here applies to the most frequent design conditions. Use the selection program 'HK-Select' to calculate the performance data for other design data. You can download 'HK-Select' free of charge on the Internet.

Heating medium temperature			80/60 °C						60/40 °C					
Unit		t_F	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W
Size	Type	°C	kW	kW	m	°C	kPa	l/h	kW	kW	m	°C	kPa	l/h
RC-6	C	-5	76.2	69.3	9.0	55.4	15	3273	47.5	40.5	11.4	39.9	6	2040
		-15	78.7	68.2	9.0	54.8	16	3383	50.0	39.5	11.6	39.3	6	2150
RC-9	C	-5	113.1	103.7	9.1	56.5	14	4860	70.2	60.7	11.6	40.6	5	3014
		-15	116.8	102.4	9.2	56.0	15	5017	73.8	59.5	11.7	40.1	6	3172
	D	-5	–	–	–	–	–	–	86.7	77.3	10.4	46.7	5	3725
		-15	–	–	–	–	–	–	91.0	76.6	10.5	46.4	6	3908

Legend:
Type = Type of coil
t_F = Fresh air temperature
Q = Coil heat output
Q_{TG} = Output to cover fabric heat losses
H_{max} = Maximum mounting height
t_S = Supply air temperature
Δp_W = Water pressure drop
m_W = Water quantity

Reference: Room air 18 °C, extract air 20 °C / 20 % rel. humidity

– These operating conditions are not permissible, because the maximum supply air temperature of 60 °C is exceeded.

Table B7: Heat output of the RoofVent® RC

Notice
The output for coverage of the fabric heat losses (Q_{TG}) allows for the ventilation heat requirement (Q_V) and the energy recovery output (Q_{ER}) under the respective air conditions. The following applies:

$$Q + Q_{ER} = Q_V + Q_{TG}$$

3.7 Cooling capacities

Cooling medium temperature				6/12 °C							8/14 °C						
Unit		t_F	RH_F	Q_{sen}	Q_{tot}	Q_{TG}	t_S	Δp_W	m_W	m_C	Q_{sen}	Q_{tot}	Q_{TG}	t_S	Δp_W	m_W	m_C
Size	Type	°C	%	kW	kW	kW	°C	kPa	l/h	kg/h	kW	kW	kW	°C	kPa	l/h	kg/h
RC-6	C	28	40	20.0	20.0	14.6	14.1	13	2862	0.0	17.7	17.7	12.3	15.4	10	2531	0.0
			60	17.6	36.8	12.2	15.4	44	5263	28.2	15.3	30.9	9.8	16.7	31	4419	22.9
		32	40	24.5	34.5	19.1	15.7	39	4943	14.7	22.2	28.6	16.8	16.9	27	4100	9.4
			60	22.1	51.6	16.7	17.0	87	7382	43.3	19.8	45.7	14.4	18.2	68	6539	38.0
R-9	C	28	40	29.0	29.0	21.3	14.1	12	4158	0.0	25.4	25.4	17.7	15.4	9	3644	0.0
			60	25.7	52.0	17.9	15.3	39	7440	38.6	22.1	43.0	14.3	16.7	27	6155	30.7
		32	40	36.0	49.6	28.2	15.5	36	7105	20.0	32.4	40.6	24.6	16.9	24	5820	12.1
			60	32.7	74.6	24.9	16.8	81	10682	61.6	29.1	65.6	21.3	18.1	63	9396	53.7
	D	28	40	35.6	39.1	27.8	11.7	14	5599	5.2	31.1	31.1	23.3	13.3	9	4449	0.0
			60	32.9	70.4	25.1	12.7	45	10079	55.1	28.4	59.8	20.6	14.3	32	8566	46.2
		32	40	44.2	66.6	36.4	12.5	40	9542	33.0	39.7	56.1	32.0	14.1	28	8029	24.0
			60	41.5	97.8	33.8	13.5	86	13999	82.6	37.0	87.2	29.3	15.1	69	12485	73.7

Legend:
- t_F = Fresh air temperature
- RH_F = Relative humidity of the fresh air
- Type = Type of coil
- Q_{sen} = Sensible cooling capacity
- Q_{tot} = Total cooling capacity
- Q_{TG} = Output for coverage of transmission sensible gains (→ sensible cooling load)
- t_S = Supply air temperature
- Δp_W = Water pressure drop
- m_W = Water quantity
- m_C = Condensate quantity

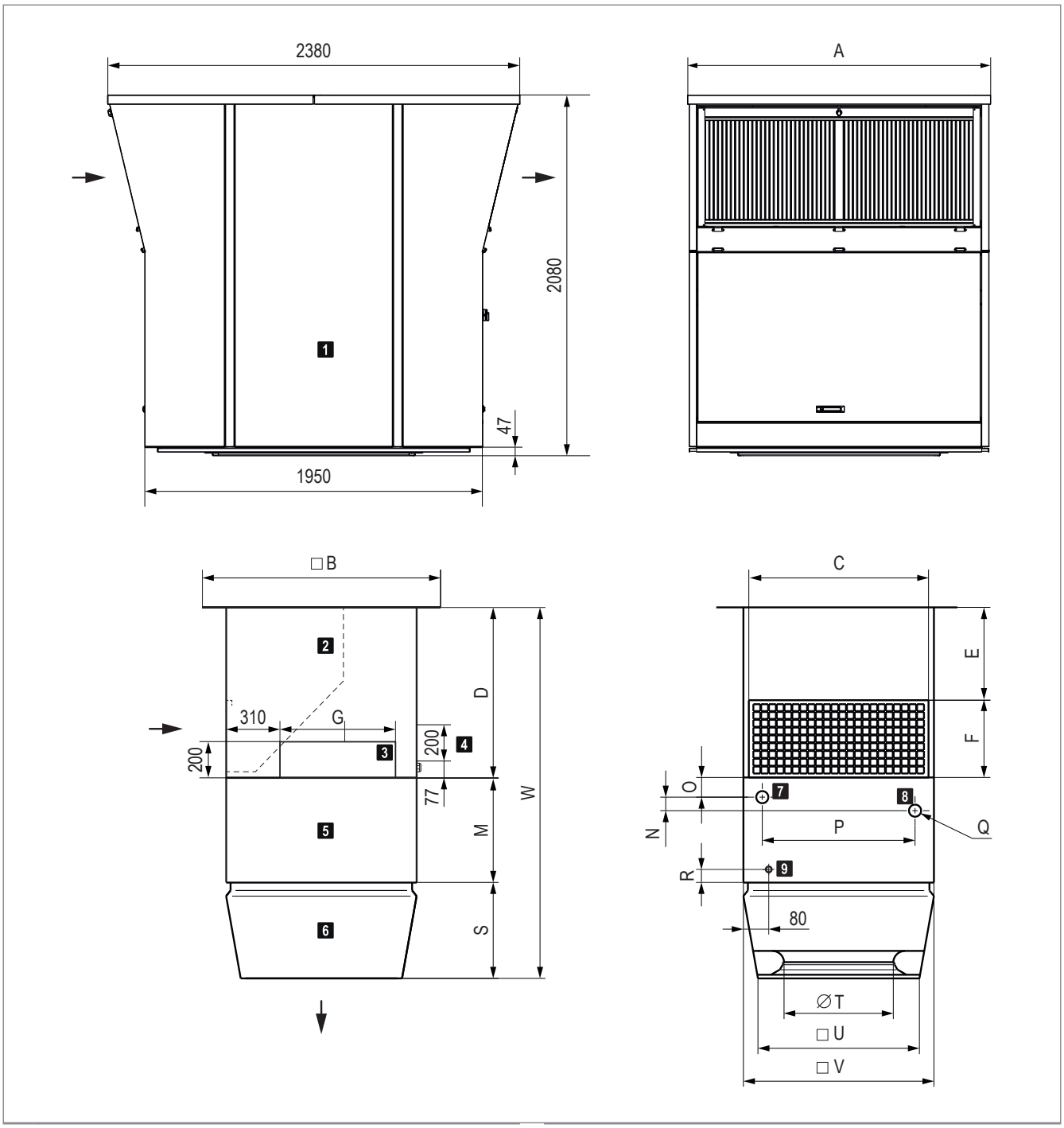
Reference:
- At fresh air temperature 28 °C: room air 22 °C, extract air 24 °C / 50 % rel. humidity
- At fresh air temperature 32 °C: room air 26 °C, extract air 28 °C / 50 % rel. humidity

Table B8: Cooling capacity of the RoofVent® RC

Notice
The output for coverage of transmission sensible gains (Q_{TG}) allows for the ventilation cooling requirement (Q_V) and the output of the energy recovery (Q_{ER}) under the respective air conditions.
The following applies:

$$Q_{sen} + Q_{ER} = Q_V + Q_{TG}$$

3.8 Dimensions and weights



1	Roof unit with energy recovery	6	Air-Injector
2	Connection module	7	Return
3	Access panel, coil	8	Flow
4	Access panel, connection box	9	Condensate connection G1" (external)
5	Heating/cooling section		

Fig. B4: Dimensional drawing for RoofVent® RC (dimensions in mm)

Unit type		RC-6				RC-9			
A	mm	1400				1750			
B	mm	1040				1240			
C	mm	848				1048			
F	mm	410				450			
G	mm	470				670			
M	mm	620				610			
S	mm	490				570			
T	mm	500				630			
U	mm	767				937			
V	mm	900				1100			
Connection module		**V0**	**V1**	**V2**	**V3**	**V0**	**V1**	**V2**	**V3**
D	mm	940	1190	1440	1940	980	1230	1480	1980
E	mm	530	780	1030	1530	530	780	1030	1530
W	mm	2050	2300	2550	3050	2160	2410	2660	3160

Table B9: Dimensions of the RoofVent® RC

Unit type		RC-6-C	RC-9-C	RC-9-D
N	mm	78	78	95
O	mm	123	92	83
P	mm	758	882	882
Q (internal thread)	"	Rp 1¼	Rp 1½	Rp 2
R	mm	54	53	53
Water content of the coil	l	6.2	9.4	14.2

Table B10: Dimensions for hydraulic connection

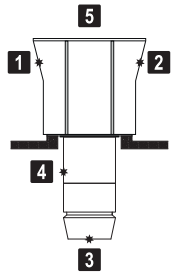
Unit type		RC-6-C	RC-9-C	RC-9-D
Total	**kg**	**882**	**1152**	**1171**
Roof unit	kg	700	900	900
Below-roof unit	kg	182	252	271
Air-Injector	kg	37	56	56
Heating/cooling section	kg	70	102	121
Connection module V0	kg	75	94	94
Additional weight V1	kg	+ 11	+ 11	+ 11
Additional weight V2	kg	+ 22	+ 22	+ 22
Additional weight V3	kg	+ 44	+ 44	+ 44

Table B11: Weights of the RoofVent® RC

3.9 Sound data

Operating mode				VE				REC
Item				1	2	3	4	5
RC-6	Sound pressure level (at a distance of 5 m) [1]		dB(A)	44	56	52	44	52
	Total sound power level		dB(A)	66	78	74	66	74
	Octave sound power level	63 Hz	dB(A)	44	46	44	44	44
		125 Hz	dB(A)	54	61	59	54	59
		250 Hz	dB(A)	60	67	64	60	64
		500 Hz	dB(A)	62	72	68	62	68
		1000 Hz	dB(A)	57	74	70	57	70
		2000 Hz	dB(A)	55	71	66	55	66
		4000 Hz	dB(A)	51	66	60	51	60
		8000 Hz	dB(A)	49	64	58	49	58
RC-9	Sound pressure level (at a distance of 5 m) [1]		dB(A)	43	55	51	42	51
	Total sound power level		dB(A)	65	77	73	64	73
	Octave sound power level	63 Hz	dB(A)	43	45	44	42	44
		125 Hz	dB(A)	54	62	60	54	60
		250 Hz	dB(A)	57	65	63	57	63
		500 Hz	dB(A)	60	70	67	59	67
		1000 Hz	dB(A)	57	73	70	56	70
		2000 Hz	dB(A)	46	70	66	55	66
		4000 Hz	dB(A)	49	64	59	48	59
		8000 Hz	dB(A)	43	59	54	42	54

1) with hemispherical radiation in a low-reflection environment



1 Fresh air
2 Exhaust air
3 Supply air
4 Extract air
5 Outdoors (roof unit)

Table B12: Sound data of the RoofVent® RC

4 Specification texts

4.1 RoofVent® RC

Supply and extract air handling unit with energy recovery for heating and cooling high spaces in the 2-pipe system.
The unit consists of the following components:
- Roof unit with energy recovery
- Below-roof unit:
  - Connection module
  - Heating/cooling section
  - Air-Injector
- Control components
- Optional components

The RoofVent® RC unit complies with all the requirements of the Ecodesign Directive 2009/125/EC relating to environmentally friendly design of ventilation systems. It is a system of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Roof unit with energy recovery

Self-supporting housing, made of aluminium (outside) and aluzinc sheet and aluminium (inside):
- Weatherproof, corrosion resistant, impact resistant, air-tight
- Low flammability, double-shelled, without heat bridges, with highly efficient insulation made of closed-pore polyurethane
- Hygienic and easy to maintain because of smooth interior surfaces and large access doors with ageing-resistant, silicone-free sealing materials

The roof unit with energy recovery includes:

Supply air and exhaust air fans:
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motor, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; inflow nozzle with optimised flow; infinitely variable speed; with active pressure registration for constant volumetric flow control and/or demand-controlled volumetric flow adjustment; low-noise; with integrated overload protection.

Fresh air filter:
Designed as highly efficient compact filter elements, class F7 (ISO ePM_1 55 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Extract air filter:
Designed as highly efficient compact filter elements, class M5 (ISO ePM_{10} 65 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Plate heat exchanger:
Cross-flow plate heat exchanger made of high-quality aluminium as a highly efficient, recuperative heat recovery system, certified by Eurovent, zero-maintenance, without moving parts, failsafe, hygienically harmless, no cross-contamination of impurities and odours. Equipped with bypass, recirculation bypass, condensate drain and condensation trap to the roof. The following dampers are arranged on the exchanger package:
- Fresh air and bypass dampers, each with their own actuator, for infinitely variable control of the heat recovery; with shut-off function by spring return.
- Extract air and recirculation dampers, interlinked in a counter-rotating arrangement with a common actuator, for controlling the recirculation and mixed air operation; with shut-off function by spring return.

All dampers correspond to seal integrity class 2 according to EN 1751.

Access openings:
- Fresh air access door: large access opening with integrated weather and bird protection, configured with quick locking system for easy access to the fresh air filter, the plate heat exchanger as well as the fresh air and bypass dampers.
- Exhaust air access door: large, lockable access opening with integrated weather and bird protection for easy access to the exhaust air filter.
- Extract air access door: large access opening, configured with quick locking system and telescopic support for easy access to the extract air filter, the plate heat exchanger, the condensation trap as well as the extract air and recirculation dampers.
- Supply air access door: large, lockable access opening, configured with telescopic support for easy access to the supply air fans, the control block and the condensate collecting channel.

Control block:
Compact design on an easily accessible mounting plate, comprising:
- Unit controller as part of the TopTronic® C control system:
  - Fully wired to the electrical components of the roof unit (fans, actuators, temperature sensors, filter monitoring, differential pressure sensor)
  - Pluggable wiring to the control box in the connection module
- High-voltage section:
  - Mains power terminals
  - Isolation switch
  - Button for stopping the fans during filter change

- Low-voltage section:
  - Transformer for actuators, sensors and the unit controller
  - Externally switchable forced heating
  - Externally switchable forced off
- Circuit board with further electronic components for unit control (differential pressure measurement, fuses for the transformer, fuses for low voltage, ...)

Connection module

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of smooth interior surfaces and ageing-resistant, silicone-free sealing materials; configured with extract air grille and access panel for easy access to the coil for maintenance. The connection module contains:

- Laced wiring harness protected in a sheet metal duct, with direct plug connection to the control block in the roof unit
- Connection box made of galvanised sheet steel, configured with circuit board, screw-on cover and cable lead-ins with splash water protection and strain relief; for connection of:
  - Power supply
  - Zone bus
  - All sensors and actuators of the below-roof unit (ready-to-connect): frost controller, supply air temperature sensor, Air-Injector actuator
  - Peripheral components (e.g. mixing valves, pumps, …)
  - Optional components as required

Connection module V1 / V2 / V3:

The connection module is extended for adapting to the local installation situation.

Heating/cooling section

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyurethane. The heating/cooling section contains:

- The highly efficient heating/cooling coil consisting of seamless copper pipes with pressed-on, optimised and profiled aluminium fins and manifolds made of copper; for connection to the hot water and cold water supply
- Frost controller
- The pull-out condensate separator with collecting channel, made of high-quality corrosion-resistant material, with a downslope in all directions for rapid draining
- The condensate trap for connecting to a condensate drain (supplied).

Air-Injector

1 Air-Injector

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyethylene, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor

2 Air-Injectors

2x Air-Injectors, supplied loose; supply air duct for connecting the RoofVent® unit to the Air-Injectors on site. Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyethylene, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor (supplied in the connection module)

Without Air-Injector

Unit configured without vortex air distributor for connection to an on-site supply air duct and air distribution within the building, supply air temperature sensor supplied in the connection module.

Options for the unit

Oil-proof design:

- Oil-proof materials
- Special extract air filter for oil and dust separation in the connection module, class M5 (ISO ePM_{10} 50 %)
- Plate heat exchanger additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Connection module in oil-tight design with integrated oil/condensate drip tray and drain connection

Design for high extract air humidity:

- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Plate heat exchanger with condensate separator; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module

- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection

Corrosion-protected design:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger for high corrosion resistance; additionally sealed; leak test according to works standard
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Corrosion-protected design for high extract air humidity:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger with condensate separator for high corrosion resistance; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Paint finish of below-roof unit:
Choice of external paint finish in RAL colour

Fresh air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and acoustic insulation lining, for reducing sound emissions on the fresh air side, insertion loss _____ dB

Exhaust air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and easily accessible sound attenuation splitters, optimised flow, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover for reducing sound emissions on the exhaust air side, insertion loss _____ dB

Supply air and extract air silencer:
Supply air silencer configured as separated component in the below-roof unit, flow-optimised sound attenuation splitters, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover, extract air silencer configured as acoustic insulation lining in the connection module, for reducing sound emission in the room, insertion loss supply air/extract air _____ dB / _____ dB

Hydraulic assembly diverting system:
Prefabricated assembly for hydraulic diverting system, consisting of mixing valve with modulating rotary actuator, regulating valve, ball valve, automatic air vent and screw connections for connection to the unit and to the distributor circuit; sized for the coil in the unit and the Hoval TopTronic® C control system.

Mixing valves:
Mixing valve with modulating rotary actuator, sized for the coil in the unit.

Condensate pump:
Consisting of a centrifugal pump and a drip tray, max. delivery rate of 150 l/h with a delivery head of 3 m.

Socket:
230 V socket installed in the control block for simple supply of external, electrical units.

Energy monitoring:
Consisting of 2 additional temperature sensors for recording the air inlet and air outlet temperatures of the plate heat exchanger. Energy monitoring makes it possible to display the energy saved by heat and cool recovery.

Pump control for mixing or injection system:
Electrical components for controlling a mixing or injection circuit in the load circuit.

Return temperature sensor:
Temperature sensor for monitoring the heating medium. If necessary, it triggers frost pre-control at the heating valve to prevent the system possibly being shut down due to frost.

4.2 TopTronic® C control systems

Freely configurable, zone-based control system ex-works for operation of decentralised Hoval indoor climate systems with optimised use of energy, suitable for demand-driven control of overall systems comprising up to 64 control zones each with up to 15 supply and extract air handling units or supply air units and 10 recirculation units.

System structure:
- Unit controller: installed in the particular indoor climate unit
- Zone bus: as serial connection of all unit controllers in one control zone with the zone controller; with robust bus protocol via shielded and twisted-pair bus line (bus cables provided by the client)
- Zone control panel with:
  - System operator terminal
  - Fresh air temperature sensor
  - Zone controllers and room air temperature sensors
  - All components for the electrical power supply and protection
- System bus (Ethernet): for connecting all zone controllers to one another and to the system operator terminal (bus cables provided by the client)

Operation:
- TopTronic® C-ST as system operator terminal: touch panel for visualisation and control by web browser via HTML interface, including software for LAN access
- TopTronic® C-ZT as zone operator terminal: for simple on-site operation of a control zone (optional)
- Manual operating selector switch (optional)
- Manual operating selector button (optional)
- Operating of the units via building management system via standardised interfaces (optional):
  - BACnet
  - Modbus IP
  - Modbus RTU

Control functions:
- Control of the supply air temperature using room supply air cascade control via sequential control of the energy recovery and the coils (depending on the unit type)
- Demand-driven control of the room air quality by variation of the supply air and exhaust air volume flows with minimum and maximum limit (for supply and extract air handling units, optional)
- Control of the unit including the air distribution according to the specifications of the zone controller

Alarms, protection:
- Central alarm management with registration of all alarms (timestamp, priority, status) in an alarm list and alarm memory of the last 50 alarms; forwarding via e-mail can be set in the parameters.
- If there is a failure of communication, bus stations, sensor systems or supply media, each part of the system transitions to a protection mode which safeguards operation.
- Frost protection control of the units with constrained control of protection functions to prevent coil icing (for supply air units as well as supply and extract air handling units)
- A maintenance mode implemented in the control algorithm for testing all physical data points and alarms guarantees high reliability.

Options for the zone control panel:
- Design for heating (RH, RC, RHC)
- Design for cooling (RC, RHC)
- Cooling lock switch (RC, RHC)
- Alarm lamp
- Socket
- Additional room air temperature sensors
- Combination sensor room air quality, temperature and humidity
- External sensor values
- External set values
- Load shedding input
- Operating selector switch on terminal
- Operating selector button on terminal
- Power supply for air handling unit
- Safety relay
- Control of distributor pump(s), incl. power supply (RH, RC, RHC)

RoofVent® RHC

Supply and extract air handling unit with energy recovery
for heating and cooling high spaces in the 4-pipe system

1 Use

1.1 Intended use

RoofVent® RHC units are supply and extract air handling units for use in tall, single-floor halls. They have the following functions:

- Fresh air supply
- Extract air removal
- Heating (with connection to a hot water supply)
- Cooling (with connection to a water chiller)
- Energy recovery with highly efficient plate heat exchanger
- Filtering of the fresh air and the extract air
- Air distribution with adjustable Air-Injector

RoofVent® RHC units are used in production halls, logistics centres, maintenance halls, shopping centres, sports halls, trade show halls, etc. A system usually consists of several RoofVent® units. These are installed distributed throughout the hall roof. The individual units are regulated individually and controlled based on zones. The system flexibly adjusts to local requirements.

RoofVent® RHC units comply with all the requirements of the Ecodesign Directive relating to environmentally friendly design of ventilation systems. They are systems of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Intended use also includes compliance with the operating instructions.
Any usage over and above this use is considered to be not as intended. The manufacturer can accept no liability for damage resulting from improper use.

1.2 User group

The units are only allowed to be installed, operated and maintained by authorised and instructed personnel who are well acquainted with the units and are informed about possible dangers.

The operating instructions are for operating engineers and technicians as well as specialists in building, heating and ventilation technology.

2 Construction and operation

2.1 Construction

The RoofVent® RHC unit consists of the following components:

Roof unit with energy recovery
Self-supporting casing for mounting on the roof frame; the double-shell design guarantees good thermal insulation and high stability.

Below-roof unit
The below-roof unit comprises the following components:

- Connection module:
  Available in 4 lengths per unit size for adapting the unit to local installation conditions
- Heating section:
  For heating the supply air
- Cooling section:
  For cooling the supply air
- Air-Injector:
  Patented, automatically adjustable vortex air distributor for draught-free air distribution over a large area

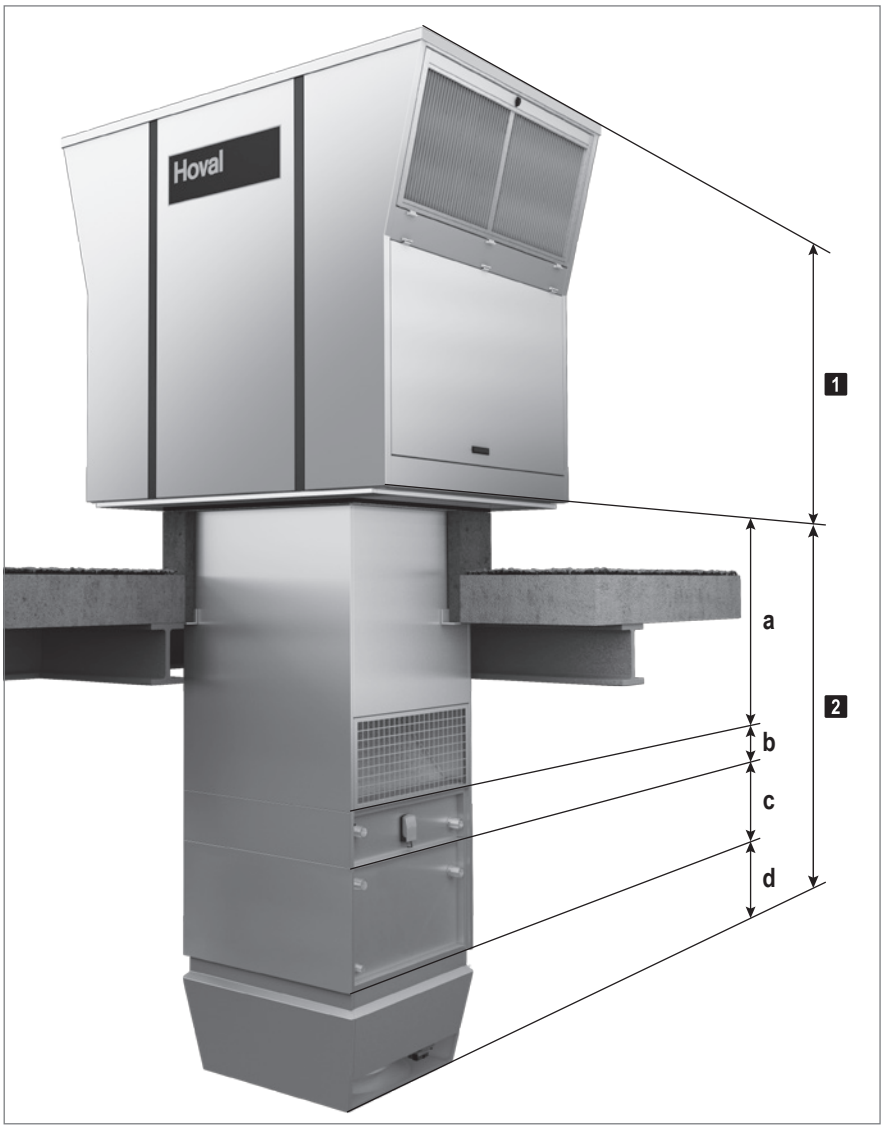
The components are bolted together and can be dismantled. The connections of the coil are located under the extract air grille as standard. The heating section can also be mounted on the connection module turned round.

Thanks to their high capability and efficient air distribution, RoofVent® units cover a large area. Therefore, compared to other systems, fewer units are needed to achieve the required conditions. Various units sizes and versions as well as a range of optional equipment offer great flexibility in adjustment to the specific project.

2.2 Air distribution with the Air-Injector

The patented air distributor – called the Air-Injector – is the core element. The air discharge angle is set by means of the infinitely variable guide vanes. It depends on the air flow rate, the mounting height and the temperature difference between the supply air and room air. The air is therefore blown into the room vertically downward, conically or horizontally. This ensures that:

- with each RoofVent® unit a large area of the hall can be reached,
- the occupied area is draught-free,
- the temperature stratification in the room is reduced, thus saving energy.

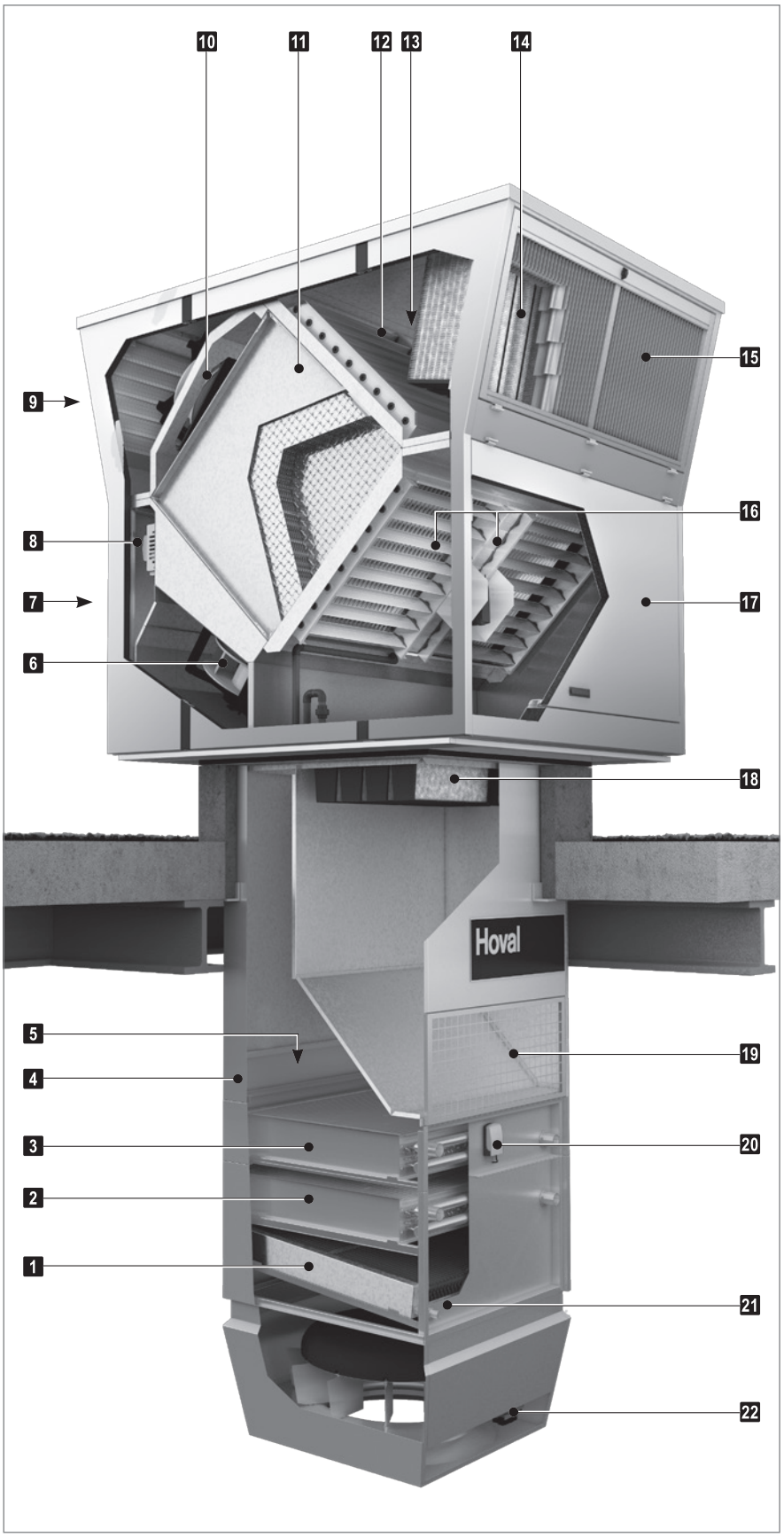


1 Roof unit with energy recovery

2 Below-roof unit
- **a** Connection module
- **b** Heating section
- **c** Cooling section
- **d** Air-Injector

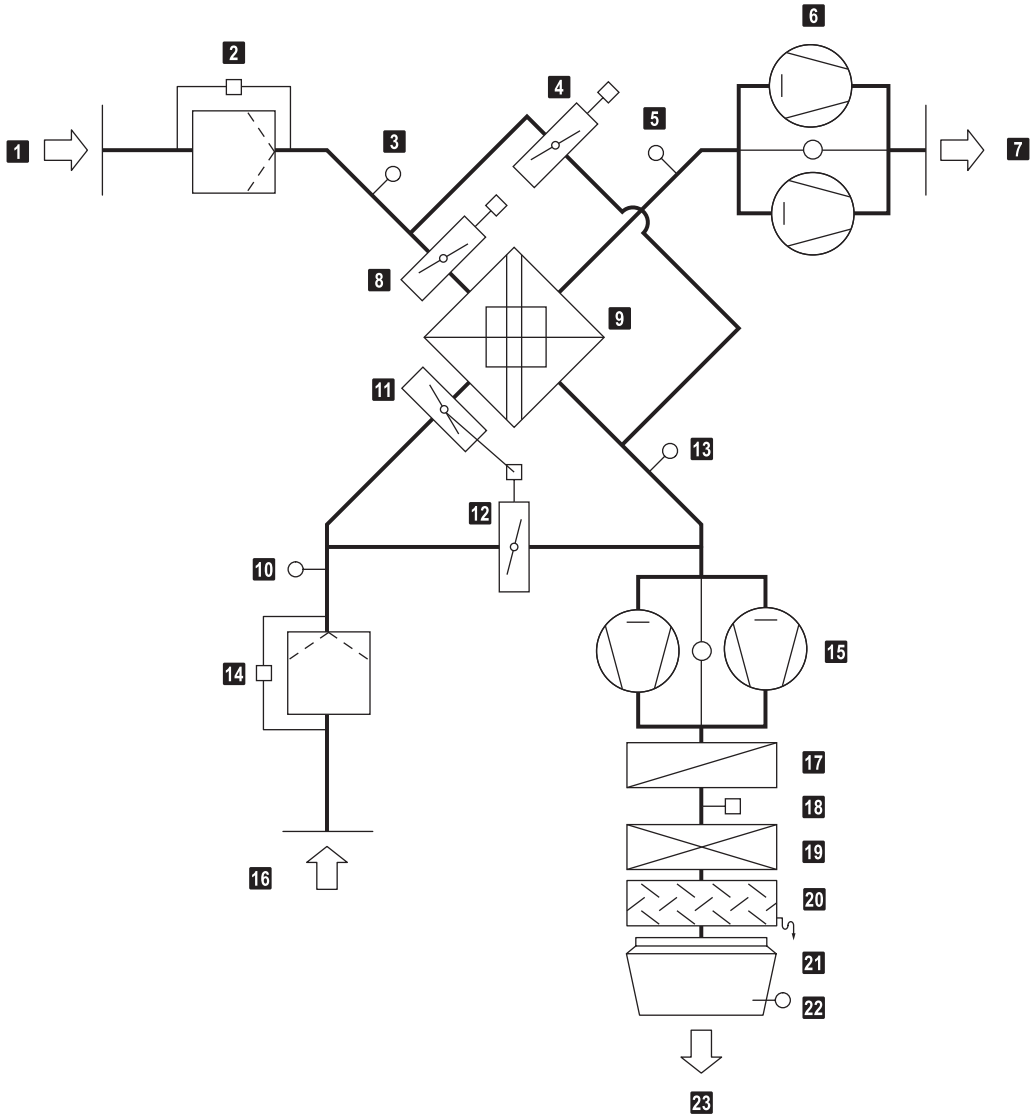
Fig. C1: Components of the RoofVent® RHC

C



1 Condensate separator
2 Cooling coil
3 Heating coil
4 Access panel, coil
5 Access panel, connection box
6 Supply air fans
7 Supply air access door
8 Control block
9 Exhaust air access door
10 Exhaust air fans
11 Plate heat exchanger with bypass (for performance control and as recirculation bypass)
12 Fresh air damper with actuator
13 Bypass damper with actuator
14 Fresh air filter
15 Fresh air access door
16 Extract air and recirculation dampers with actuator
17 Extract air access door
18 Extract air filter
19 Extract air grille
20 Frost controller
21 Condensate connection
22 Actuator of the Air-Injector

Fig. C2: Structure of the RoofVent® RHC



1	Fresh air	13	Temperature sensor air outlet ER (optional)
2	Fresh air filter with differential pressure switch	14	Extract air filter with differential pressure switch
3	Temperature sensor air inlet ER (optional)	15	Supply air fans with flow rate monitoring
4	Bypass damper with actuator	16	Extract air
5	Exhaust air temperature sensor	17	Heating coil
6	Exhaust air fans with flow rate monitoring	18	Frost controller
7	Exhaust air	19	Cooling coil
8	Fresh air damper with actuator	20	Condensate separator
9	Plate heat exchanger	21	Air-Injector with actuator
10	Extract air temperature sensor	22	Supply air sensor
11	Extract air damper with actuator	23	Supply air
12	Recirculation damper (opposed to the extract air damper)		

Fig. C3: Function diagram for RoofVent® RHC

2.3 Operating modes

The RoofVent® RHC has the following operating modes:

- Ventilation
- Ventilation (reduced)
- Air quality
- Recirculation
- Exhaust air
- Supply air
- Standby
- Forced heating

The TopTronic® C control system regulates these operating modes automatically for each control zone in accordance with the specifications in the calendar. The following points also apply:

- The operating mode of a control zone can be switched over manually.
- Each RoofVent® unit can operate individually in a local operating mode: Off, Recirculation, Supply air, Exhaust air, Ventilation.

You will find a detailed description of the TopTronic® C control system in section G 'Control systems' of this handbook.

Code	Operating mode	Description
VE	**Ventilation** The unit blows fresh air into the room and exhausts polluted room air. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating/cooling	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 % *) Adjustable flow rate
VEL	**Ventilation (reduced)** As VE, but the unit only operates with the set minimum values for the supply and exhaust air volumes	Supply air fan ..... MIN Exhaust air fan ..... MIN Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 %
AQ	**Air quality** This is the operating mode for demand-controlled ventilation of the room. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery ■ the heating/cooling Depending on the room air quality, the system operates in one of the following operating states:	
AQ_REC	■ Air quality Recirculation: When air quality is good, the unit heats or cools in recirculation operation.	Like REC
AQ_ECO	■ Air quality Mixed air: When ventilation requirements are medium, the unit heats or cools in mixed air operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... 50 % Recirculation damper ..... 50 % Heating/cooling ..... 0-100 %
AQ_VE	■ Air quality Ventilation: When ventilation requirements are high, the unit heats or cools in pure ventilation operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 %

Code	Operating mode	Description
REC	**Recirculation** On/Off recirculation operation with TempTronic algorithm: During heat or cool demand, the unit draws in room air, heats or cools it and blows it back into the room. The room temperature set value day is active. The flow rate is controlled in 2 stages.	Supply air fan ..... 0 / Speed 1 / Speed 2 *) Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... on *) *) Depending on heat or cool demand
EA	**Exhaust air** The unit extracts spent room air. There is no room temperature control. Unfiltered fresh air enters the room through open windows and doors or another system provides air supply.	Supply air fan ..... Off Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... off *) Adjustable flow rate
SA	**Supply air** The unit blows fresh air into the room. The room temperature set value day is active. Depending on the temperature conditions, the system controls the heating/cooling. Spent room air passes through open windows and doors or another system provides extraction.	Supply air fan ..... on *) Exhaust air fan ..... off Energy recovery ..... 0 % **) Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... 0-100 % *) Adjustable flow rate **) Fresh air and bypass dampers are open
ST	**Standby** The unit is normally switched off. The following functions remain active:	
CPR	■ Cooling protection: If the room temperature drops below the set value for cooling protection, the unit heats up the room in recirculation operation.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... on
OPR	■ Overheating protection: If the room temperature rises above the set value for overheating protection, the unit cools down the room in recirculation operation. If the temperatures also permit fresh air cooling, the units automatically switches to night cooling (NCS) to save energy.	
NCS	■ Night cooling: If the room temperature exceeds the set value for night cooling and the current fresh air temperature permits it, the unit blows cool fresh air into the room and extracts warmer room air.	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed Heating/cooling ..... off *) Adjustable flow rate
L_OFF	**Off** (local operating mode) The unit is switched off. Frost protection remains active.	Supply air fan ..... Off Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating/cooling ..... off
–	**Forced heating** The unit draws in room air, warms it and blows it back into the room. Forced heating is activated by inserting a wire jumper in the control block. For example, it is suitable for heating the hall before taking the control system into operation or if the controller fails during the heating period. Connecting a room thermostat makes it possible to specify a room temperature set value.	Supply air fan ..... MAX Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open Heating ..... on

Table C1: Operating modes of the RoofVent® RHC

3 Technical data

3.1 Unit type reference

RHC - 6 B C - ...

Unit type
RoofVent® RHC

Unit size
6 or 9

Heating section
B with coil type B
C with coil type C
D with coil type D

Cooling section
C with coil type C
D with coil type D

Further options
See section E 'Options'

Table C2: Unit type reference

3.2 Application limits

Extract air temperature		max.	50	°C
Extract air relative humidity		max.	60	%
Moisture content of extract air		max.	12.5	g/kg
Fresh air temperature		min.	-30	°C
Temperature of the heating medium [1)]		max.	90	°C
Pressure of the heating/cooling medium		max.	800	kPa
Supply air temperature		max.	60	°C
Air flow rate	Size 6: Size 9:	min. min.	3100 5000	m³/h m³/h
Condensate quantity	Size 6: Size 9:	max. max.	90 150	kg/h kg/h

1) Design for higher temperatures on request

Table C3: Application limits

Notice
Use units in the design for high extract air humidity if the humidity in the room increases by more than 2 g/kg (see section E 'Options').

3.3 Heat recovery system (HRS)

Unit type		RHC-6	RHC-9
Temperature efficiency, dry	%	77	78
Temperature efficiency, wet	%	89	90

Table C4: Thermal transfer level of the plate heat exchanger

3.4 Air filtration

Filter	Fresh air	Extract air
Class acc. to ISO 16890	ePM_1 55 %	ePM_{10} 65 %
Class acc. to EN 779	F7	M5
Factory setting of differential pressure switches	250 Pa	250 Pa

Table C5: Air filtration

3.5 Flow rate, product parameters

Unit type			RHC-6		RHC-9					
Nominal air flow rate		m³/h	5500		8000					
		m³/s	1.53		2.22					
Floor area reached		m²	480		797					
Specific fan power SFP_{int}		W/(m³/s)	920		940					
Face velocity		m/s	2.69		2.98					
Static efficiency of the fans		%	62		63					
Internal pressure drop of ventilation components										
	Fresh air/supply air	Pa	270		268					
	Extract air/exhaust air	Pa	300		316					
Maximum leakage rate										
	External	%	0.45		0.25					
	Internal	%	1.50		1.20					
Coil type			**BC**	**CC**	**BC**	**BD**	**CC**	**CD**	**DC**	**DD**
Nominal external pressure										
	Supply air	Pa	80	50	170	140	130	100	100	40
	Extract air	Pa	190	190	300	300	300	300	300	300
Effective electric power input		kW	2.27	2.33	2.90	3.60	3.63	3.74	3.74	3.98

Table C6: Technical data of the RoofVent® RHC

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3.6 Heat output

Notice
The performance data listed here applies to the most frequent design conditions. Use the selection program 'HK-Select' to calculate the performance data for other design data. You can download 'HK-Select' free of charge on the Internet.

Heating medium temperature			80/60 °C						60/40 °C					
Unit		t_F	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W	Q	Q_{TG}	H_{max}	t_S	Δp_W	m_W
Size	Type	°C	kW	kW	m	°C	kPa	l/h	kW	kW	m	°C	kPa	l/h
RHC-6	B	-5	47.4	40.5	11.4	39.9	13	2038	28.6	21.7	15.3	29.7	5	1231
		-15	49.1	38.5	11.7	38.8	14	2108	30.3	19.7	16.0	28.7	5	1300
	C	-5	76.2	69.3	9.0	55.4	15	3273	47.5	40.5	11.4	39.9	6	2040
		-15	78.7	68.2	9.0	54.8	16	3383	50.0	39.5	11.6	39.3	6	2150
RHC-9	B	-5	68.9	59.5	11.7	40.1	10	2962	40.9	31.5	15.8	29.7	3	1758
		-15	71.2	56.8	12.0	39.1	10	3059	43.2	28.8	16.4	28.7	4	1856
	C	-5	113.1	103.7	9.1	56.5	14	4860	70.2	60.7	11.6	40.6	5	3014
		-15	116.8	102.4	9.2	56.0	15	5017	73.8	59.5	11.7	40.1	6	3172
	D	-5	–	–	–	–	–	–	86.7	77.3	10.4	46.7	5	3725
		-15	–	–	–	–	–	–	91.0	76.6	10.5	46.4	6	3908

Legend:
Type = Type of coil
t_F = Fresh air temperature
Q = Coil heat output
Q_{TG} = Output to cover fabric heat losses
H_{max} = Maximum mounting height
t_S = Supply air temperature
Δp_W = Water pressure drop
m_W = Water quantity

Reference: Room air 18 °C, extract air 20 °C / 20 % rel. humidity

– These operating conditions are not permissible, because the maximum supply air temperature of 60 °C is exceeded.

Table C7: Heat output of the RoofVent® RHC

Notice
The output for coverage of the fabric heat losses (Q_{TG}) allows for the ventilation heat requirement (Q_V) and the energy recovery output (Q_{ER}) under the respective air conditions. The following applies:

$$Q + Q_{ER} = Q_V + Q_{TG}$$

3.7 Cooling capacities

Cooling medium temperature				6/12 °C							8/14 °C						
Unit		t_F	RH_F	Q_{sen}	Q_{tot}	Q_{TG}	t_S	Δp_W	m_W	m_C	Q_{sen}	Q_{tot}	Q_{TG}	t_S	Δp_W	m_W	m_C
Size	Type	°C	%	kW	kW	kW	°C	kPa	l/h	kg/h	kW	kW	kW	°C	kPa	l/h	kg/h
RHC-6	C	28	40	20.0	20.0	14.6	14.1	13	2862	0.0	17.7	17.7	12.3	15.4	10	2531	0.0
			60	17.6	36.8	12.2	15.4	44	5263	28.2	15.3	30.9	9.8	16.7	31	4419	22.9
		32	40	24.5	34.5	19.1	15.7	39	4943	14.7	22.2	28.6	16.8	16.9	27	4100	9.4
			60	22.1	51.6	16.7	17.0	87	7382	43.3	19.8	45.7	14.4	18.2	68	6539	38.0
RHC-9	C	28	40	29.0	29.0	21.3	14.1	12	4158	0.0	25.4	25.4	17.7	15.4	9	3644	0.0
			60	25.7	52.0	17.9	15.3	39	7440	38.6	22.1	43.0	14.3	16.7	27	6155	30.7
		32	40	36.0	49.6	28.2	15.5	36	7105	20.0	32.4	40.6	24.6	16.9	24	5820	12.1
			60	32.7	74.6	24.9	16.8	81	10682	61.6	29.1	65.6	21.3	18.1	63	9396	53.7
	D	28	40	35.6	39.1	27.8	11.7	14	5599	5.2	31.1	31.1	23.3	13.3	9	4449	0.0
			60	32.9	70.4	25.1	12.7	45	10079	55.1	28.4	59.8	20.6	14.3	32	8566	46.2
		32	40	44.2	66.6	36.4	12.5	40	9542	33.0	39.7	56.1	32.0	14.1	28	8029	24.0
			60	41.5	97.8	33.8	13.5	86	13999	82.6	37.0	87.2	29.3	15.1	69	12485	73.7

Legend:
- t_F = Fresh air temperature
- RH_F = Relative humidity of the fresh air
- Type = Type of coil
- Q_{sen} = Sensible cooling capacity
- Q_{tot} = Total cooling capacity
- Q_{TG} = Output for coverage of transmission sensible gains (→ sensible cooling load)
- t_S = Supply air temperature
- Δp_W = Water pressure drop
- m_W = Water quantity
- m_C = Condensate quantity

Reference:
- At fresh air temperature 28 °C: room air 22 °C, extract air 24 °C / 50 % rel. humidity
- At fresh air temperature 32 °C: room air 26 °C, extract air 28 °C / 50 % rel. humidity

Table C8: Cooling capacity of the RoofVent® RHC

Notice
The output for coverage of transmission sensible gains (Q_{TG}) allows for the ventilation cooling requirement (Q_V) and the output of the energy recovery (Q_{ER}) under the respective air conditions. The following applies:
$Q_{sen} + Q_{ER} = Q_V + Q_{TG}$

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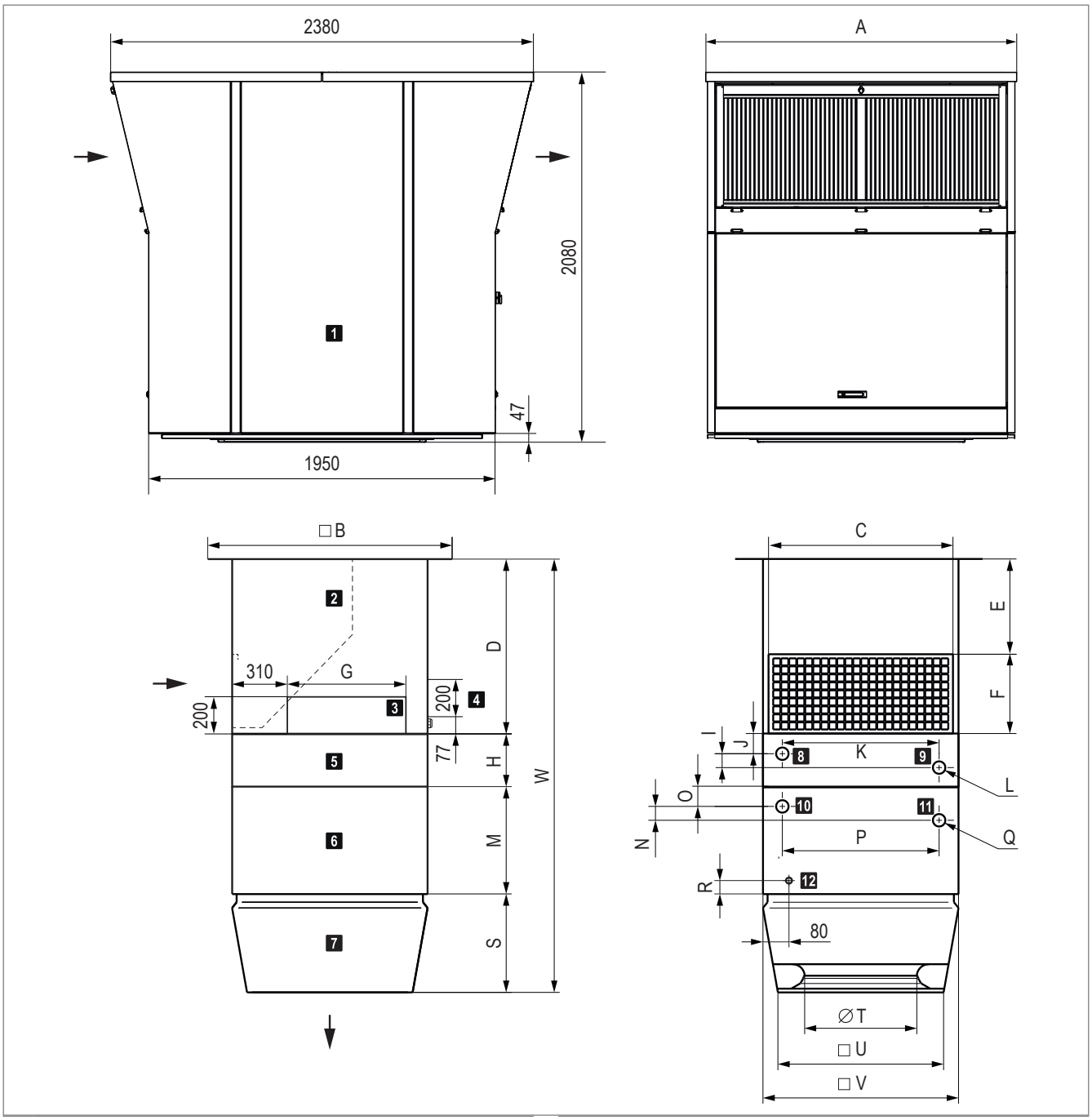
3.8 Dimensions and weights



1	Roof unit with energy recovery	7	Air-Injector
2	Connection module	8	Heating circuit return
3	Access panel, coil	9	Heating circuit flow
4	Access panel, connection box	10	Cooling circuit return
5	Heating section	11	Cooling circuit flow
6	Cooling section	12	Condensate connection G1" (external)

Fig. C4: Dimensional drawing for RoofVent® RHC (dimensions in mm)

Unit type		RHC-6				RHC-9			
A	mm	1400				1750			
B	mm	1040				1240			
C	mm	848				1048			
F	mm	410				450			
G	mm	470				670			
H	mm	270				300			
M	mm	620				610			
S	mm	490				570			
T	mm	500				630			
U	mm	767				937			
V	mm	900				1100			
Connection module		**V0**	**V1**	**V2**	**V3**	**V0**	**V1**	**V2**	**V3**
D	mm	940	1190	1440	1940	980	1230	1480	1980
E	mm	530	780	1030	1530	530	780	1030	1530
W	mm	2320	2570	2820	3320	2460	2710	2960	3460

Table C9: Dimensions of the RoofVent® RHC

Size		RHC-6		RHC-9		
Type of heating coil		**B**	**C**	**B**	**C**	**D**
I	mm	78	78	78	78	95
J	mm	101	101	111	111	102
K	mm	758	758	882	882	882
L (internal thread)	"	Rp 1¼	Rp 1¼	Rp 1½	Rp 1½	Rp 2
Water content of the coil	l	3.1	6.2	4.7	9.4	14.2

Table C10: Dimensions for hydraulic connection of the heating section

Size		RHC-6	RHC-9	
Type of the cooling coil		**C**	**C**	**D**
N	mm	78	78	95
O	mm	123	92	83
P	mm	758	882	882
Q (internal thread)	"	Rp 1¼	Rp 1½	Rp 2
R	mm	54	53	53
Water content of the coil	l	6.2	9.4	14.2

Table C11: Dimensions for hydraulic connection of the cooling section

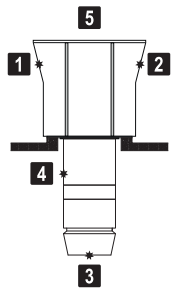
Unit type		RHC-6BC	RHC-6CC	RHC-9BC	RHC-9BD	RHC-9CC	RHC-9CD	RHC-9DC	RHC-9DD
Total	**kg**	**912**	**919**	**1196**	**1215**	**1206**	**1225**	**1225**	**1244**
Roof unit	kg	700	700	900	900	900	900	900	900
Below-roof unit	kg	212	219	296	315	306	325	325	344
Air-Injector	kg	37	37	56	56	56	56	56	56
Heating section	kg	30	37	44	44	54	54	73	73
Cooling section	kg	70	70	102	121	102	121	102	121
Connection module V0	kg	75		94					
Additional weight V1	kg	+ 11		+ 13					
Additional weight V2	kg	+ 22		+ 26					
Additional weight V3	kg	+ 44		+ 52					

Table C12: Weights of the RoofVent® RHC

3.9 Sound data

Operating mode				VE				REC
Item				1	2	3	4	5
RHC-6	Sound pressure level (at a distance of 5 m) [1]		dB(A)	44	56	51	44	51
	Total sound power level		dB(A)	66	78	73	66	73
	Octave sound power level	63 Hz	dB(A)	44	46	43	43	43
		125 Hz	dB(A)	54	61	56	54	56
		250 Hz	dB(A)	60	67	63	60	63
		500 Hz	dB(A)	62	71	67	62	67
		1000 Hz	dB(A)	58	74	69	57	69
		2000 Hz	dB(A)	55	70	64	55	64
		4000 Hz	dB(A)	51	66	59	51	59
		8000 Hz	dB(A)	50	64	56	49	56
RHC-9	Sound pressure level (at a distance of 5 m) [1]		dB(A)	44	55	51	42	51
	Total sound power level		dB(A)	66	77	73	64	73
	Octave sound power level	63 Hz	dB(A)	45	45	45	42	45
		125 Hz	dB(A)	57	62	60	54	60
		250 Hz	dB(A)	60	65	64	57	64
		500 Hz	dB(A)	62	70	68	59	68
		1000 Hz	dB(A)	59	73	70	56	70
		2000 Hz	dB(A)	58	70	66	55	66
		4000 Hz	dB(A)	51	64	59	48	59
		8000 Hz	dB(A)	45	59	54	42	54

1) with hemispherical radiation in a low-reflection environment



1 Fresh air
2 Exhaust air
3 Supply air
4 Extract air
5 Outdoors (roof unit)

Table C13: Sound data of the RoofVent® RHC

4 Specification texts

4.1 RoofVent® RHC

Supply and extract air handling unit with energy recovery for heating and cooling high spaces in the 4-pipe system.
The unit consists of the following components:
- Roof unit with energy recovery
- Below-roof unit:
  - Connection module
  - Heating section
  - Cooling section
  - Air-Injector
- Control components
- Optional components

The RoofVent® RHC unit complies with all the requirements of the Ecodesign Directive 2009/125/EC relating to environmentally friendly design of ventilation systems. It is a system of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Roof unit with energy recovery

Self-supporting housing, made of aluminium (outside) and aluzinc sheet and aluminium (inside):
- Weatherproof, corrosion resistant, impact resistant, air-tight
- Low flammability, double-shelled, without heat bridges, with highly efficient insulation made of closed-pore polyurethane
- Hygienic and easy to maintain because of smooth interior surfaces and large access doors with ageing-resistant, silicone-free sealing materials

The roof unit with energy recovery includes:

Supply air and exhaust air fans:
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motor, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; inflow nozzle with optimised flow; infinitely variable speed; with active pressure registration for constant volumetric flow control and/or demand-controlled volumetric flow adjustment; low-noise; with integrated overload protection.

Fresh air filter:
Designed as highly efficient compact filter elements, class F7 (ISO ePM_1 55 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Extract air filter:
Designed as highly efficient compact filter elements, class M5 (ISO ePM_{10} 65 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Plate heat exchanger:
Cross-flow plate heat exchanger made of high-quality aluminium as a highly efficient, recuperative heat recovery system, certified by Eurovent, zero-maintenance, without moving parts, failsafe, hygienically harmless, no cross-contamination of impurities and odours. Equipped with bypass, recirculation bypass, condensate drain and condensation trap to the roof. The following dampers are arranged on the exchanger package:
- Fresh air and bypass dampers, each with their own actuator, for infinitely variable control of the heat recovery; with shut-off function by spring return.
- Extract air and recirculation dampers, interlinked in a counter-rotating arrangement with a common actuator, for controlling the recirculation and mixed air operation; with shut-off function by spring return.

All dampers correspond to seal integrity class 2 according to EN 1751.

Access openings:
- Fresh air access door: large access opening with integrated weather and bird protection, configured with quick locking system for easy access to the fresh air filter, the plate heat exchanger as well as the fresh air and bypass dampers.
- Exhaust air access door: large, lockable access opening with integrated weather and bird protection for easy access to the exhaust air filter.
- Extract air access door: large access opening, configured with quick locking system and telescopic support for easy access to the extract air filter, the plate heat exchanger, the condensation trap as well as the extract air and recirculation dampers.
- Supply air access door: large, lockable access opening, configured with telescopic support for easy access to the supply air fans, the control block and the condensate collecting channel.

Control block:
Compact design on an easily accessible mounting plate, comprising:
- Unit controller as part of the TopTronic® C control system:
  - Fully wired to the electrical components of the roof unit (fans, actuators, temperature sensors, filter monitoring, differential pressure sensor)
  - Pluggable wiring to the control box in the connection module

- High-voltage section:
  - Mains power terminals
  - Isolation switch
  - Button for stopping the fans during filter change
- Low-voltage section:
  - Transformer for actuators, sensors and the unit controller
  - Externally switchable forced heating
  - Externally switchable forced off
- Circuit board with further electronic components for unit control (differential pressure measurement, fuses for the transformer, fuses for low voltage, ...)

Connection module

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of smooth interior surfaces and ageing-resistant, silicone-free sealing materials; configured with extract air grille and access panel for easy access to the coil for maintenance. The connection module contains:

- Laced wiring harness protected in a sheet metal duct, with direct plug connection to the control block in the roof unit
- Connection box made of galvanised sheet steel, configured with circuit board, screw-on cover and cable lead-ins with splash water protection and strain relief; for connection of:
  - Power supply
  - Zone bus
  - All sensors and actuators of the below-roof unit (ready-to-connect): frost controller, supply air temperature sensor, Air-Injector actuator
  - Peripheral components (e.g. mixing valves, pumps, …)
  - Optional components as required

Connection module V1 / V2 / V3:

The connection module is extended for adapting to the local installation situation.

Heating section

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials. The heating section contains:

- The highly efficient heating coil consisting of seamless copper pipes with pressed-on, optimised and profiled aluminium fins and manifolds made of copper; for connection to the hot water supply
- Frost controller

Cooling section

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyurethane. The heating/cooling section contains:

- The highly efficient heating/cooling coil consisting of seamless copper pipes with pressed-on, optimised and profiled aluminium fins and manifolds made of copper; for connection to the hot water and cold water supply
- The pull-out condensate separator with collecting channel, made of high-quality corrosion-resistant material, with a downslope in all directions for rapid draining
- The condensate trap for connecting to a condensate drain (supplied).

Air-Injector

1 Air-Injector

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyethylene, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor

2 Air-Injectors

2x Air-Injectors, supplied loose; supply air duct for connecting the RoofVent® unit to the Air-Injectors on site. Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, internally insulated with close-pored polyethylene, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor (supplied in the connection module)

Without Air-Injector

Unit configured without vortex air distributor for connection to an on-site supply air duct and air distribution within the building, supply air temperature sensor supplied in the connection module.

Options for the unit

Oil-proof design:
- Oil-proof materials
- Special extract air filter for oil and dust separation in the connection module, class M5 (ISO ePM$_{10}$ 50 %)
- Plate heat exchanger additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Connection module in oil-tight design with integrated oil/condensate drip tray and drain connection

Design for high extract air humidity:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Plate heat exchanger with condensate separator; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection

Corrosion-protected design:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger for high corrosion resistance; additionally sealed; leak test according to works standard
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Corrosion-protected design for high extract air humidity:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger with condensate separator for high corrosion resistance; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

Paint finish of below-roof unit:
Choice of external paint finish in RAL colour

Fresh air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and acoustic insulation lining, for reducing sound emissions on the fresh air side, insertion loss _____ dB

Exhaust air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and easily accessible sound attenuation splitters, optimised flow, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover for reducing sound emissions on the exhaust air side, insertion loss _____ dB

Supply air and extract air silencer:
Supply air silencer configured as separated component in the below-roof unit, flow-optimised sound attenuation splitters, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover, extract air silencer configured as acoustic insulation lining in the connection module, for reducing sound emission in the room, insertion loss supply air/extract air _____ dB / _____ dB

Hydraulic assembly diverting system:
Prefabricated assembly for hydraulic diverting system, consisting of mixing valve with modulating rotary actuator, regulating valve, ball valve, automatic air vent and screw connections for connection to the unit and to the distributor circuit; sized for the coil in the unit and the Hoval TopTronic® C control system.

Mixing valves:
Mixing valve with modulating rotary actuator, sized for the coil in the unit.

Condensate pump:
Consisting of a centrifugal pump and a drip tray, max. delivery rate of 150 l/h with a delivery head of 3 m.

Socket:
230 V socket installed in the control block for simple supply of external, electrical units.

Energy monitoring:
Consisting of 2 additional temperature sensors for recording the air inlet and air outlet temperatures of the plate heat exchanger. Energy monitoring makes it possible to display the energy saved by heat and cool recovery.

Pump control for mixing or injection system:
Electrical components for controlling a mixing or injection circuit in the load circuit.

Return temperature sensor:
Temperature sensor for monitoring the heating medium. If necessary, it triggers frost pre-control at the heating valve to prevent the system possibly being shut down due to frost.

4.2 TopTronic® C control systems

Freely configurable, zone-based control system ex-works for operation of decentralised Hoval indoor climate systems with optimised use of energy, suitable for demand-driven control of overall systems comprising up to 64 control zones each with up to 15 supply and extract air handling units or supply air units and 10 recirculation units.

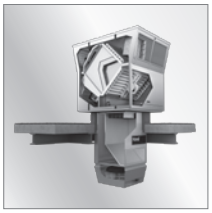
System structure:
- Unit controller: installed in the particular indoor climate unit
- Zone bus: as serial connection of all unit controllers in one control zone with the zone controller; with robust bus protocol via shielded and twisted-pair bus line (bus cables provided by the client)
- Zone control panel with:
  - System operator terminal
  - Fresh air temperature sensor
  - Zone controllers and room air temperature sensors
  - All components for the electrical power supply and protection
- System bus (Ethernet): for connecting all zone controllers to one another and to the system operator terminal (bus cables provided by the client)

Operation:
- TopTronic® C-ST as system operator terminal: touch panel for visualisation and control by web browser via HTML interface, including software for LAN access
- TopTronic® C-ZT as zone operator terminal: for simple on-site operation of a control zone (optional)
- Manual operating selector switch (optional)
- Manual operating selector button (optional)
- Operating of the units via building management system via standardised interfaces (optional):
  - BACnet
  - Modbus IP
  - Modbus RTU

Control functions:
- Control of the supply air temperature using room supply air cascade control via sequential control of the energy recovery and the coils (depending on the unit type)
- Demand-driven control of the room air quality by variation of the supply air and exhaust air volume flows with minimum and maximum limit (for supply and extract air handling units, optional)
- Control of the unit including the air distribution according to the specifications of the zone controller

Alarms, protection:
- Central alarm management with registration of all alarms (timestamp, priority, status) in an alarm list and alarm memory of the last 50 alarms; forwarding via e-mail can be set in the parameters.
- If there is a failure of communication, bus stations, sensor systems or supply media, each part of the system transitions to a protection mode which safeguards operation.
- Frost protection control of the units with constrained control of protection functions to prevent coil icing (for supply air units as well as supply and extract air handling units)
- A maintenance mode implemented in the control algorithm for testing all physical data points and alarms guarantees high reliability.

Options for the zone control panel:
- Design for heating (RH, RC, RHC)
- Design for cooling (RC, RHC)
- Cooling lock switch (RC, RHC)
- Alarm lamp
- Socket
- Additional room air temperature sensors
- Combination sensor room air quality, temperature and humidity
- External sensor values
- External set values
- Load shedding input
- Operating selector switch on terminal
- Operating selector button on terminal
- Power supply for air handling unit
- Safety relay
- Control of distributor pump(s), incl. power supply (RH, RC, RHC)



RoofVent® R

Supply and extract air handling unit with energy recovery
for use in high spaces

D

1 Use

1.1 Intended use

RoofVent® R units are supply and extract air handling units for use in tall, single-floor halls. They have the following functions:

- Fresh air supply
- Extract air removal
- Energy recovery with highly efficient plate heat exchanger
- Filtering of the fresh air and the extract air
- Air distribution with adjustable Air-Injector

RoofVent® R units are used in production halls, logistics centres, maintenance halls, shopping centres, sports halls, trade show halls, etc. A system usually consists of several RoofVent® units. These are installed distributed throughout the hall roof. The individual units are regulated individually and controlled based on zones. The system flexibly adjusts to local requirements.

RoofVent® R units comply with all the requirements of the Ecodesign Directive relating to environmentally friendly design of ventilation systems. They are systems of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Intended use also includes compliance with the operating instructions.
Any usage over and above this use is considered to be not as intended. The manufacturer can accept no liability for damage resulting from improper use.

1.2 User group

The units are only allowed to be installed, operated and maintained by authorised and instructed personnel who are well acquainted with the units and are informed about possible dangers.

The operating instructions are for operating engineers and technicians as well as specialists in building, heating and ventilation technology.

2 Construction and operation

2.1 Construction

The RoofVent® R unit consists of the following components:

Roof unit with energy recovery
Self-supporting casing for mounting on the roof frame; the double-shell design guarantees good thermal insulation and high stability.

Below-roof unit
The below-roof unit comprises the following components:

- Connection module:
  Available in 4 lengths per unit size for adapting the unit to local installation conditions
- Air-Injector:
  Patented, automatically adjustable vortex air distributor for draught-free air distribution over a large area

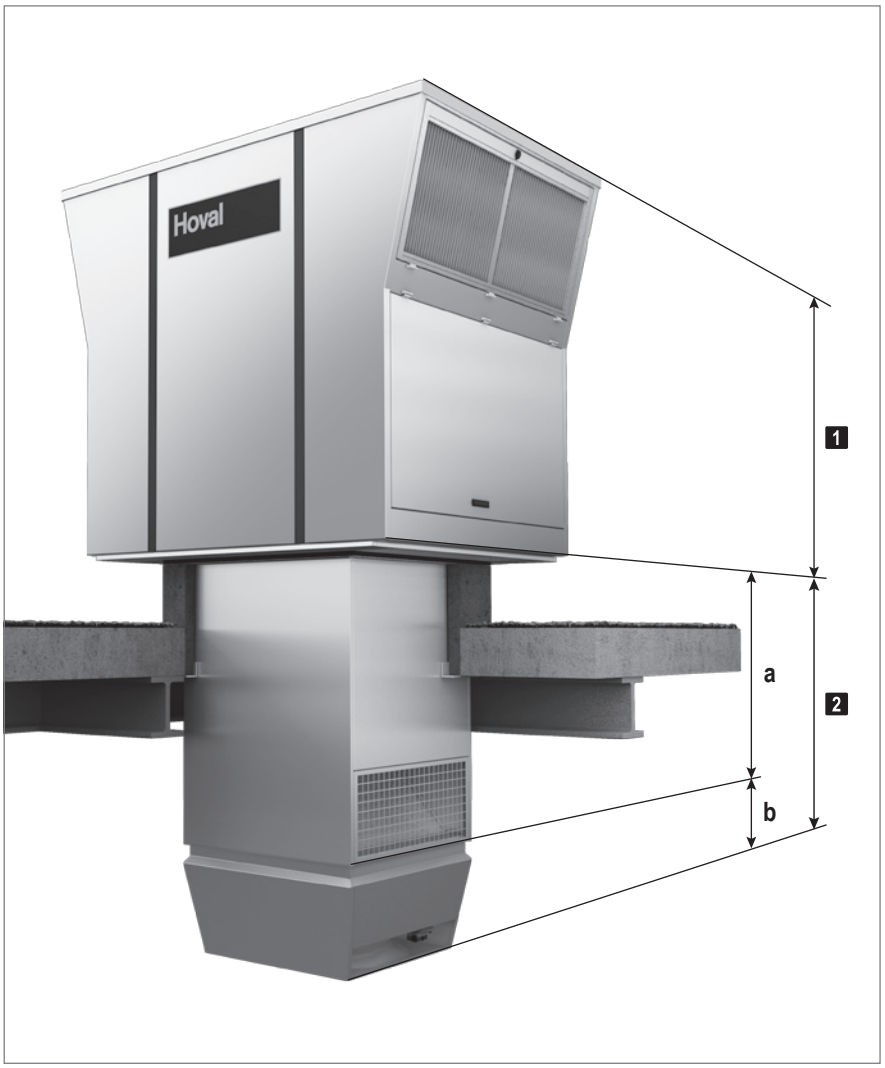
The components are bolted together and can be dismantled.

Thanks to their high capability and efficient air distribution, RoofVent® units cover a large area. Therefore, compared to other systems, fewer units are needed to achieve the required conditions. Various units sizes and versions as well as a range of optional equipment offer great flexibility in adjustment to the specific project.

2.2 Air distribution with the Air-Injector

The patented air distributor – called the Air-Injector – is the core element. The air discharge angle is set by means of the infinitely variable guide vanes. It depends on the air flow rate, the mounting height and the temperature difference between the supply air and room air. The air is therefore blown into the room vertically downward, conically or horizontally. This ensures that:

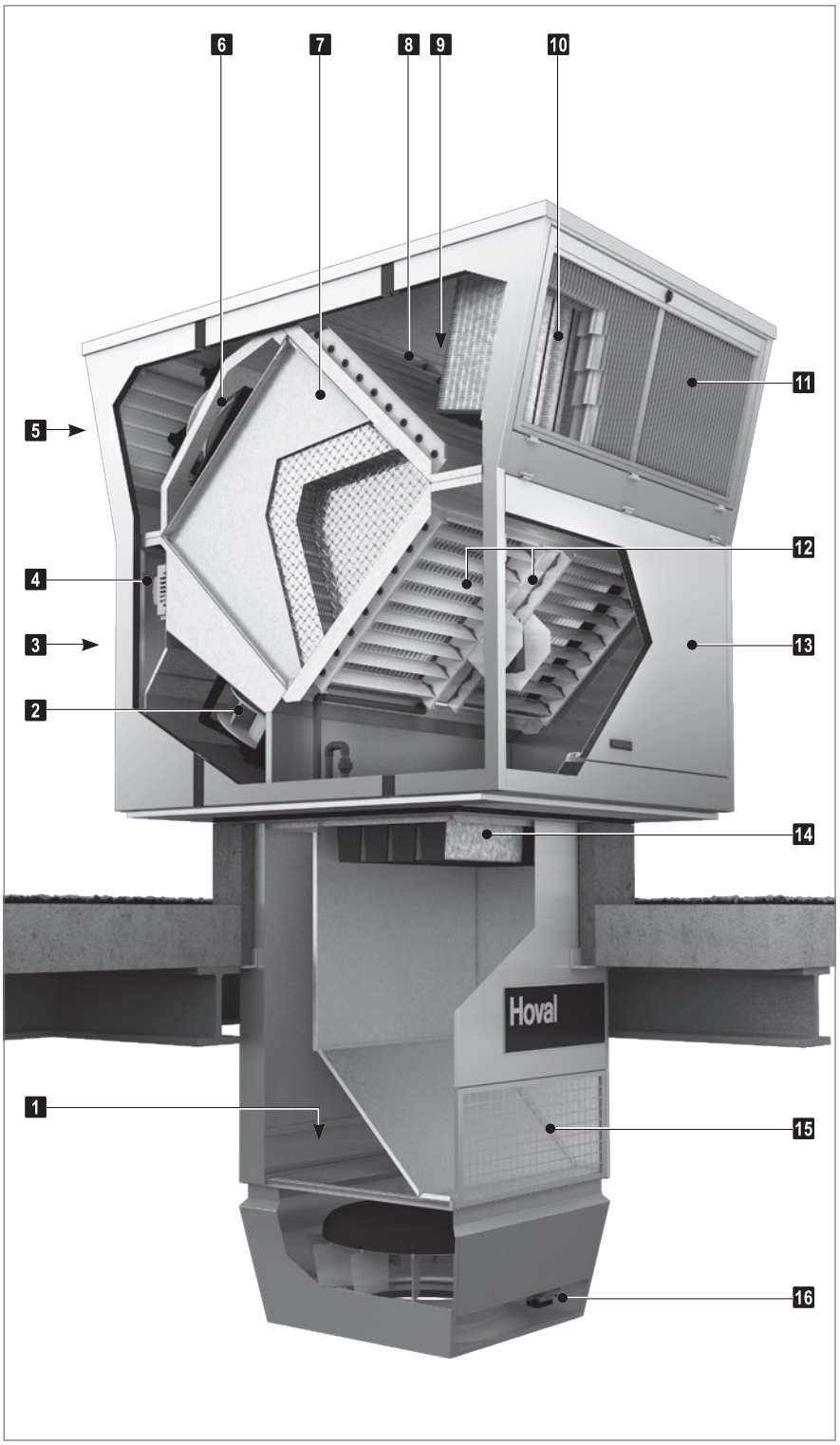
- with each RoofVent® unit a large area of the hall can be reached,
- the occupied area is draught-free,
- the temperature stratification in the room is reduced, thus saving energy.



1 Roof unit with energy recovery

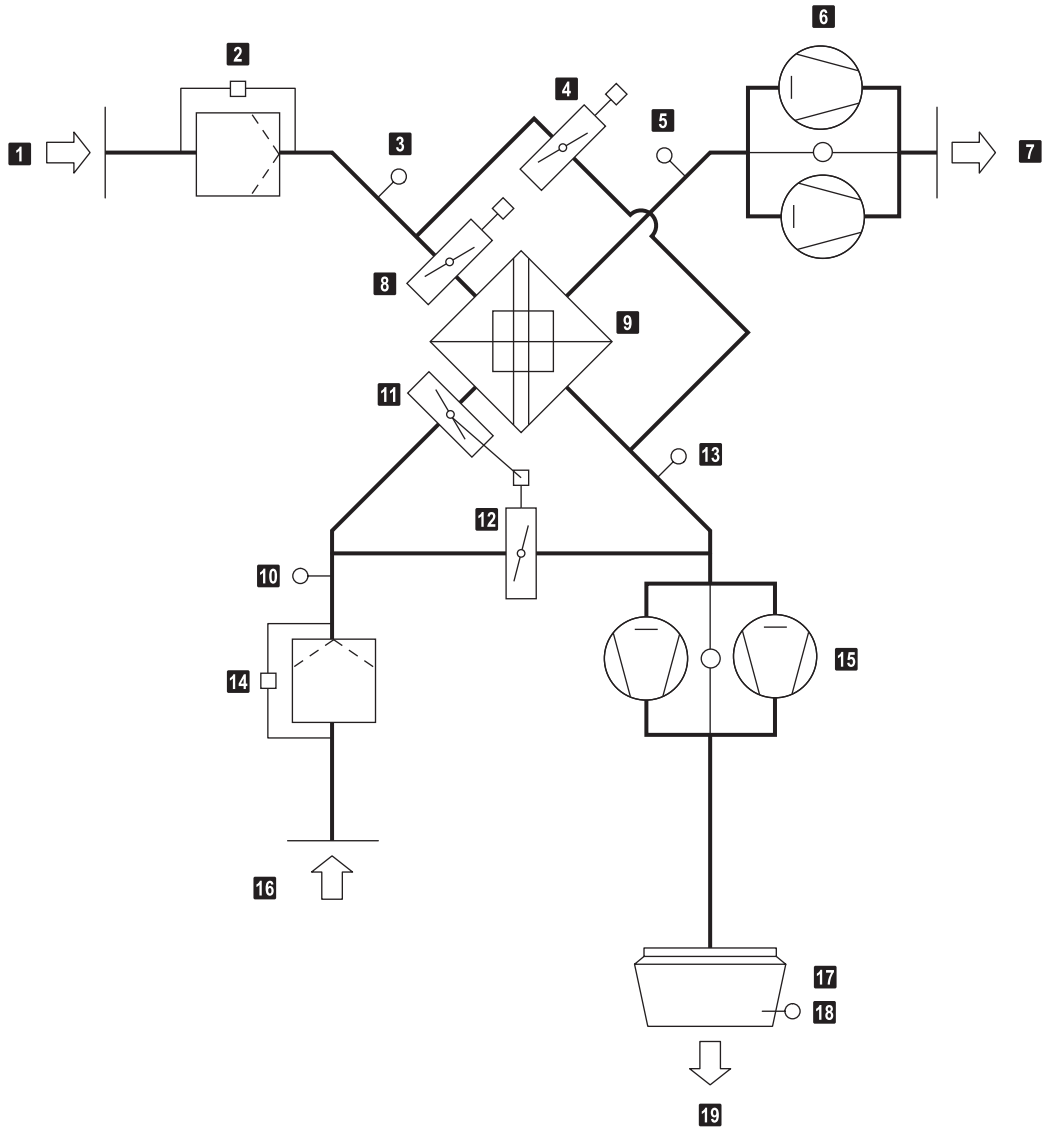
2 Below-roof unit
- **a** Connection module
- **b** Air-Injector

Fig. D1: Components of the RoofVent® R



1	Access panel, connection box
2	Supply air fans
3	Supply air access door
4	Control block
5	Exhaust air access door
6	Exhaust air fans
7	Plate heat exchanger with bypass (for performance control and as recirculation bypass)
8	Fresh air damper with actuator
9	Bypass damper with actuator
10	Fresh air filter
11	Fresh air access door
12	Extract air and recirculation dampers with actuator
13	Extract air access door
14	Extract air filter
15	Extract air grille
16	Actuator of the Air-Injector

Fig. D2: Structure of the RoofVent® R



1	Fresh air	11	Extract air damper with actuator
2	Fresh air filter with differential pressure switch	12	Recirculation damper (opposed to the extract air damper)
3	Temperature sensor air inlet ER (optional)	13	Temperature sensor air outlet ER (optional)
4	Bypass damper with actuator	14	Extract air filter with differential pressure switch
5	Exhaust air temperature sensor	15	Supply air fans with flow rate monitoring
6	Exhaust air fans with flow rate monitoring	16	Extract air
7	Exhaust air	17	Air-Injector with actuator
8	Fresh air damper with actuator	18	Supply air sensor
9	Plate heat exchanger	19	Supply air
10	Extract air temperature sensor		

Fig. D3: Function diagram for RoofVent® R

2.3 Operating modes

The RoofVent® R has the following operating modes:
- Ventilation
- Ventilation (reduced)
- Air quality
- Exhaust air
- Supply air
- Standby

The TopTronic® C control system regulates these operating modes automatically for each control zone in accordance with the specifications in the calendar. The following points also apply:
- The operating mode of a control zone can be switched over manually.
- Each RoofVent® units can operate individually in a local operating mode: Off, Supply air, Exhaust air, Ventilation.

You will find a detailed description of the TopTronic® C control system in section G 'Control systems' of this handbook.

Code	Operating mode	Description
VE	**Ventilation** The unit blows fresh air into the room and exhausts polluted room air. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls: ■ the energy recovery	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed *) Adjustable flow rate
VEL	**Ventilation (reduced)** As VE, but the unit only operates with the set minimum values for the supply and exhaust air volumes	Supply air fan ..... MIN Exhaust air fan ..... MIN Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed
AQ	**Air quality** This is the operating mode for demand-controlled ventilation of the room. The room temperature set value day is active. Depending on the temperature conditions, the system continuously controls energy recovery. Depending on the room air quality, the system operates in one of the following operating states:	
AQ_ECO	■ Air quality Mixed air: When ventilation requirements are medium, the unit works in mixed air operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... 50 % Recirculation damper ..... 50 %
AQ_VE	■ Air quality Ventilation: When ventilation requirements are high, the unit works in pure ventilation operation. The supply/exhaust air volume is based on the air quality.	Supply air fan ..... MIN-MAX Exhaust air fan ..... MIN-MAX Energy recovery ..... 0-100 % Extract air damper ..... open Recirculation damper ..... closed
EA	**Exhaust air** The unit extracts spent room air. There is no room temperature control. Unfiltered fresh air enters the room through open windows and doors or another system provides air supply.	Supply air fan ..... Off Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed *) Adjustable flow rate

Code	Operating mode	Description
SA	**Supply air** The unit blows fresh air into the room. Spent room air passes through open windows and doors or another system provides extraction.	Supply air fan ..... on *) Exhaust air fan ..... off Energy recovery ..... 0 % **) Extract air damper ..... open Recirculation damper ..... closed *) Adjustable flow rate **) Fresh air and bypass dampers are open
ST	**Standby** The unit is normally switched off. The following functions remain active:	
NCS	■ Night cooling: If the room temperature exceeds the set value for night cooling and the current fresh air temperature permits it, the unit blows cool fresh air into the room and extracts warmer room air.	Supply air fan ..... on *) Exhaust air fan ..... on *) Energy recovery ..... 0 % Extract air damper ..... open Recirculation damper ..... closed *) Adjustable flow rate
L_OFF	**Off** (local operating mode) The unit is switched off.	Supply air fan ..... Off Exhaust air fan ..... off Energy recovery ..... 0 % Extract air damper ..... closed Recirculation damper ..... open

Table D1: Operating modes of the RoofVent® R

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3 Technical data

3.1 Unit type reference

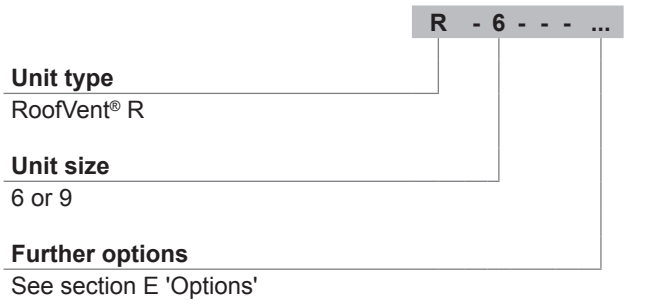

Table D2: Unit type reference

3.2 Application limits

Extract air temperature		max.	50	°C
Extract air relative humidity		max.	60	%
Moisture content of extract air		max.	12.5	g/kg
Fresh air temperature		min.	-30	°C
Supply air temperature		max.	60	°C
Air flow rate	Size 6: Size 9:	min. min.	3100 5000	m³/h m³/h

Table D3: Application limits

Notice
Use units in the design for high extract air humidity if the humidity in the room increases by more than 2 g/kg (see section E 'Options').

3.3 Heat recovery system (HRS)

Unit type		R-6	R-9
Temperature efficiency, dry	%	77	78
Temperature efficiency, wet	%	89	90

Table D4: Thermal transfer level of the plate heat exchanger

3.4 Air filtration

Filter	Fresh air	Extract air
Class acc. to ISO 16890	ePM_1 55 %	ePM_{10} 65 %
Class acc. to EN 779	F7	M5
Factory setting of differential pressure switches	250 Pa	250 Pa

Table D5: Air filtration

3.5 Flow rate, product parameters

Unit type			R-6	R-9
Nominal air flow rate		m³/h	5500	8000
		m³/s	1.53	2.22
Floor area reached		m²	480	797
Specific fan power SFP_{int}		W/(m³/s)	920	940
Face velocity		m/s	2.69	2.98
Static efficiency of the fans		%	62	63
Internal pressure drop of ventilation components				
	Fresh air/supply air	Pa	270	268
	Extract air/exhaust air	Pa	300	316
Maximum leakage rate				
	External	%	0.45	0.25
	Internal	%	1.50	1.20
Nominal external pressure				
	Supply air	Pa	260	330
	Extract air	Pa	190	300
Effective electric power input		kW	1.93	2.99

Table D6: Technical data of the RoofVent® R

3.6 Heat output

Notice
The performance data listed here applies to the most frequent design conditions. Use the selection program 'HK-Select' to calculate the performance data for other design data. You can download 'HK-Select' free of charge on the Internet.

Unit	t_F	Q_{ER}	Q_{TG}	t_S
Size	°C	kW	kW	°C
R-6	-5	35.6	-6.9	14.3
	-15	50.6	-10.5	12.3
R-9	-5	52.5	-9.4	14.5
	-15	74.5	-14.4	12.7

Legend:
t_F = Fresh air temperature
Q_{ER} = Heat output of the energy recovery
Q_{TG} = Output to cover fabric heat losses
t_S = Supply air temperature

Reference: Room air 18 °C, extract air 20 °C / 20 % rel. humidity

Table D7: Heat output of the RoofVent® R

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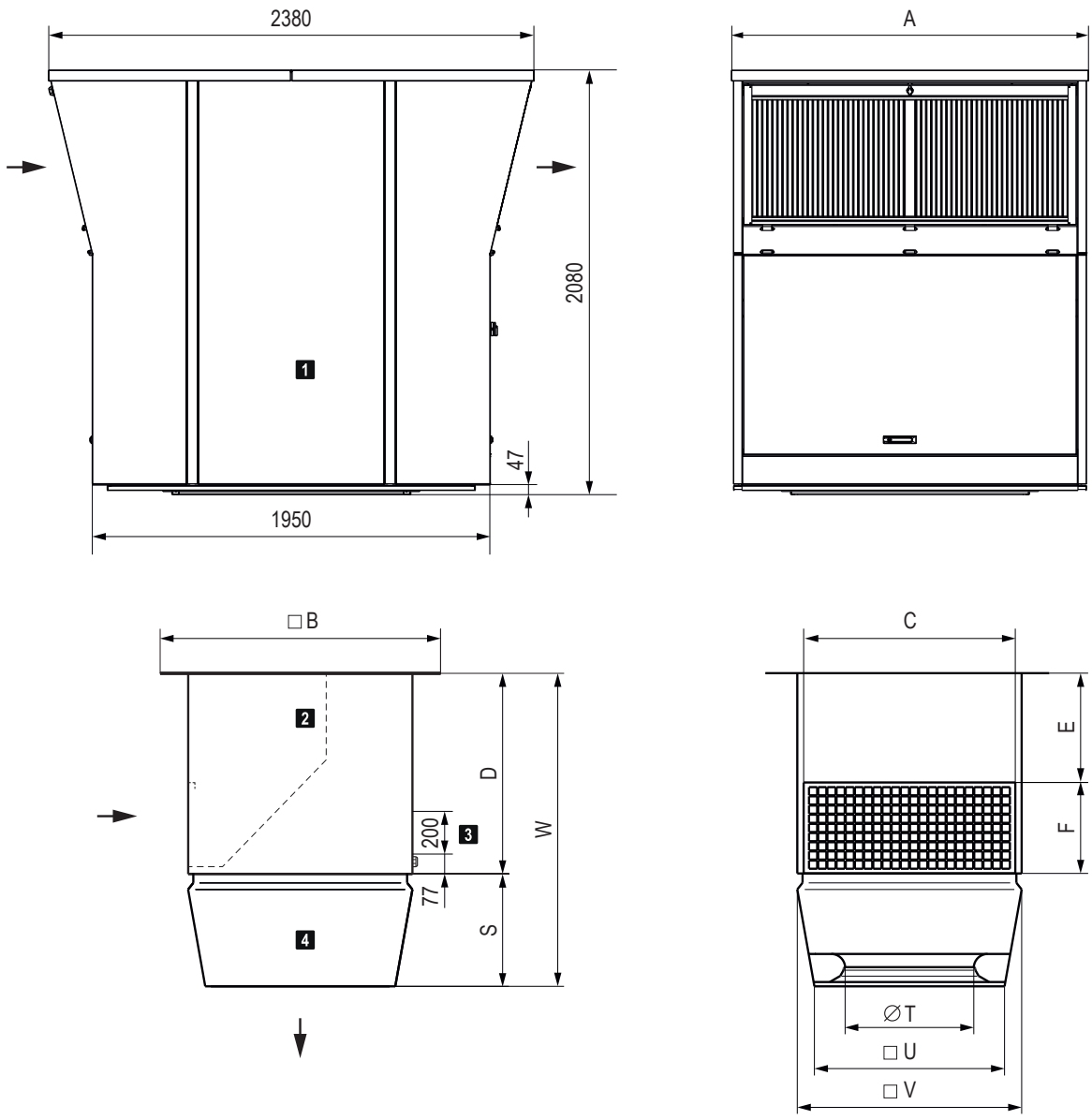
3.7 Dimensions and weights



1 Roof unit with energy recovery	3 Access panel, connection box
2 Connection module	4 Air-Injector

Fig. D4: Dimensional drawing for RoofVent® R (dimensions in mm)

Unit type		R-6				R-9			
A	mm	1400				1750			
B	mm	1040				1240			
C	mm	848				1048			
F	mm	410				450			
S	mm	490				570			
T	mm	500				630			
U	mm	767				937			
V	mm	900				1100			
Connection module		**V0**	**V1**	**V2**	**V3**	**V0**	**V1**	**V2**	**V3**
D	mm	940	1190	1440	1940	980	1230	1480	1980
E	mm	530	780	1030	1530	530	780	1030	1530
W	mm	1430	1680	1930	2430	1550	1800	2050	2550

Table D8: Dimensions of the RoofVent® R

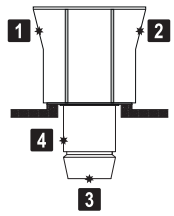
Unit type			R-6	R-9
Total		**kg**	**812**	**1050**
Roof unit		kg	700	900
Below-roof unit		kg	112	150
Air-Injector		kg	37	56
Connection module V0		kg	75	94
	Additional weight V1	kg	+ 11	+ 13
	Additional weight V2	kg	+ 22	+ 26
	Additional weight V3	kg	+ 44	+ 52

Table D9: Weights of the RoofVent® R

3.8 Sound data

Operating mode				VE			
Item				1	2	3	4
R-6	Sound pressure level (at a distance of 5 m) [1]		dB(A)	43	55	52	43
	Total sound power level		dB(A)	65	77	74	65
	Octave sound power level	63 Hz	dB(A)	43	46	45	43
		125 Hz	dB(A)	54	60	59	54
		250 Hz	dB(A)	58	66	64	58
		500 Hz	dB(A)	61	71	69	61
		1000 Hz	dB(A)	56	73	70	56
		2000 Hz	dB(A)	54	69	65	54
		4000 Hz	dB(A)	51	66	62	51
		8000 Hz	dB(A)	49	63	59	49
R-9	Sound pressure level (at a distance of 5 m) [1]		dB(A)	41	55	50	42
	Total sound power level		dB(A)	63	77	72	64
	Octave sound power level	63 Hz	dB(A)	42	45	43	42
		125 Hz	dB(A)	54	62	60	54
		250 Hz	dB(A)	56	65	62	57
		500 Hz	dB(A)	58	70	67	59
		1000 Hz	dB(A)	54	73	68	56
		2000 Hz	dB(A)	54	70	65	55
		4000 Hz	dB(A)	48	64	59	48
		8000 Hz	dB(A)	40	59	53	42

1) with hemispherical radiation in a low-reflection environment



1 Fresh air
2 Exhaust air
3 Supply air
4 Extract air

Table D10: Sound data of the RoofVent® R

4 Specification texts

4.1 RoofVent® R

Supply and extract air handling unit with energy recovery for use in high spaces.
The unit consists of the following components:
- Roof unit with energy recovery
- Below-roof unit:
  - Connection module
  - Air-Injector
- Control components
- Optional components

The RoofVent® R unit complies with all the requirements of the Ecodesign Directive 2009/125/EC relating to environmentally friendly design of ventilation systems. It is a system of the 'non-residential ventilation unit' (NRVU) and 'bidirectional ventilation unit' (BVU) type.

Roof unit with energy recovery

Self-supporting housing, made of aluminium (outside) and aluzinc sheet and aluminium (inside):
- Weatherproof, corrosion resistant, impact resistant, air-tight
- Low flammability, double-shelled, without heat bridges, with highly efficient insulation made of closed-pore polyurethane
- Hygienic and easy to maintain because of smooth interior surfaces and large access doors with ageing-resistant, silicone-free sealing materials

The roof unit with energy recovery includes:

Supply air and exhaust air fans:
Designed as maintenance-free, direct-drive radial fans with high-efficiency EC motor, backwards-curved, 3D contoured blades and a free-running rotating wheel made of a high-performance composite material; inflow nozzle with optimised flow; infinitely variable speed; with active pressure registration for constant volumetric flow control and/or demand-controlled volumetric flow adjustment; low-noise; with integrated overload protection.

Fresh air filter:
Designed as highly efficient compact filter elements, class F7 (ISO ePM_1 55 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Extract air filter:
Designed as highly efficient compact filter elements, class M5 (ISO ePM_{10} 65 %), fully incinerable, easy to change, including differential pressure switch for filter monitoring.

Plate heat exchanger:
Cross-flow plate heat exchanger made of high-quality aluminium as a highly efficient, recuperative heat recovery system, certified by Eurovent, zero-maintenance, without moving parts, failsafe, hygienically harmless, no cross-contamination of impurities and odours. Equipped with bypass, recirculation bypass, condensate drain and condensation trap to the roof. The following dampers are arranged on the exchanger package:
- Fresh air and bypass dampers, each with their own actuator, for infinitely variable control of the heat recovery; with shut-off function by spring return.
- Extract air and recirculation dampers, interlinked in a counter-rotating arrangement with a common actuator, for controlling the recirculation and mixed air operation; with shut-off function by spring return.

All dampers correspond to seal integrity class 2 according to EN 1751.

Access openings:
- Fresh air access door: large access opening with integrated weather and bird protection, configured with quick locking system for easy access to the fresh air filter, the plate heat exchanger as well as the fresh air and bypass dampers.
- Exhaust air access door: large, lockable access opening with integrated weather and bird protection for easy access to the exhaust air filter.
- Extract air access door: large access opening, configured with quick locking system and telescopic support for easy access to the extract air filter, the plate heat exchanger, the condensation trap as well as the extract air and recirculation dampers.
- Supply air access door: large, lockable access opening, configured with telescopic support for easy access to the supply air fans, the control block and the condensate collecting channel.

Control block:
Compact design on an easily accessible mounting plate, comprising:
- Unit controller as part of the TopTronic® C control system:
  - Fully wired to the electrical components of the roof unit (fans, actuators, temperature sensors, filter monitoring, differential pressure sensor)
  - Pluggable wiring to the control box in the connection module

- High-voltage section:
  - Mains power terminals
  - Isolation switch
  - Button for stopping the fans during filter change
- Low-voltage section:
  - Transformer for actuators, sensors and the unit controller
  - Externally switchable forced off
- Circuit board with further electronic components for unit control (differential pressure measurement, fuses for the transformer, fuses for low voltage, ...)

Connection module

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of smooth interior surfaces and ageing-resistant, silicone-free sealing materials; configured with extract air grille and access panel. The connection module contains:

- Laced wiring harness protected in a sheet metal duct, with direct plug connection to the control block in the roof unit
- Connection box made of galvanised sheet steel, configured with circuit board, screw-on cover and cable lead-ins with splash water protection and strain relief; for connection of:
  - Power supply
  - Zone bus
  - All sensors and actuators of the below-roof unit (ready-to-connect): supply air temperature sensor, Air-Injector actuator
  - Optional components as required

Connection module V1 / V2 / V3:

The connection module is extended for adapting to the local installation situation.

Air-Injector

1 Air-Injector

Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor

2 Air-Injectors

2x Air-Injectors, supplied loose; supply air duct for connecting the RoofVent® unit to the Air-Injectors on site. Housing made of aluzinc sheet, air-tight, flame retardant, hygienic and easy to maintain because of ageing-resistant, silicone-free sealing materials, with:

- Vortex air distributor with concentric outlet nozzle, adjustable vanes and integrated absorber hood
- Actuator for infinitely variable adjustment of the air distribution from vertical to horizontal for draught-free air distribution in the hall under changing operating conditions
- Supply air sensor (supplied in the connection module)

Without Air-Injector

Unit configured without vortex air distributor for connection to an on-site supply air duct and air distribution within the building, supply air temperature sensor supplied in the connection module.

Options for the unit

Oil-proof design:

- Oil-proof materials
- Special extract air filter for oil and dust separation in the connection module, class M5 (ISO ePM$_{10}$ 50 %)
- Plate heat exchanger additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Connection module in oil-tight design with integrated oil/condensate drip tray and drain connection

Design for high extract air humidity:

- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Plate heat exchanger with condensate separator; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection

Corrosion-protected design:

- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger for high corrosion resistance; additionally sealed; leak test according to works standard
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)

Corrosion-protected design for high extract air humidity:
- Powder-coated supply air and exhaust air fans, coat thickness > 80 µm; electronics potted on both sides
- Specially coated plate heat exchanger with condensate separator for high corrosion resistance; additionally sealed; leak test according to works standard
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection
- Connecting elements (blind rivet nuts, screws, rivets) made of stainless steel 1.4301
- Casing of the roof unit powder-coated on the inside
- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)

Paint finish of below-roof unit:
Choice of external paint finish in RAL colour

Fresh air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and acoustic insulation lining, for reducing sound emissions on the fresh air side, insertion loss _____ dB

Exhaust air silencer:
Configured as add-on part for the roof unit which can be folded downwards, housing made of aluminium with a bird screen and easily accessible sound attenuation splitters, optimised flow, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover for reducing sound emissions on the exhaust air side, insertion loss _____ dB

Supply air and extract air silencer:
Supply air silencer configured as separated component in the below-roof unit, flow-optimised sound attenuation splitters, with abrasion-resistant and easily cleaned surfaces, non-flammable, hygienically clean with high-quality glass filament cover, extract air silencer configured as acoustic insulation lining in the connection module, for reducing sound emission in the room, insertion loss supply air/extract air _____ dB / _____ dB

Socket:
230 V socket installed in the control block for simple supply of external, electrical units.

Energy monitoring:
Consisting of 2 additional temperature sensors for recording the air inlet and air outlet temperatures of the plate heat exchanger. Energy monitoring makes it possible to display the energy saved by heat and cool recovery.

4.2 TopTronic® C control systems

Freely configurable, zone-based control system ex-works for operation of decentralised Hoval indoor climate systems with optimised use of energy, suitable for demand-driven control of overall systems comprising up to 64 control zones each with up to 15 supply and extract air handling units or supply air units and 10 recirculation units.

System structure:
- Unit controller: installed in the particular indoor climate unit
- Zone bus: as serial connection of all unit controllers in one control zone with the zone controller; with robust bus protocol via shielded and twisted-pair bus line (bus cables provided by the client)
- Zone control panel with:
  - System operator terminal
  - Fresh air temperature sensor
  - Zone controllers and room air temperature sensors
  - All components for the electrical power supply and protection
- System bus (Ethernet): for connecting all zone controllers to one another and to the system operator terminal (bus cables provided by the client)

Operation:
- TopTronic® C-ST as system operator terminal: touch panel for visualisation and control by web browser via HTML interface, including software for LAN access
- TopTronic® C-ZT as zone operator terminal: for simple on-site operation of a control zone (optional)
- Manual operating selector switch (optional)
- Manual operating selector button (optional)
- Operating of the units via building management system via standardised interfaces (optional):
  - BACnet
  - Modbus IP
  - Modbus RTU

Control functions:
- Control of the supply air temperature using room supply air cascade control via sequential control of the energy recovery and the coils (depending on the unit type)
- Demand-driven control of the room air quality by variation of the supply air and exhaust air volume flows with minimum and maximum limit (for supply and extract air handling units, optional)
- Control of the unit including the air distribution according to the specifications of the zone controller

Alarms, protection:
- Central alarm management with registration of all alarms (timestamp, priority, status) in an alarm list and alarm memory of the last 50 alarms; forwarding via e-mail can be set in the parameters.

- If there is a failure of communication, bus stations, sensor systems or supply media, each part of the system transitions to a protection mode which safeguards operation.
- Frost protection control of the units with constrained control of protection functions to prevent coil icing (for supply air units as well as supply and extract air handling units)
- A maintenance mode implemented in the control algorithm for testing all physical data points and alarms guarantees high reliability.

Options for the zone control panel:

- Design for heating (RH, RC, RHC)
- Design for cooling (RC, RHC)
- Cooling lock switch (RC, RHC)
- Alarm lamp
- Socket
- Additional room air temperature sensors
- Combination sensor room air quality, temperature and humidity
- External sensor values
- External set values
- Load shedding input
- Operating selector switch on terminal
- Operating selector button on terminal
- Power supply for air handling unit
- Safety relay
- Control of distributor pump(s), incl. power supply (RH, RC, RHC)

Options

1 Unit type reference

RHC - 9 B C - RX / ST . -- / V0 . D1 . LU / AF . SI / Y . KP . -- . SD / TC . EM . PH . RF

Unit type
RoofVent® RH | RC | RHC | R

Unit size
6 or 9

Heating section
- - without heating section
- B with coil type B
- C with coil type C
- D with coil type D

Heating/cooling section
- - without heating/cooling section
- C with coil type C
- D with coil type D

Heat recovery
- RX Temperature efficiency ErP 2018

Design
- ST Standard
- OE Oil-proof design
- HA Design for high extract air humidity
- KG Corrosion-protected design
- KA Corrosion-protected design for high extract air humidity

Reserve

Connection module
- V0 Standard
- V1 Length +250 mm
- V2 Length +500 mm
- V3 Length +1000 mm

Air outlet
- D1 Design with 1 Air-Injector
- D2 Design with 2 Air-Injectors
- D0 Design without Air-Injector

Paint finish
- - without
- LU Paint finish of below-roof unit

RHC - 9 B C - RX / ST . -- / V0 . D1 . LU / AF . SI / Y . KP . -- . SD / TC . EM . PH . RF

Silencers outside
- without
A- Fresh air silencer
-F Exhaust air silencer
AF Fresh air and exhaust air silencer

Silencers inside
- without
SI Supply air and extract air silencer

Hydraulics
- without
Y Hydraulic assembly diverting system
M Mixing valve

Condensate pump
- without
KP Condensate pump

Socket
- without
SD Socket in the unit
CH Socket in the unit Switzerland

Control system
TC TopTronic® C

Energy monitoring
- without
EM Energy monitoring

Pump control
- without
PH Heating pump
PK Heating or cooling pump
PP Heating pump and cooling pump

Return temperature sensor
- without
RF Return temperature sensor

2 Oil-proof design

RoofVent® units in oil-proof design are suitable for use in applications with oil-saturated extract air. The maximum oil load in the extract air is 10 mg/m³ air. The following features ensure trouble-free operation of the system:

- Oil-proof materials
- Special extract air filter for oil and dust separation (class M5), factory setting of the differential pressure switch 320 Pa
- Plate heat exchanger additionally sealed
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Connection module in oil-tight design with integrated oil/condensate drip tray and drain connection

Please note the following:

- Install an oil/condensate drain with trap in accordance with the local provisions to remove these types of emulsions.
- Do not damage or drill into the connection module, in order not to breach the sealing.
- Check the extract air filter at regular intervals.
- Due to the special extract air filter the unit has an additional pressure drop of 70 Pa.
- In the 'Air quality' operating mode the units always work in pure ventilation operation (AQ_VE).
- Do not operate the units in 'Recirculation' mode (REC) unless there is no oil pollution in the room.

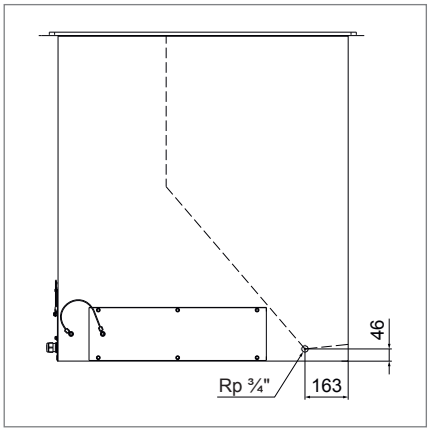


Fig. E1: Dimensional drawing for oil/condensate drain (in mm) for oil-proof design and design for high extract air humidity

3 Design for high extract air humidity

RoofVent® units in the design for high extract air humidity are suitable for use in applications in which there is humidification in the room (increase in humidity in the room by more than 2 g/kg), for example applications in paper and electronics industries.

The following features ensure trouble-free operation of the system:

- Powder-coated fans; electronics potted on both sides
- Plate heat exchanger with condensate separator (additional pressure drop 80 Pa); additionally sealed
- Condensate drain from the plate heat exchanger to the drip tray in the connection module
- Additional insulation of various equipment components to avoid condensation
- Connection module with integrated condensate drip tray and drain connection

Please note the following:

- Install an condensate drain with trap in accordance with the local provisions to remove the condensate.
- Do not damage or drill into the connection module, in order not to breach the sealing.
- There is an increased risk of ice formation in the plate heat exchanger in applications with high extract air humidity. Consequently, it is important to activate icing protection when commissioning the plant. It is essential to have a humidity sensor for this.

Attention
Danger of damaging the units due to ice formation. Order a combination sensor room air quality, temperature and humidity (option). It is required for icing protection.

4 Corrosion-protected design

RoofVent® units in corrosion-protected design are suitable for use in applications with an increased corrosion risk, for example applications in the foot industry.

The following features ensure trouble-free operation of the system:

- Powder-coated fans; electronics potted on both sides
- Plate heat exchanger specially coated and additionally sealed
- Connecting elements of stainless steel
- Casing of the roof unit powder-coated on the inside

- Parts prone to corrosion powder-coated, sheet metal parts of the dampers and all sheet metal parts of the below-roof unit powder-coated on both sides (pebble grey RAL 7032)
- Painted coil

5 Corrosion-protected design for high extract air humidity

RoofVent® units in corrosion-protected design for high extract air humidity are suitable for use in applications with an increased corrosion risk and high increase in humidity in the room, for example applications in a car wash.
This unit design combines the features of the design for high extract air humidity and the corrosion-protected design.

Please note the following:

- Install an condensate drain with trap in accordance with the local provisions to remove the condensate.
- Do not damage or drill into the connection module, in order not to breach the sealing.
- There is an increased risk of ice formation in the plate heat exchanger in applications with high extract air humidity. Consequently, it is important to activate icing protection when commissioning the plant. It is essential to have a humidity sensor for this.

Attention
Danger of damaging the units due to ice formation. Order a combination sensor room air quality, temperature and humidity (option). It is required for icing protection.

6 Connection module

The connection module is available in 4 lengths for adapting the RoofVent® unit to local conditions.

7 Design with 2 Air-Injectors

A supply air duct can be connected to the RoofVent® unit for distributing the supply air over a very wide area. 2 Air-Injectors can be installed on this. The supply air duct and the cabling must be provided by the client.

Notice
An actuator is installed in each of the two Air-Injectors. The supply air temperature sensor is enclosed in the connection module for on-site installation in the supply air duct.

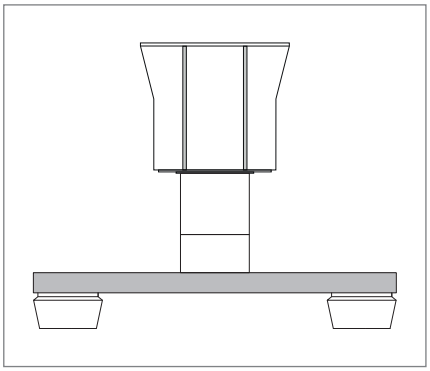
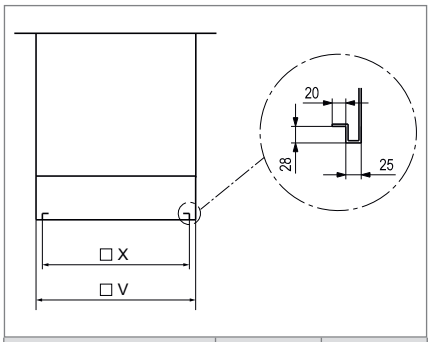


Fig. E2: RoofVent® unit with supply air duct and 2 Air-Injectors



Size		6	9
X	mm	850	1050
V	mm	900	1100

Fig. E3: Connection dimensions for supply air duct (in mm)

E

8 Design without Air-Injector

RoofVent® units in the design without Air-Injector are suitable for connecting to an air distribution system supplied by the client.

Notice
The supply air temperature sensor is enclosed in the connection module for on-site installation in the supply air duct.

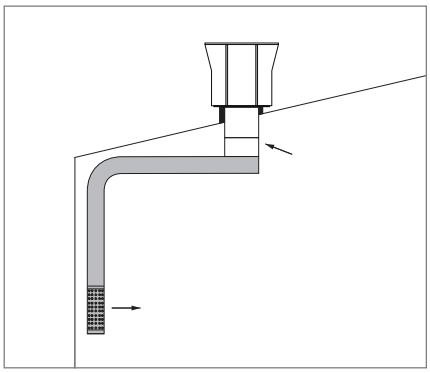
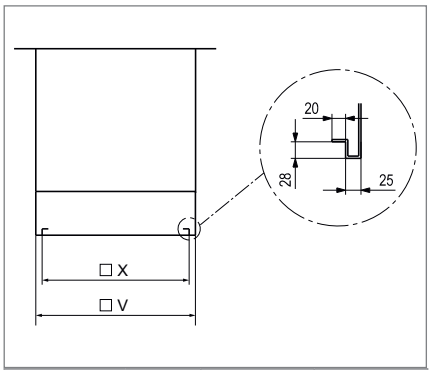


Fig. E4: Connection to an air distribution system supplied by the client



Size		6	9
X	mm	850	1050
V	mm	900	1100

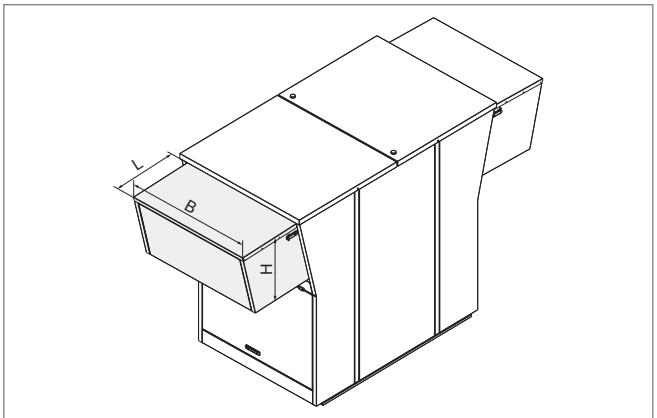
Table E1: Connection dimensions for supply air duct (in mm)

9 Paint finish of below-roof unit

The entire below-roof unit is painted in any colour. If the below-roof unit is equipped with a supply air silencer, this is also painted.

10 Fresh air silencer

The fresh air silencer reduces noise emissions from RoofVent® units on the fresh air side. It consists of an aluminium casing with a bird screen and acoustic insulation lining and is configured as an add-on part for the roof unit which can be folded downwards.



Size		6	9
L	mm	625	625
B	mm	1280	1630
H	mm	650	650
Weight	kg	30	42
Pressure drop	Pa	10	10

Table E2: Technical data of the fresh air silencer

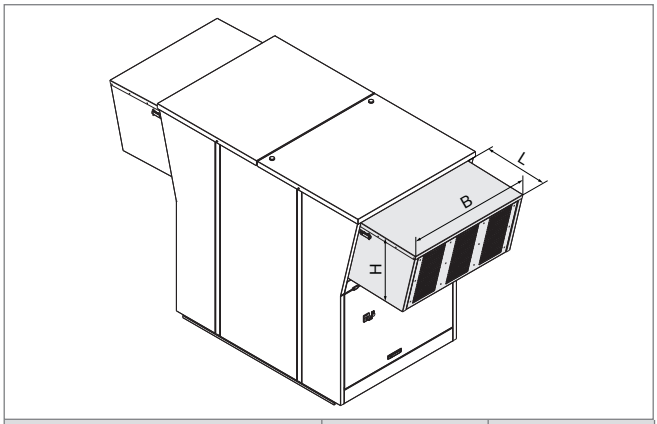
Frequency	Size 6	Size 9
63 Hz	0	0
125 Hz	1	1
250 Hz	3	3
500 Hz	4	4
1000 Hz	4	4
2000 Hz	4	4
4000 Hz	3	3
8000 Hz	3	3
Sum	**3**	**3**

Table E3: Insertion attenuation of the fresh air silencer (values in dB, relating to the nominal air flow rate)

Notice
The fresh air silencer is not available for the following unit designs:
– Design for high extract air humidity
– Corrosion-protected design
– Corrosion-protected design for high extract air humidity

11 Exhaust air silencer

The exhaust air silencer reduces noise emissions from RoofVent® units on the exhaust air side. It consists of an aluminium casing with a bird screen and sound attenuation splitters and is configured as an add-on part for the roof unit which can be folded downwards.



Size		6	9
L	mm	625	625
B	mm	1280	1630
H	mm	650	650
Weight	kg	52	68
Pressure drop	Pa	50	53

Table E4: Technical data of the exhaust air silencer

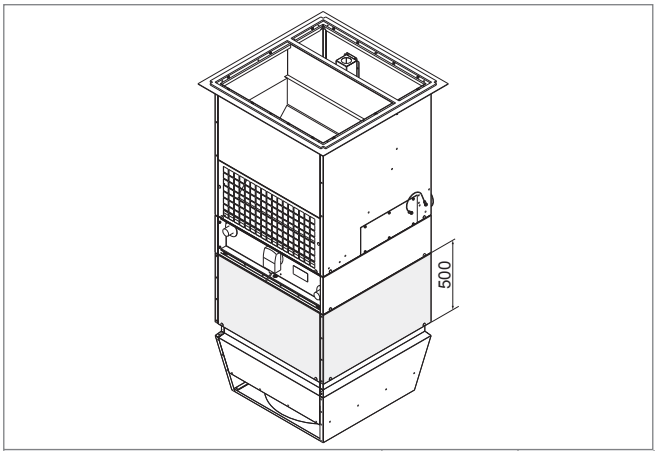
Frequency	Size 6	Size 9
63 Hz	2	2
125 Hz	3	3
250 Hz	9	9
500 Hz	11	11
1000 Hz	15	15
2000 Hz	14	14
4000 Hz	10	10
8000 Hz	8	8
Sum	**9**	**9**

Table E5: Insertion attenuation of the exhaust air silencer (values in dB, relating to the nominal air flow rate)

Notice
The exhaust air silencer is not available for the following unit designs:
– Design for high extract air humidity
– Corrosion-protected design
– Corrosion-protected design for high extract air humidity

12 Supply air and extract air silencers

Supply air and extract air silencers reduce the noise from RoofVent® units within the room. The supply air silencer is designed as a separated component and is installed above the Air-Injector. The extract air silencer consists of acoustic insulation lining in the connection module.



Size		6	9
Weight	kg	53	80
Supply air pressure drop	Pa	22	26
Extract air pressure drop	Pa	0	0

Table E6: Technical data of the supply air and extract air silencers

	Supply air		Extract air	
Frequency	Size 6	Size 9	Size 6	Size 9
63 Hz	7	5	0	0
125 Hz	9	7	0	0
250 Hz	15	15	2	2
500 Hz	17	17	3	3
1000 Hz	19	20	3	3
2000 Hz	15	17	3	3
4000 Hz	13	12	2	2
8000 Hz	10	9	2	2
Sum	**15**	**15**	**2**	**2**

Table E7: Insertion attenuation of the supply and extract air silencers (values in dB, relating to the nominal air flow rate)

Notice
Supply air and extract air silencers are not available for the following unit designs:
– Oil-resistant design
– Design for high extract air humidity
– Corrosion-protected design
– Corrosion-protected design for high extract air humidity

13 Hydraulic assembly diverting system

Assemblies for hydraulic diverting which are optimally matched to the units are available for easy installation of RoofVent® units. Please note the following:

- Thermally insulate the assembly on site.
- To ensure correct operation, install the assembly horizontally.
- Mount the assembly so that its weight does not need to be absorbed by the coil.

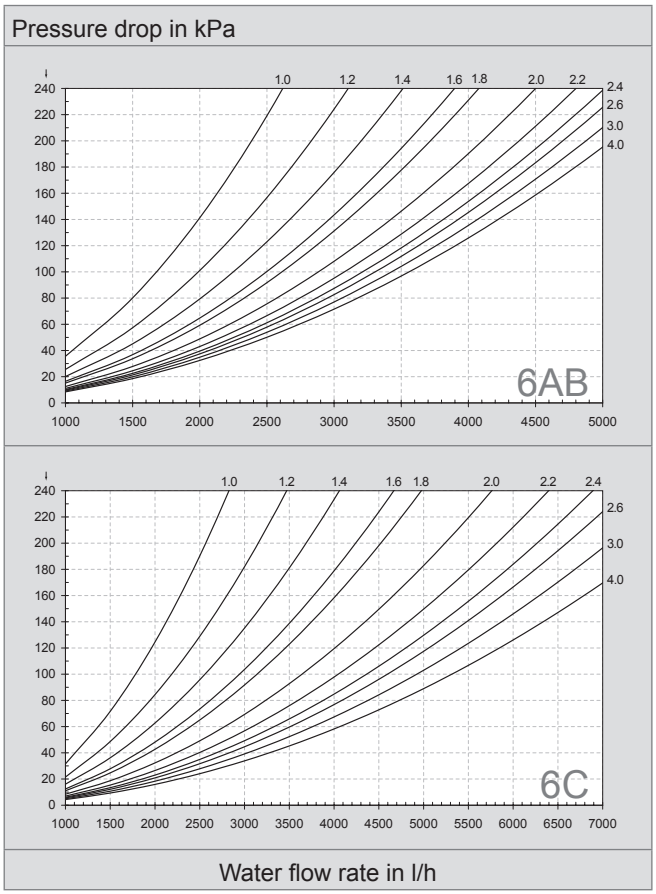
Default settings for the hydraulic alignment

Read off the default settings from Diagram E1. The curves 1.0 to 4.0 correspond to the revolutions of the valve spindles of the balancing valve; they are shown on the turning knob:

0.0 ___ Valve closed

4.0 ___ Valve fully open

The coil and the hydraulic assembly are already included in the specified pressure drops. Thus, only consider the pressure drops of the distributor circuit up to the screw connections.



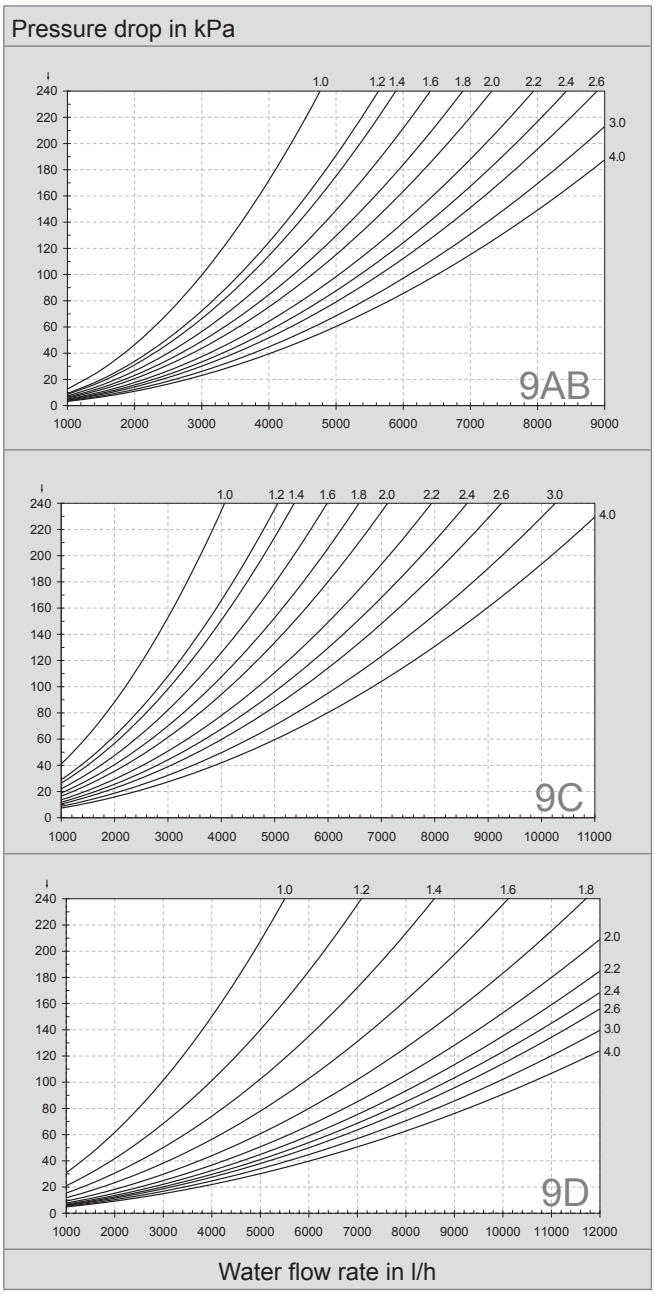
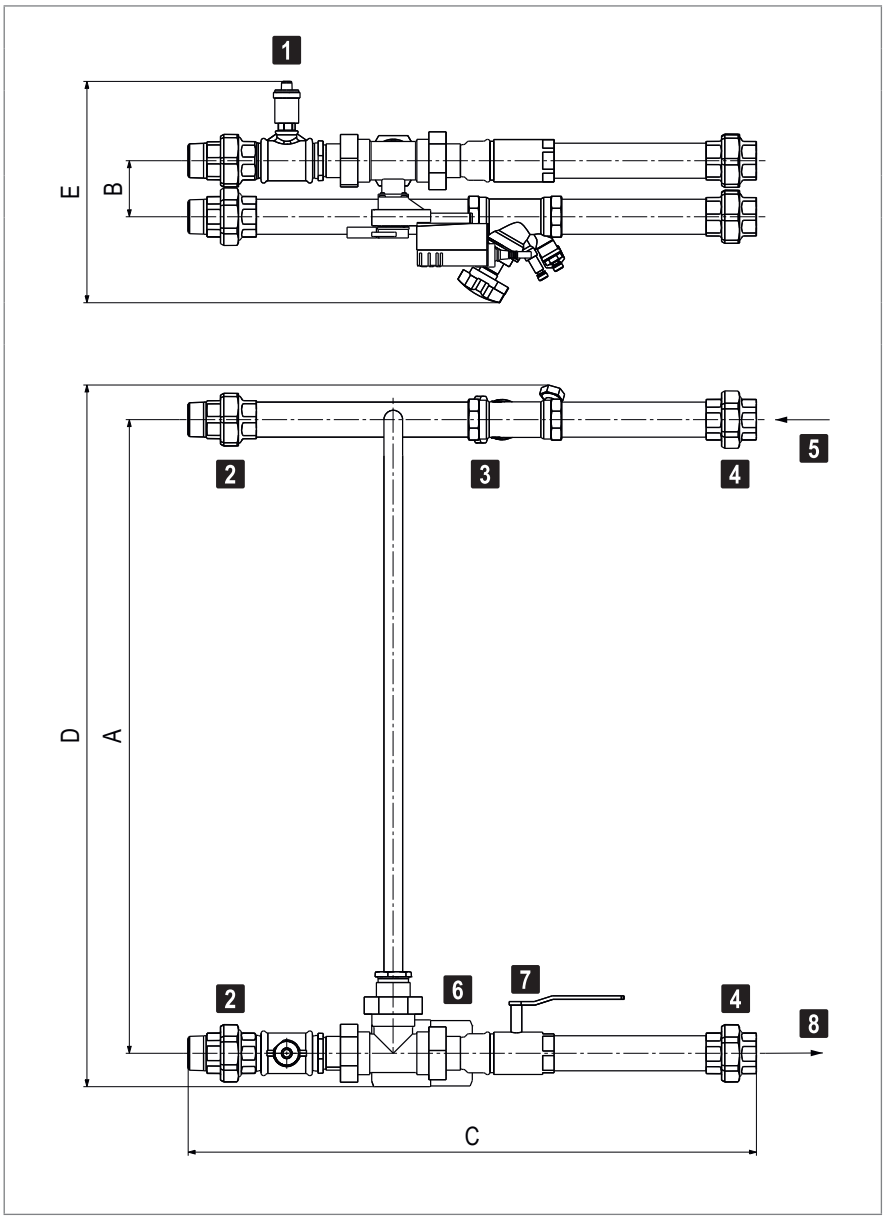


Diagram E1: Default values for the balancing valves



1	Automatic air vent
2	Coil screw joint
3	Control valve
4	Distributor circuit screw joint
5	Flow
6	Mixing valve
7	Ball valve
8	Return

Fig. E5: Dimensional drawing

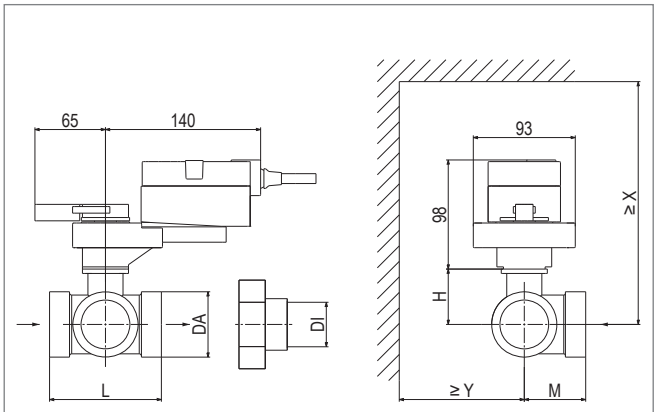
Type	A	B	C	D	E	Mixing valve	Control valve	Screw joint
Y-6AB	758	78	726	853	300	20-6.3HV	STAD DN32	1¼ "
Y-6C	758	78	745	853	300	25-10HV	STAD DN32	1¼ "
Y-9AB	882	78	770	977	320	25-10HV	STAD DN40	1½ "
Y-9C	882	78	791	977	320	32-10HV	STAD DN40	1½ "
Y-9D	882	95	840	977	340	40-16HV	STAD DN50	2 "

Table E8: Dimensions (in mm) and valves of the hydraulic assembly

14 Mixing valve

Mixing valves which are optimally matched to the units are available for easy installation of RoofVent® units. They have the following specifications:

- 3-way mixing valve with modulating rotary actuator (run time 9 s)
- Flow characteristic:
  - Equal percentage control path
  - Linear bypass
- Integrated position control and response



Type	DN	kvs	DA	DI	L	H	M	X	Y
		m³/h	"	"	mm	mm	mm	mm	mm
M-6AB	20	6.3	G 1¼	Rp ¾	86	46	42	220	90
M-6C	25	10	G 1½	Rp 1	85	46	45	220	90
M-9AB	25	10	G 1½	Rp 1	85	46	45	220	90
M-9C	32	10	G2	Rp 1¼	104	46	56	220	90
M-9D	40	16	G 2¼	Rp 1½	115	51	56	230	90

Table E9: Dimensions of mixing valves

Type	Weight
	kg
M-6AB	2.6
M-6C	3.1
M-9AB	3.1
M-9C	4.0
M-9D	4.7

Table E10: Weights of the mixing valves

15 Condensate pump

RoofVent® cooling units must be connected to a condensate drainage system. For applications in which connection to the waste water system is too expensive or not possible for structural reasons, a condensate pump can be provided. This is installed directly under the condensate drain connection; the supplied container is prepared for installation on the Air-Injector. It pumps the condensate through a flexible hose to a delivery head of 3 m, thus enabling discharge of the condensate

- through waste water pipes directly below the ceiling,
- onto the roof.

Flow rate (at 3 m delivery head)	l/h	max. 150
Tank capacity	l	max. 1.9
Dimensions (L x W x H)	mm	288 x 127 x 178
Weight	kg	2.4

Table E11: Technical data of the condensate pump

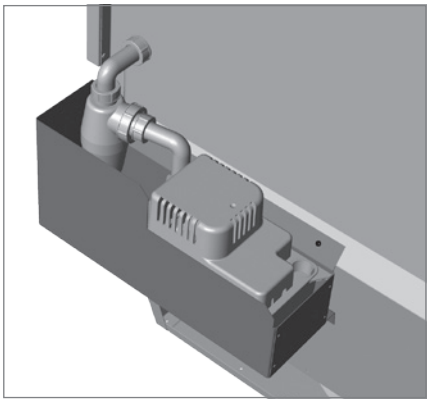


Fig. E6: Condensate pump

16 Socket

For maintenance work, a socket (1-phase, 230 V AC, 50 Hz) can be installed in the roof unit, next to the control block.

17 Energy monitoring

Energy monitoring makes it possible to display the energy saved by heat and cool recovery. For this purpose, 2 additional temperature sensors are installed in the RoofVent® units; they record the air inlet and air outlet temperatures of the plate heat exchanger.

18 Return temperature sensor

The return temperature sensor monitors the return temperature of the heating medium. If necessary, it triggers frost pre-control at the heating valve to prevent the system possibly being shut down due to frost.

19 Pump control for mixing or injection system

Instead of the diverting system, an injection or mixing circuit can also be installed in the load circuit.

Please note the following:
- Not only the mixing valves but also the pumps in the load circuit are controlled directly by the control block.
- Terminals for wiring the mixing valves and the pumps in the load circuit are located in the connection box.
- Make sure that valves and pumps which meet the following requirements are provided on site.

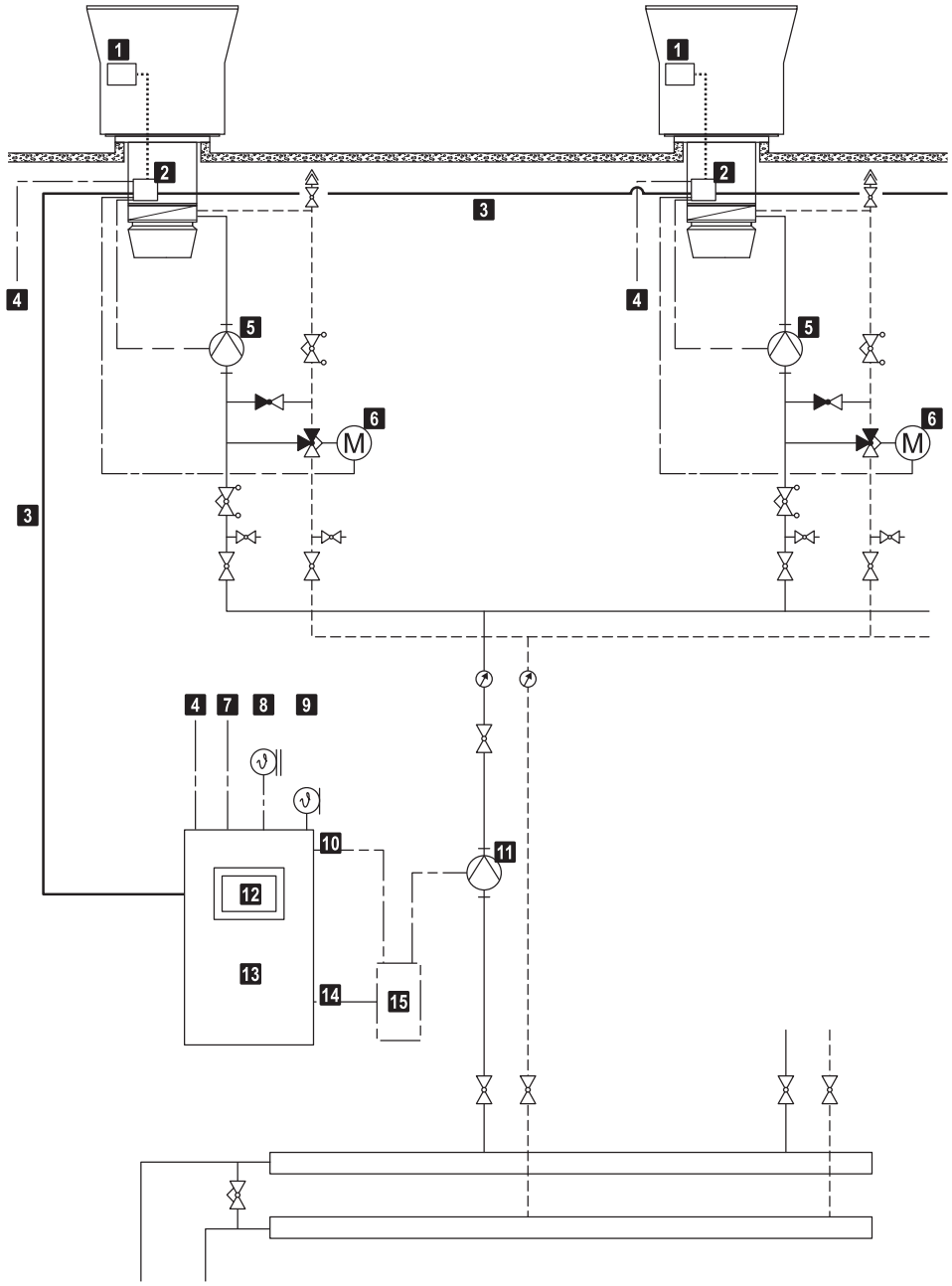
19.1 Requirements for mixing valves

- Use 3-way mixing valves with the following flow characteristics:
  - Equal percentage control path
  - Linear bypass
- The valve authority must be ≥ 0.5.
- The maximum run time of the valve actuator is 45 s.
- The valve actuator must be continuous, i.e. the stroke changes in proportion to the control voltage (DC 2…10 V).
- The valve actuator must be designed with a position response (0...10 VDC or 2…10 VDC).
- The maximum power consumption is 20 VA.
- Install the valve close to the unit (max. distance 2 m).

19.2 Requirements for pumps

Voltage_____ 230 V AC
Current_____up to 4.0 A

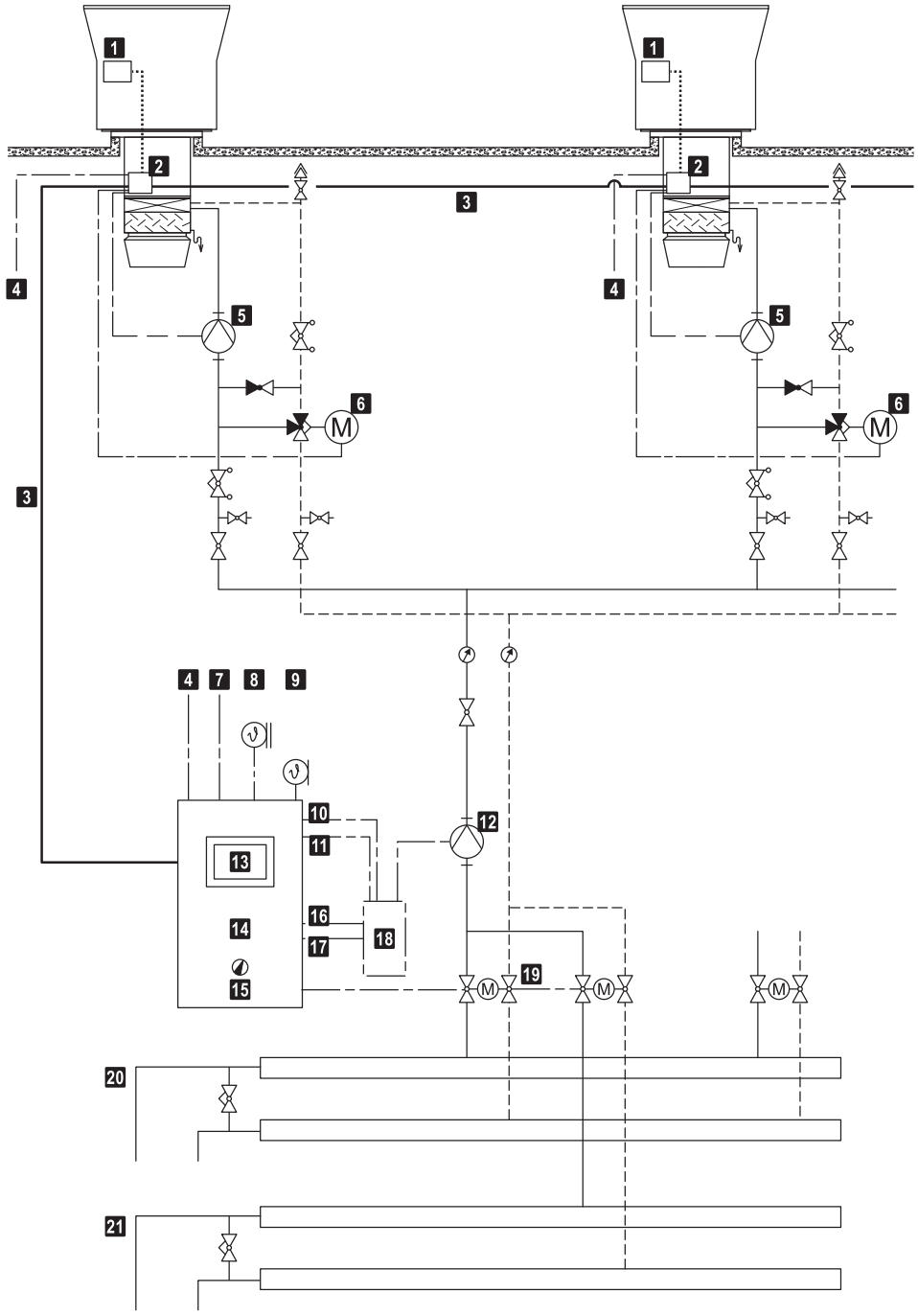
RoofVent® RH



1 Control block	6 Mixing valve	11 Distributor pump
2 Connection box	7 Collective alarm	12 System operator terminal
3 Zone bus	8 Fresh air temperature sensor	13 Zone control panel
4 Power supply	9 Room temperature sensor	14 Enable heating
5 Heating pump	10 Trouble input heating	15 Heating control panel

Table E12: Schematic diagram for injection system of RoofVent® RH

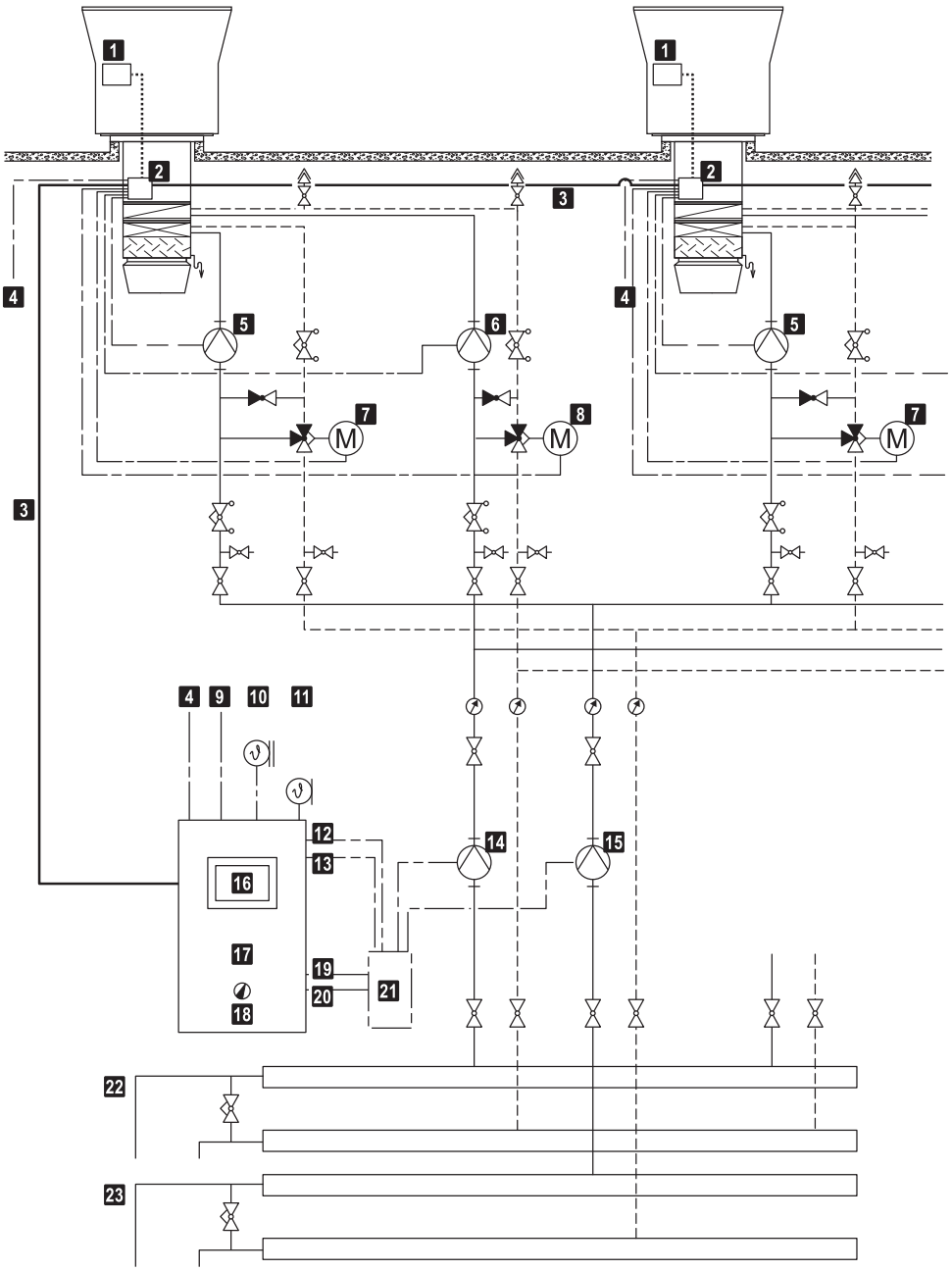
RoofVent® RC



1 Control block	8 Fresh air temperature sensor	15 Cooling lock switch (option)
2 Connection box	9 Room temperature sensor	16 Enable heating
3 Zone bus	10 Trouble input heating	17 Enable cooling
4 Power supply	11 Trouble input cooling	18 Heating control panel
5 Heating/cooling pump	12 Distributor pump	19 Changeover valves heating/cooling
6 Mixing valve	13 System operator terminal	20 Heating circuit
7 Collective alarm	14 Zone control panel	21 Cooling circuit

Table E13: Schematic diagram for injection system of RoofVent® RC

RoofVent® RHC



1	Control block	9	Collective alarm	17	Zone control panel
2	Connection box	10	Fresh air temperature sensor	18	Cooling lock switch (option)
3	Zone bus	11	Room temperature sensor	19	Enable heating
4	Power supply	12	Trouble input heating	20	Enable cooling
5	Cooling pump	13	Trouble input cooling	21	Heating control panel
6	Heating pump	14	Distributor pump cooling	22	Heating circuit
7	Mixing valve cooling	15	Distributor pump heating	23	Cooling circuit
8	Mixing valve heating	16	System operator terminal		

Table E14: Schematic diagram for injection system of RoofVent® RHC

Transport and installation

F

1 Installation

RoofVent® units are delivered as standard in 2 parts on pallets:
- Roof unit
- Below-roof unit

Associated parts are labelled with the same unit number.

1.1 Preparing for installation

The following guidelines are important when preparing for installation:
- The units are assembled from roof level. A crane or helicopter is required.
- Make sure that the roof frames correspond to the specifications in chapter 1.2.
- A sealing compound (e.g. PU foam) is required for sealing.
- Depending on the unit size, the below-roof unit can be delivered in 2 parts.
- Transport eyes are supplied for lifting the below-roof unit and the roof unit.
- Define the desired orientation of the units (position of the coil connections).

Notice
The standard position of the coil connections is underneath the extract air grille. Check the local installation conditions. If another orientation is required, the heating or cooling section can be mounted turned round on the connection module.

- Fresh air and exhaust air silencers are supplied separately. Install them on the unit before transporting it to the roof, and make sure they are locked.
- Follow the installation instructions included.

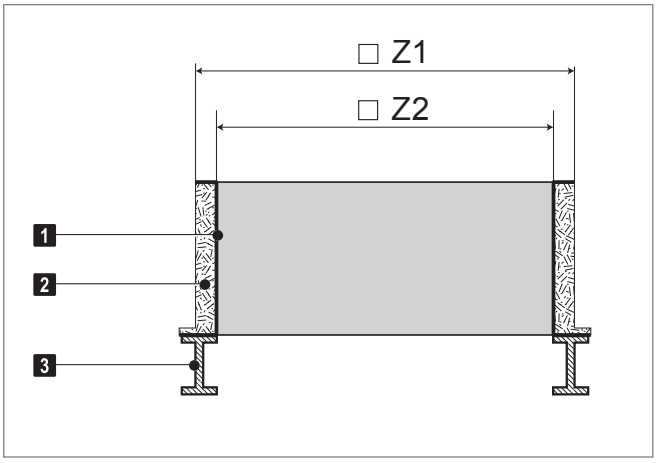
Notice
Provide suitable protective devices and make sure the units can be accessed easily. The maximum roof load of the RoofVent® units is 80 kg.

1.2 Roof frame

Roof frames are required for installing RoofVent® units in the roof. Please consider the following in the design process:
- The extract air grille and the access panels must be freely accessible under the roof.
- The roof frame must protrude at least 200 mm from the roof, so that no water can penetrate during a rainstorm or snowfall.

Notice
The connection module is available in 4 lengths for adapting to the local installation situation.

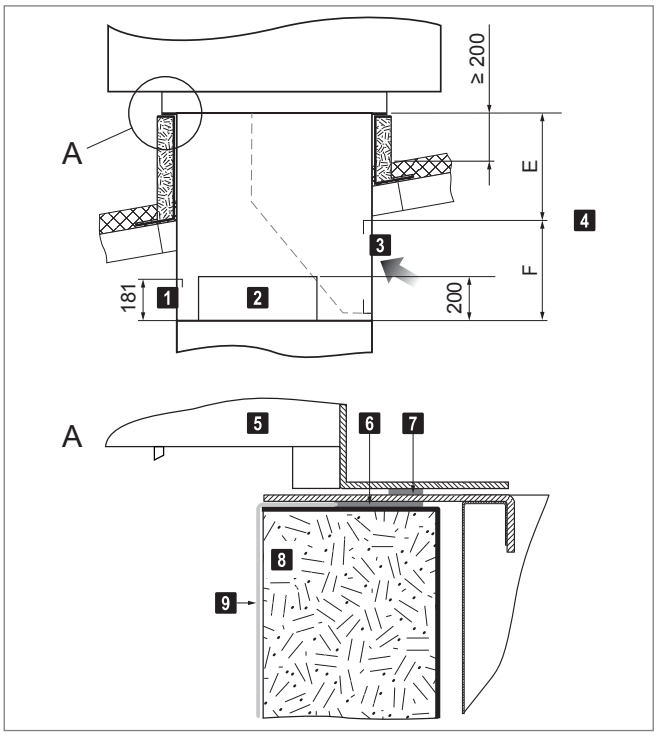
- The opening (dimension Z2) must be large enough to accommodate the below-roof unit.
- The condensate must be able to drain off freely.
- The roof frame must be flat and horizontal.
- Insulate the roof frame before installing the unit (e.g. 40 mm PU foam).
- Please observe the minimum distances when designing the roof frame (see chapter 1.3). Change the orientation of the coil connections, if necessary.



1 Weight-bearing inner wall of the roof frame
2 Insulation (e.g. 40 mm PU foam)
3 IPE beam

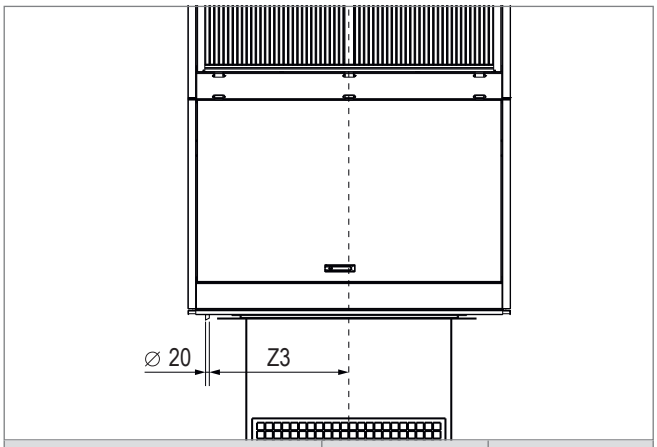
Size			6	9
Z1	max.	mm	1110	1460
Z2	min.	mm	954	1154
	max.	mm	970	1170

Table F1: Dimensions for roof frame



1	Access panel, connection box
2	Access panel, coil (both sides)
3	Extract air grille
4	Dimensions E and F see 'Technical data' chapter
5	Roof unit
6	Sealing compound (on site)
7	Sealing strip (fitted at the factory)
8	Roof frame
9	Membrane

Table F2: Installation of RoofVent® units in the roof frame (dimensions in mm)



Size		6	9
Z3	mm	571	749

Table F3: Condensate drain of the plate heat exchanger (measured from unit centre)

Depending on local conditions, 2 different types of roof frame can be used:

- Roof frame with straight side walls (where there is sufficient space)
- Roof frame with conical side walls (where a below-roof unit protruding into the room interferes with the craneways, for example)

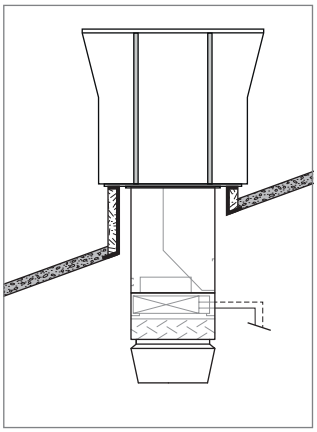


Fig. F1: Roof frame with straight side walls

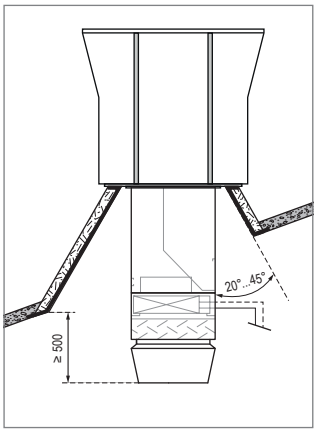


Fig. F2: Roof frame with conical side walls

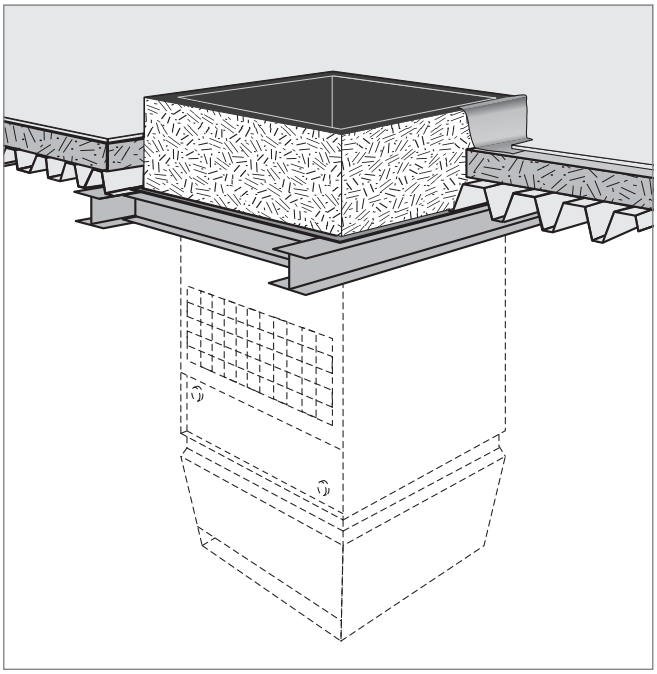


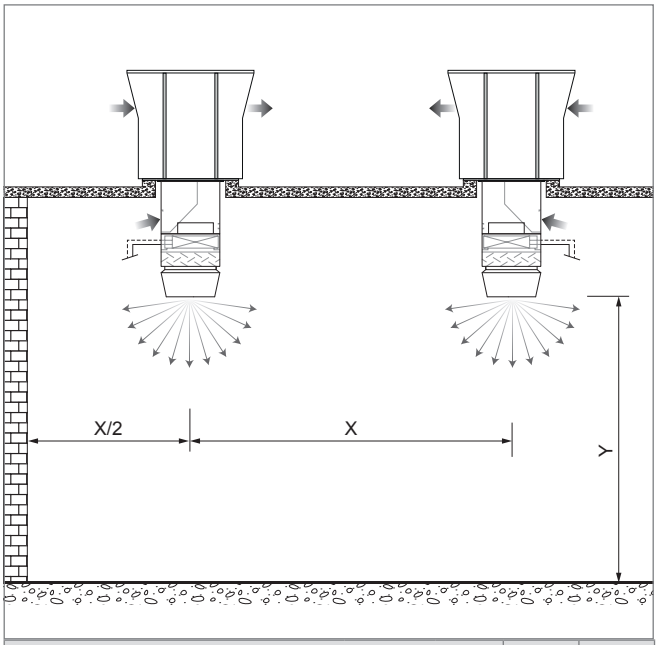
Fig. F3: Conceptual drawing of the roof frame

F

1.3 Positioning

When positioning the units consider the following:

- Comply with the minimum and maximum distances.
- Align the units so that no unit draws in the exhaust air from another unit as fresh air.
- All air inlet and air outlet openings must be freely accessible. The supply air jet must be free to spread out unhindered.
- The access doors in the roof unit and the access panels in the below-roof unit must be easily accessible.
- Provide a space of approx. 1 m on the side opposite the coil connections for service and maintenance.

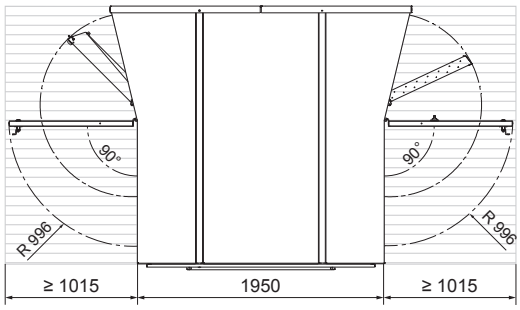


Size			6	9
Distance X	min.	m	11	13
	max.	m	22	28
Mounting height Y	min.	m	4	5
	max. [1]	m	Approx. 9…25	

1) The maximum mounting height varies depending on the boundary conditions (for values, see table of heat outputs or calculation with the 'HK-Select' selection program)

Table F4: Minimum and maximum distances

Roof unit



Roof unit with silencers

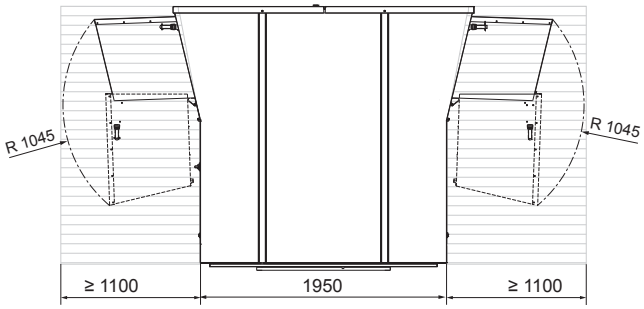
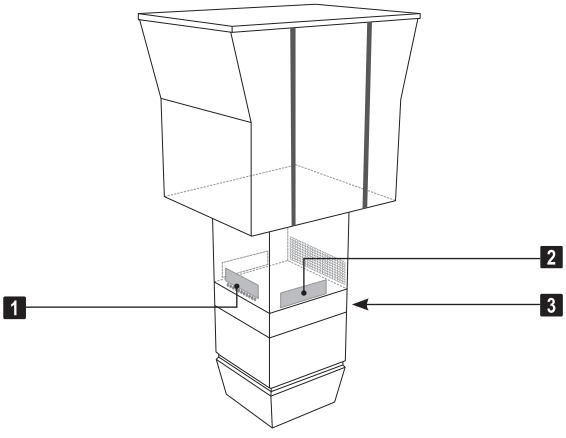


Fig. F4: Space requirements for maintenance on the roof (dimensions in mm)

Notice
If side access is not possible, proportionally more space is required for opening the access doors.



1 Access panel, connection box
2 Access panel, coil (both sides)
3 Coil connections

Fig. F5: Position of the access panels in the connection module

1.4 Unit installation

Proceed as follows to position the unit:

Below-roof unit

- Apply sealing compound to the roof frame.
- Screw in the transport eyes and attach the lifting gear (minimum length of lifting ropes: 2 m).
- Transport the below-roof unit to the roof frame using a helicopter or crane.
- Turn the below-roof unit to the desired position.
- Hang the below-roof unit into the roof frame from above.

Roof unit

- Remove the cover caps on the unit roof.
- Screw in the transport eyes and attach the lifting gear (minimum length of lifting ropes: 3 m).
- Transport the roof unit to the roof, correctly position the roof unit over the below-roof unit and set it down.
- Screw the the roof unit and below-roof unit together.
- Remove the transport eyes and refit the cover caps.

Fig. F6: Lifting the roof unit using screwed-in transport eyes

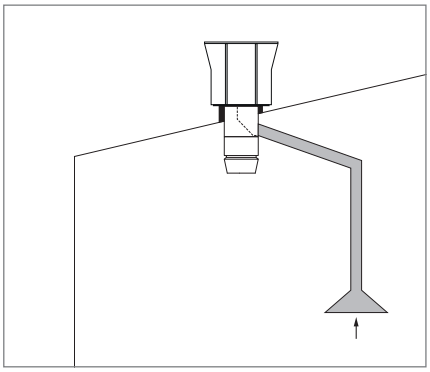
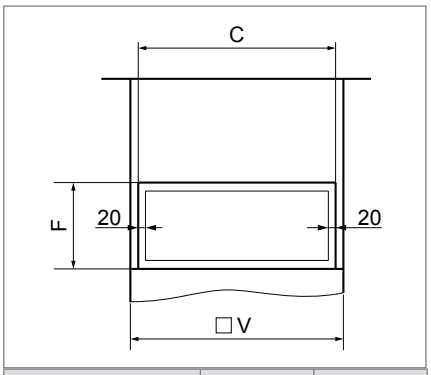


Fig. F7: Extract air duct – connection to the connection module in place of the extract air grille



Size		6	9
C	mm	848	1048
F	mm	410	450
V	mm	900	1100

Table F5: Connection dimensions for extract air duct (in mm)

1.5 Duct connection

If required, it is possible to connect an extract air duct.

2 Hydraulic installation

2.1 Heating/cooling coil

The TopTronic® C control system is designed for a distributor circuit with separate hydraulic connection of the units; i.e. a mixing valve is installed in front of each unit. The diverting system is used as standard.

Requirements on the boiler system and the distributor circuit

- Hydraulically coordinate the pipework for the individual units within a control zone to ensure even distribution.
- The heating medium must be available at the mixing valve without delay in the required amount and temperature.
- The condensate separator in cooling units only functions while the fan is running. No coolant must be allowed to circulate in the coil when the unit is switched off.
- The heating/cooling changeover valves must be designed with a digital position response.
- Depending on local conditions, check whether compensators for linear expansion are required for the supply and return lines and/or articulated connections are required for the units.
- Do not fasten any loads to the coil, e.g. by means of the flow or return lines.
- Insulate the hydraulic lines.

The TopTronic® C control system switches on the heating/cooling pumps and 'Enable heating/cooling' every day. This prevents the pumps from blocking in case of a long shutdown.

Requirements on mixing valves

- Use 3-way mixing valves with the following flow characteristics:
  - Equal percentage control path
  - Linear bypass
- The valve authority must be ≥ 0.5.
- The valve actuator must have a short run time (< 10 s).
- The valve actuator must be continuous, i.e. the stroke changes in proportion to the control voltage (DC 2…10 V).
- The valve actuator must be designed with a position response (0...10 VDC or 2…10 VDC).
- The maximum power consumption is 20 VA.
- Install the valve close to the unit (max. distance 2 m).

Notice
Use the 'Hydraulic assembly' or 'Mixing valve' options for quick and easy hydraulic installation.

Requirements on changeover valves

Use changeover valves conforming to the following specification:

- 3-way changeover valves
- Supply voltage 24 V AC
- 1-wire control (0/24 V AC)
- Position response via limit switches (0°/90°)
- Power consumption max. 44 VA

2.2 Condensate connection

Condensate arising in cooling units must be removed via a condensate-proof line.

- Install and insulate the supplied trap on the condensate connection of the unit.
- Dimension the slope and cross-section of the condensate line so that no condensate backflow takes place.
- Route the condensate line from the pump directly upwards.
- Ensure that the condensate produced is drained in compliance with local regulations.

Notice
Use the 'Condensate pump' option for quick and easy hydraulic installation.

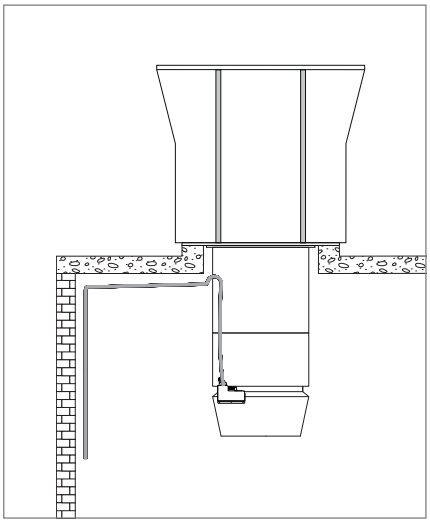
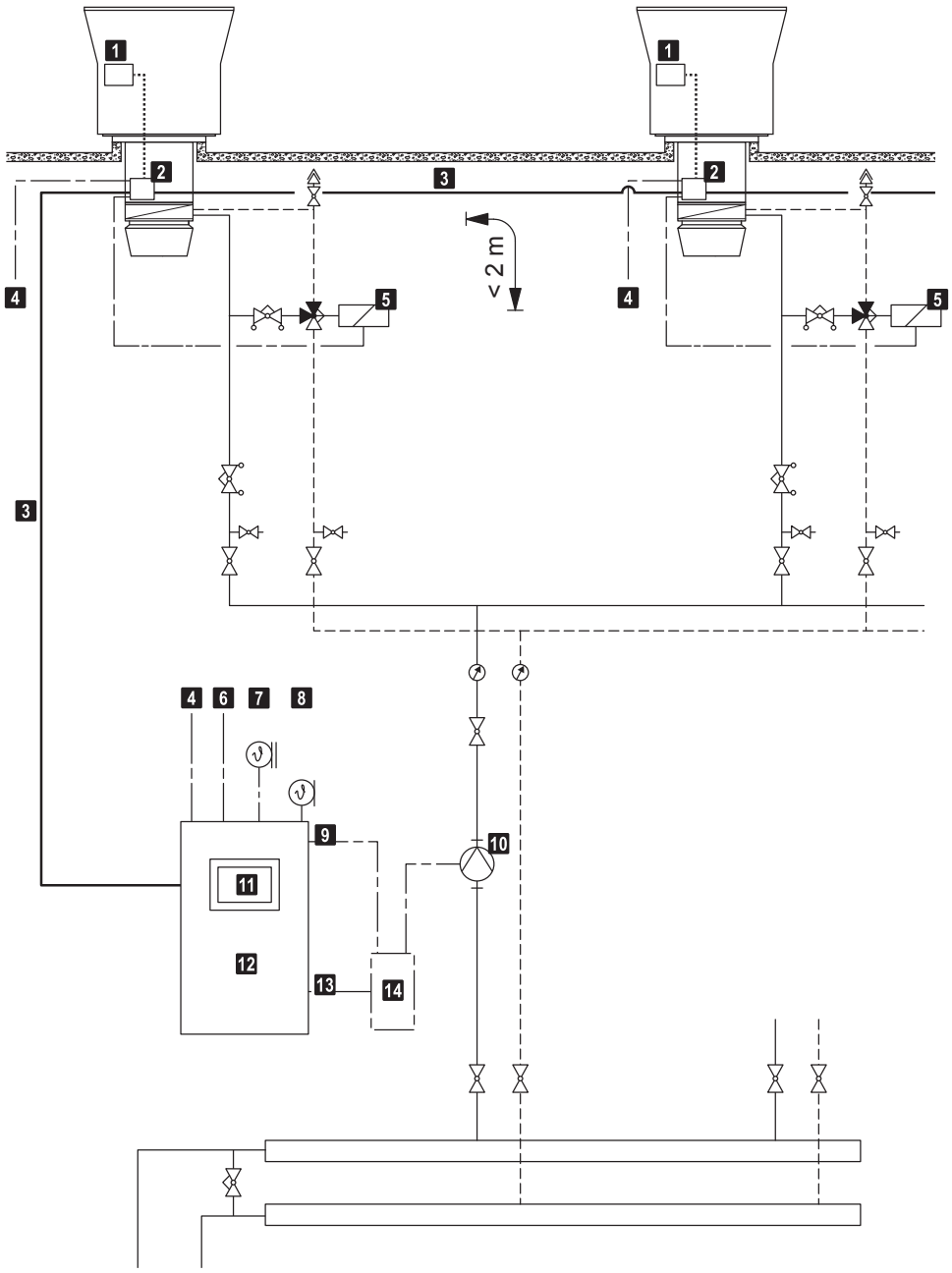


Fig. F8: Condensate line

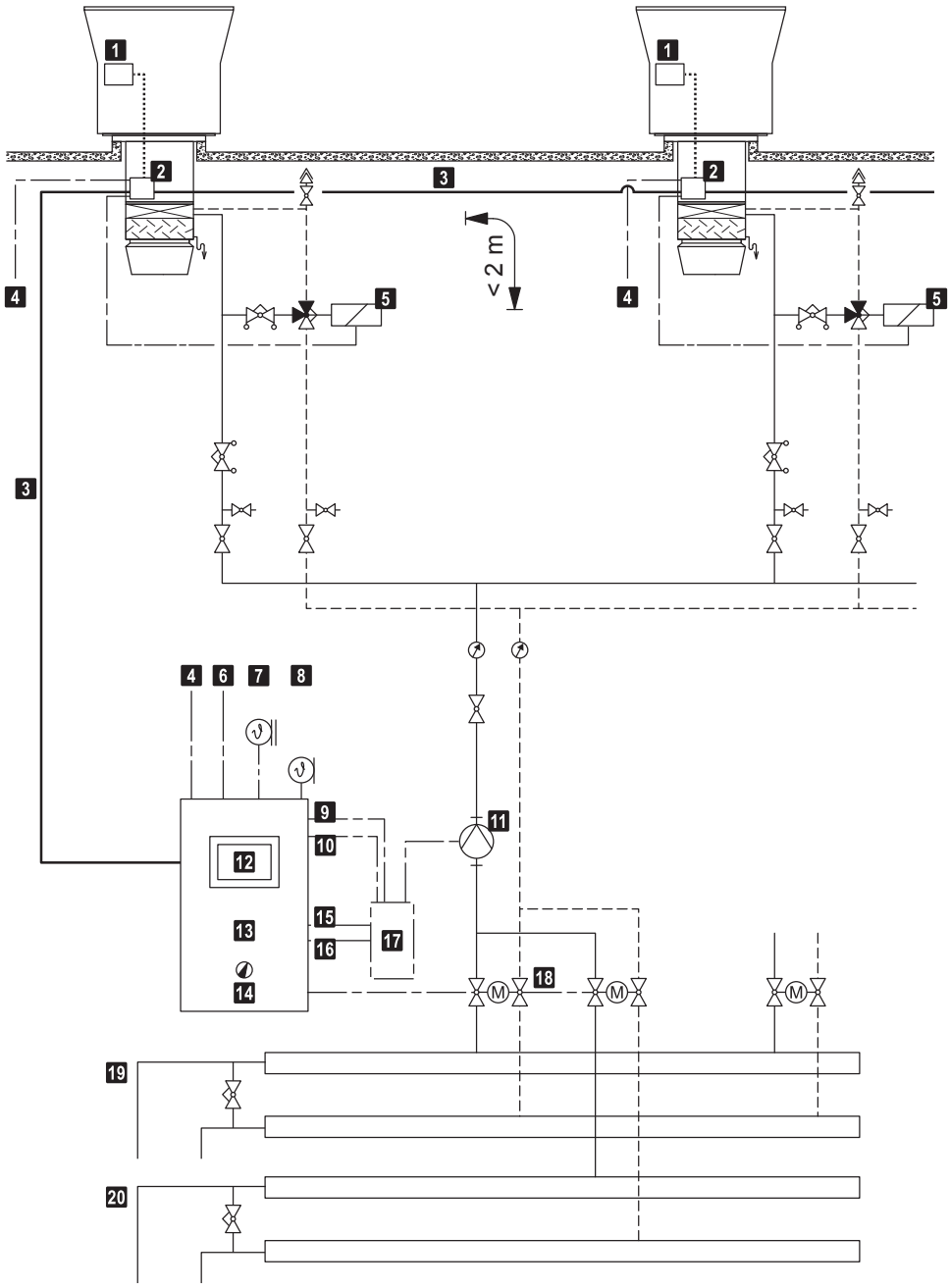
RoofVent® RH



1 Control block	6 Collective alarm	11 System operator terminal
2 Connection box	7 Fresh air temperature sensor	12 Zone control panel
3 Zone bus	8 Room temperature sensor	13 Enable heating
4 Power supply	9 Trouble input heating	14 Heating control panel
5 Mixing valve	10 Distributor pump	

Table F6: Conceptual drawing for hydraulic diverting system RoofVent® RH

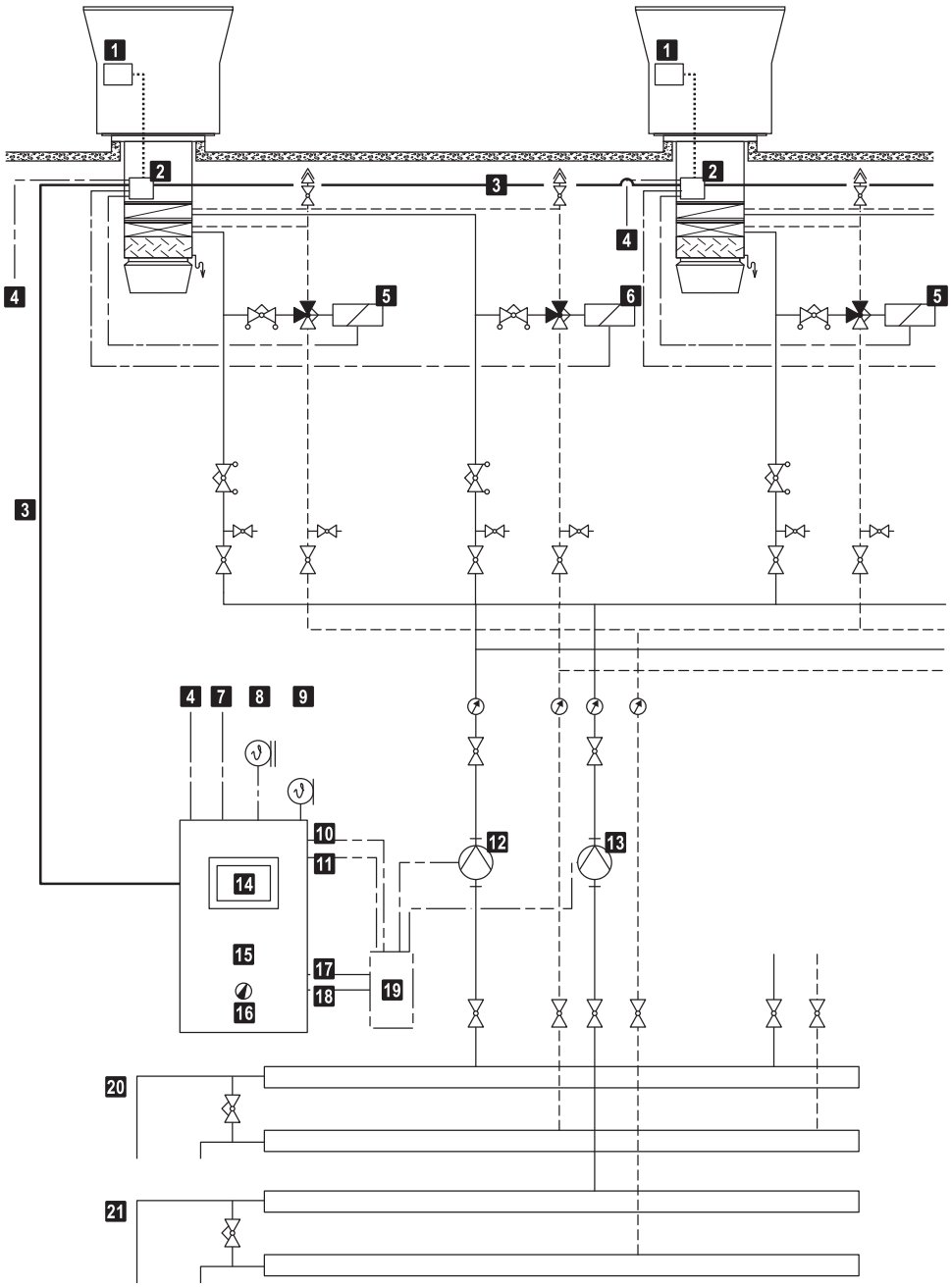
RoofVent® RC



1 Control block	8 Room temperature sensor	15 Enable heating
2 Connection box	9 Trouble input heating	16 Enable cooling
3 Zone bus	10 Trouble input cooling	17 Heating control panel
4 Power supply	11 Distributor pump	18 Changeover valves heating/cooling
5 Mixing valve	12 System operator terminal	19 Heating circuit
6 Collective alarm	13 Zone control panel	20 Cooling circuit
7 Fresh air temperature sensor	14 Cooling lock switch (option)	

Table F7: Conceptual drawing for hydraulic diverting system RoofVent® RC

RoofVent® RHC



1 Control block	8 Fresh air temperature sensor	15 Zone control panel
2 Connection box	9 Room temperature sensor	16 Cooling lock switch (option)
3 Zone bus	10 Trouble input heating	17 Enable heating
4 Power supply	11 Trouble input cooling	18 Enable cooling
5 Mixing valve cooling	12 Distributor pump heating	19 Heating control panel
6 Mixing valve heating	13 Distributor pump cooling	20 Heating circuit
7 Collective alarm	14 System operator terminal	21 Cooling circuit

Table F8: Conceptual drawing for hydraulic diverting system RoofVent® RHC

3 Electrical installation

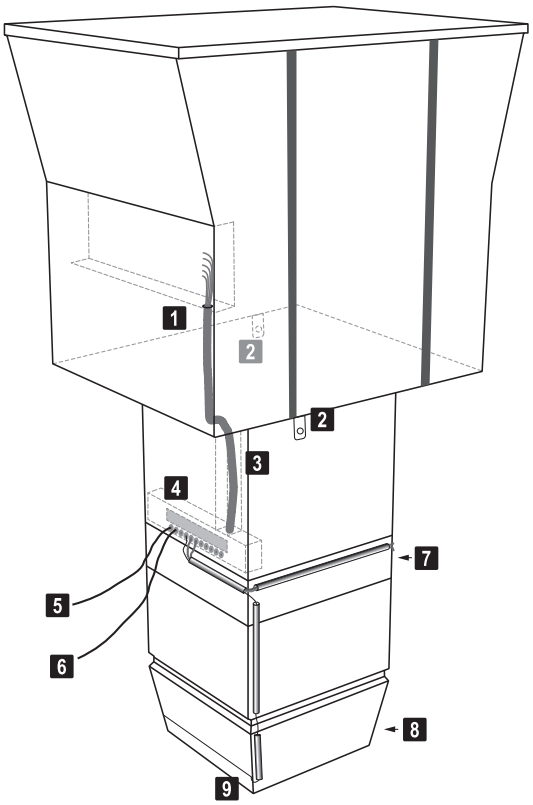
- The electrical installation is to be carried out only by a qualified electrician.
- Observe all applicable regulations (e.g. EN 60204-1).
- Choose the dimensions of the cable cross sections in line with the applicable regulations.
- Electrical installation to be carried out according to wiring diagram.
- Route signal and bus lines separately from mains cables.
- Make the plug connection from the connection box in the below-roof unit to the control block in the roof unit.
- Make the plug connections from the actuator of the Air-Injector, frost controller and supply air sensor to the connection box.
- Wire up mixing valves to the connection box.
- For injection system: Wire the pump to the connection box.
- Make sure the lightning protection system for the units or for the entire building is planned and carried out by professionals.
- Provide overload protection equipment on site in the mains connection line of the zone control panel.

Caution
Use an all-pole sensitive residual current circuit breaker for a leakage current protective circuit.

Unit size		6	9
Supply voltage	V AC	3 x 400	3 x 400
Permitted voltage tolerance	%	± 5	± 5
Frequency	Hz	50	50
Connected load	kW	4.6	8.6
Current consumption max.	A	7.9	14.5
Series fuse	A	13.0	20.0

Table F9: Electrical connection

Notice
The connected load is the determining factor for calculating cable cross section. The effective electric power input is indicated in the 'Technical data' chapter of the individual unit types.



1	Plug connection to the control block
2	Connections for lightning arresters
3	Cable duct
4	Connection box
5	Power supply
6	Zone bus
7	Frost controller
8	Actuator Air-Injector
9	Supply air sensor

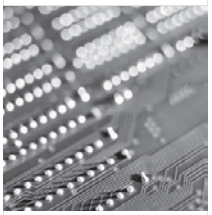
Fig. F9: Electrical installation

Component	Designation	Voltage	Cable	Comments
Zone control panel	Power supply	3 × 400 V AC	NYM-J 5 × … mm²	3-phase
		1 × 230 V AC	NYM-J 3 × … mm²	1-phase
	Zone bus		J-Y(St)Y 2 × 2 × 0.8 mm	max. 1000 m length
	System bus		Ethernet ≥ CAT 5	For connecting several zone control panels
	Integration into the building management system		Ethernet ≥ CAT 5	BACnet, Modbus IP
			J-Y(St)Y 2 × 2 × 0.8 mm	Modbus RTU
	Room temperature sensor		J-Y(St)Y 2 × 2 × 0.8 mm	Max. 250 m
	Fresh air temperature sensor		J-Y(St)Y 2 × 2 × 0.8 mm	Max. 250 m
	Additional room air sensors		J-Y(St)Y 2 × 2 × 0.8 mm	Max. 250 m
	Combination sensor room air quality, temperature and humidity		J-Y(St)Y 4 × 2 × 0.8 mm	Max. 250 m
	Enable heating	Volt-free max. 230 V AC max. 24 VDC	NYM-O 2 × 1.5 mm²	max. 6 A
	Setpoint heating demand	0-10 V DC	J-Y(St)Y 2 × 2 × 0.8 mm	Max. 250 m
	Enable cooling	Volt-free max. 230 V AC max. 24 VDC	NYM-O 2 × 1.5 mm²	max. 6 A
	Trouble input heating	24 V AC	NYM-O 2 × 1.5 mm²	max. 1 A
	Trouble input cooling	24 V AC	NYM-O 2 × 1.5 mm²	max. 1 A
	Collective alarm	Volt-free max. 230 V AC max. 24 VDC	NYM-O 2 × 1.5 mm²	max. 3 A
	Distributor pump heat supply	3 × 400 V AC	NYM-J 4 × 1.5 mm² (min.)	Power supply 3-phase, max. 6 A
		1 × 230 V AC	NYM-J 3 × 1.5 mm² (min.)	Power supply 1-phase, max. 6 A
			NYM-O 4 × 1.5 mm²	Control line
	Distributor pump cold supply	3 × 400 V AC	NYM-J 4 × 1.5 mm² (min.)	Power supply 3-phase, max. 6 A
		1 × 230 V AC	NYM-J 3 × 1.5 mm² (min.)	Power supply 1-phase, max. 6 A
			NYM-O 4 × 1.5 mm²	Control line
	Power supply for units	3 × 400 V AC	NYM-J 5 × 1.5 mm² (min.)	RoofVent® units size 6
		3 × 400 V AC	NYM-J 5 × 4.0 mm² (min.)	RoofVent® units size 9
		3 × 400 V AC	NYM-J 5 × 1.5 mm² (min.)	TopVent® units
	System operator terminal (if external)	24 V AC	NYM-J 3 × 1.5 mm²	Power supply, 1 A fusing
			Ethernet ≥ CAT 5	Communication
	Zone operator terminal (if external)	24 V AC	J-Y(St)Y 4 × 2 × 0.8 mm	Power supply, 1 A fusing, max. 250 m length
	External sensor values	0-10 V DC	J-Y(St)Y 2 × 2 × 0.8 mm	
	External set values	0-10 V DC	J-Y(St)Y 2 × 2 × 0.8 mm	
	Load shedding input	24 V AC	NYM-O 2 × 1.5 mm²	max. 1 A
	Operating selector switch on terminal (analogue)	0-10 V DC	J-Y(St)Y 2 × 2 × 0.8 mm	
	Operating selector switch on terminal (digital)	0-10 V DC	J-Y(St)Y 5 × 2 × 0.8 mm	
	Operating selector button on terminal	24 V AC	J-Y(St)Y 5 × 2 × 0.8 mm	
	Forced off	24 V AC	NYM-O 2 × 1.5 mm²	max. 1 A
	Signal external enabling/setting heating/cooling		NYM-O 2 × 1.5 mm²	
	Changeover valve flow		NYM-O 7 × 1.5 mm²	
	Changeover valve return		NYM-O 7 × 1.5 mm²	

F

Component	Designation	Voltage	Cable		Comments
RoofVent®	Power supply	3 × 400 V AC	NYM-J	5 × 1.5 mm² (min.)	RoofVent® units size 6
		3 × 400 V AC	NYM-J	5 × 4.0 mm² (min.)	RoofVent® units size 9
	Zone bus		J-Y(St)Y	2 × 2 × 0.8 mm	max. 1000 m length
	Mixing valve heating		NYM-O	5 × 1.0 mm²	
	Mixing valve cooling		NYM-O	4 × 1.0 mm²	
	Heating pump	230 V AC	NYM-J	3 × 1.5 mm²	Power supply
		24 V AC	NYM-O	4 × 1.0 mm²	Control line
	Cooling pump	230 V AC	NYM-J	3 × 1.5 mm²	Power supply
		24 V AC	NYM-O	4 × 1.0 mm²	Control line
	Forced off	24 V AC	NYM-O	2 × 1.5 mm²	max. 1 A
	Forced heating	24 V AC	NYM-J	2 × 1.5 mm²	max. 1 A

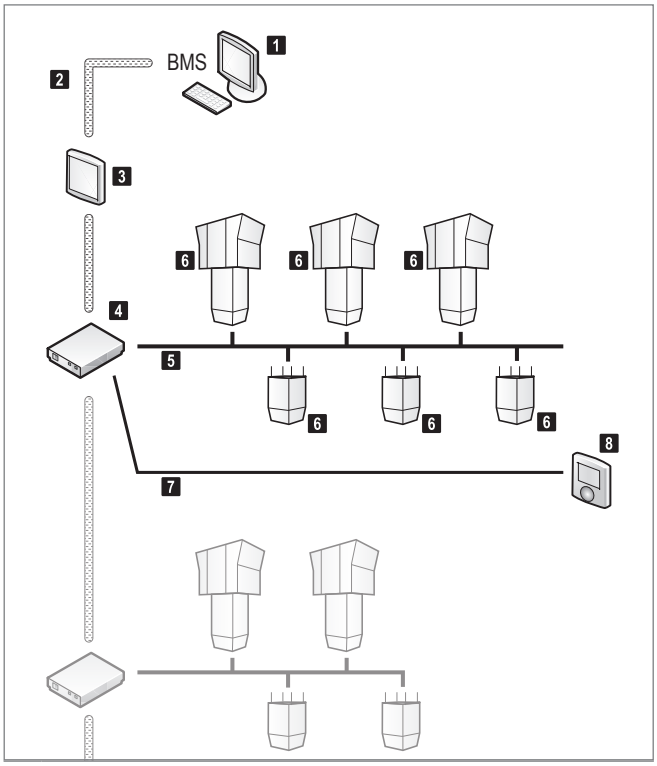
Table F10: Cable list for on-site connections



Control system

1 System structure

Hoval TopTronic® C, the integrated control system for decentralised indoor climate systems, works fully automatically to ensure that all components operate with energy efficiency and according to requirements.



1	Building management system
2	System bus
3	System operator terminal
4	Zone controller
5	Zone bus
6	Unit controller
7	Connection for zone operator terminal
8	Zone operator terminal

Fig. G1: System structure TopTronic® C

1.1 Basic principles

Indoor climate units that operate under the same conditions are grouped into control zones. The criteria concerning how the zones are created can be, for example, operating times, room temperature set values and so on. The individual units are individually regulated and controlled zone-by-zone:

- A unit controller is integrated in each indoor climate unit and controls it according to the local conditions.
- There is one zone controller for each control zone in the zone control panel. It switches the operating modes according to the calendar, sends the outdoor and room temperatures to the individual units, manages set values and functions as an interface to external systems.

A system comprises up to 64 control zones with the following types of indoor climate units:

- Supply and extract air handling units (VENU)
- Supply air units (REMU)
- Recirculation units (RECU)

The following variants of control zones are available:

Type of units	Max. number
Supply and extract air handling units	15
Supply air units	15
Recirculation units	10
Supply and extract air handling units + Recirculation units [1)]	15 + 10
Supply air units + Recirculation units [1)]	15 + 10

[1)] The recirculation units are switched on depending on heat or cool demand.

Table G1: Variants of control zones

1.2 System bus

The system bus combines all zone controllers with the system operation.

Cable type:	Ethernet cable ≥ CAT5

Table G2: Specification of system bus

1.3 Zone bus

The zone bus functions as serial connection and connects all unit controllers in one control zone with the corresponding zone controller.

Cable type:	J-Y(ST)Y 2 x 2 x 0.8 mm
Communication:	Modbus
Length:	max. 1000 m Plan repeaters and on-site power supply for longer lengths.
Bus termination	Terminate the zone bus at both ends with a 120 Ω, ¼ W resistor.
Topology:	Line

Table G3: Specification of zone bus

2 Operating options

2.1 System operator terminal

The system operator terminal is a touch panel with a colour display, making it simple and clear to operate the system. It gives trained users access to all information and settings that are necessary for normal operation:

- Display and setting of operating modes
- Display of temperatures and setting of the room temperature set values
- Display and programming of the weekly and annual calendar
- Display and handling of alarms and maintaining an alarm log
- Display and setting of control parameters
- Differentiated password protection

The scope of delivery also includes the C-SSR software package for LAN access to the system operator terminal. Thus the system can be operated easily using a PC.

The system operator terminal is installed in the door of the zone control panel, or supplied loose. At least 1 system operator terminal is required for each system. A maximum of 3 system operator terminals can be used per system or 1 per zone control panel.

Electrical supply:	24 VAC (-15…+10%) 50…60 Hz, max. 1.3 A (27 VA)
	12…30 VDC ± 5% max. 1.0 A at 12 VDC
Power consumption:	max. 12 W
Communication:	via system bus (Ethernet interface)

Table G4: Technical data of the system operator terminal

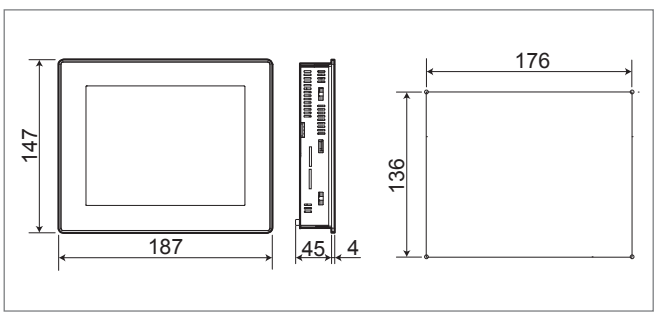


Fig. G2: Dimensional drawing and borehole diagram for the system operator terminal (dimensions in mm)

2.2 Zone operator terminal

The zone operator terminal is used for simple on-site operation of a control zone. It offers the following functions:

- Display of the current room temperature actual value
- Increase or decrease the set value by up to 5 °C
- Manual changeover of the operating mode
- Display of the collective fault signal

The zone operator terminal is installed in the door of the zone control panel, or supplied loose for surface or flush mounting in any location.

Electrical supply:	24 V AC
Cable type:	J-Y(ST)Y 4 x 2 x 0.8 mm
Length:	Max. 250 m

Table G5: Connection for zone operator terminal

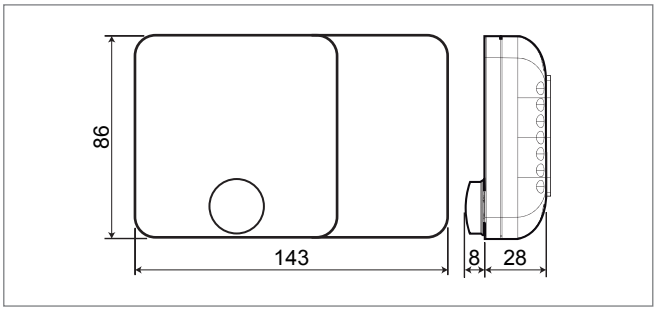


Fig. G3: Dimensional drawing for the zone operator terminal for surface mounting (dimensions in mm)

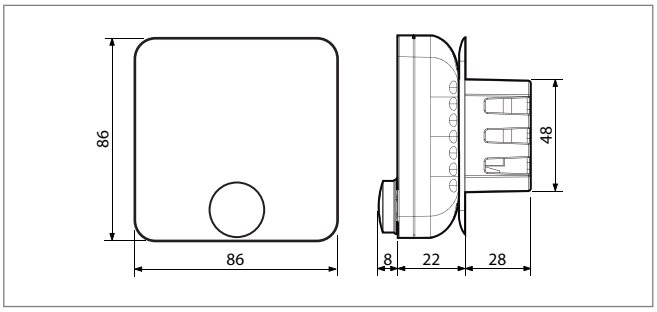


Fig. G4: Dimensional drawing for the zone operator terminal for flush mounting (dimensions in mm)

2.3 Operating selector switch

An operating selector switch makes it possible to specify an operating mode manually for a control zone. Automatic mode according to the calendar is overridden. The units work in the selected operating mode until the switch is moved back to 'AUTO'.
The switches are installed in the door of the zone control panel. There is only 1 operating selector switch for each control zone. The operating modes available depend on the unit types present in the zone in question.

Notice
Operating selector switches installed in the panel door cannot be combined with operating selector switches connected to a terminal (see chapter 3.4).

2.4 Operating selector button

The operating selector button makes it possible to specify a particular operating mode temporarily for a control zone. After an adjustable time period, the units switch back to the operating mode that was being carried out previously.

Notice
The mode of function of the operating selector button can be set. The selected operating mode can also remain active until it is switched off again by pressing the button once more.

The buttons are configured as illuminated pushbuttons. They are installed in the door of the zone control panel. There are a maximum of 3 operating selector buttons for each control zone:
- Standby (ST)
- Ventilation (VE)
- Recirculation (REC)

There is also the option of connecting external operating selector buttons to a terminal (see chapter 3.4).

2.5 Integration into the building management system

The TopTronic® C can be easily integrated into the building management system via different bus interfaces. The following protocols are available:
- BACnet
- Modbus IP
- Modbus RTU

A full data point list is available on request. When planning observe the following:

BACnet
- Each control zone represents 1 node requiring 1 BACnet licence (BACnet instance).
- The following must be provided on site:
  - an IP address range in the local area network for all bus participants
  - 1 IP connection per control panel
- TopTronic® C uses the following BACnet object types:

BACnet object types
Analogue Value
Binary Value
Integer Value
Multi-state Value

Table G6: Used BACnet object types

Modbus IP
- 1 Modbus IP gateway RS485 is used for each control zone.
- The following must be provided on site:
  - an IP address range in the local area network for all bus participants
  - 1 IP connection per control zone

Modbus RTU
- 1 Modbus RTU gateway RS485 is used for each control zone.
- The following must be provided on site:
  - 1 Modbus slave address per control zone

3 Zone control panel

The zone control panel is made of painted steel sheet (colour: light grey RAL 7035). It includes the following components:

- Operating elements in the panel door
- Power and control section
- 1 safety relay (external)
- 1 fresh air sensor per system (included)
- 1 zone controller per control zone
- 1 room air sensor per control zone (included)

Caution
Danger of electric shocks. Ensure that overcurrent protection equipment is installed on site for the power supply cable.

Size	Type	Dimensions (W x H x D)	Base height	Doors
3	SDZ3	600 x 760 x 210	–	1
5	SDZ5	800 x 1000 x 300	–	1
6	SDZ6	800 x 1200 x 300	–	1
7	SDZ7	800 x 1800 x 400	200	1
8	SDZ8	1000 x 1800 x 400	200	2
9	SDZ9	1200 x 1800 x 400	200	2

Table G7: Available sizes for the zone control panel (dimensions in mm)

Short circuit resistance I_{CW}		10 kA_{eff}
Use		Indoors
Protection class	SDZ3, SDZ5, SDZ6	IP 66
	SZD7, SDZ8, SDZ9	IP 55
Ambient temperature		5…40°C

Table G8: Technical data for the zone control panel

Location of the temperature sensors

- Install the fresh air sensor at least 3 m above the ground on a north-facing wall, so that it is protected from direct sunlight. Insulate the sensor from the building.
- Install the room air sensor at a representative position in the occupied area at a height of about 1.5 m. Its measured values must not be distorted by the presence of sources of heat or cold (machines, windows, etc.). Several averaging sensors can also be used.

External connections

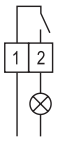
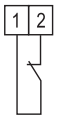
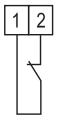
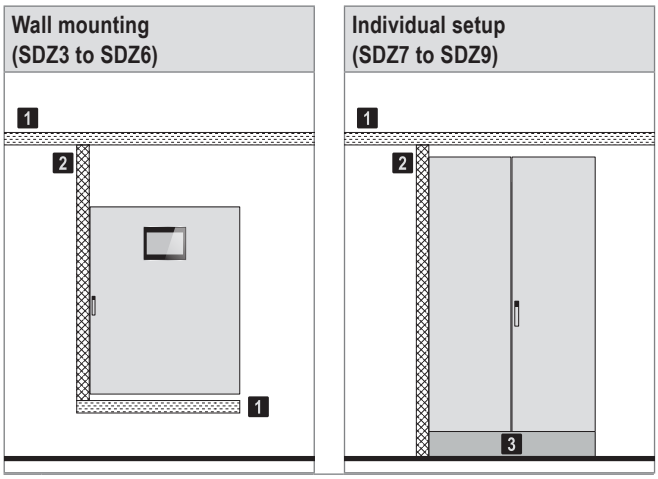
Collective alarm	
Volt-free signal for the external display of a collective alarm	 max. 230 VAC, 3 A max. 24 VDC, 3 A
Forced off (zone controller)	
Input signal for emergency switch-off via software control (all units in a zone): ■ Fans off (without post operation) ■ Dampers closed (by spring return) Recommended for emergency shut-off of the units with high priority (e.g. in the event of a fire)	 24 VAC, max. 1 A
Forced off (ventilation unit)	
Input signal for emergency switch-off via hardware control (one unit): ■ Fans off (without post operation) ■ Dampers closed (by spring return) Recommended for emergency shut-off of the units with highest priority (e.g. in the event of a fire)	 24 VAC, max. 1 A

Table G9: External connections

3.1 Design of the control panels

- Control panels sizes 3 to 6 are configured as compact cabinets for wall installation. The cables are introduced from below through flange plates and screwed cable glands.
- Control panels of sizes 7 to 9 are configured for individual setup in a self-supporting design. The cables are introduced through clamping profiles in the floor panel (cable introduction into the base is possible from the left or right side or from behind).

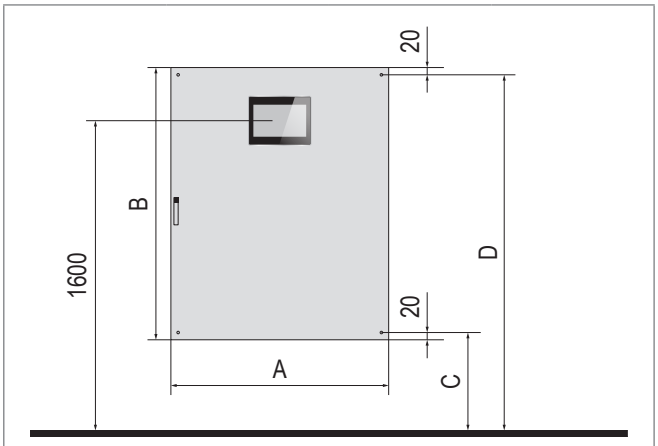


1 Cable run
2 Cable duct
3 Base

Fig. G5: Design of control panels

If the system operator terminal is installed in the door of the zone control panel the correct mounting height is essential for convenient operation.

- In control panels for individual setup the distance from the middle of the operator terminal to the floor is 1600 mm.
- Control panels for wall mounting must be mounted at the right height. The heights for the drill holes are given in the following table:



Type	SDZ3	SDZ5	SDZ6
A	600	800	800
B	760	1000	1200
C	1013	818	618
D	1733	1778	1778

Table G10: Distance of drill holes from the floor for convenient operation

3.2 Design for heating

For systems with indoor climate units connected to a hot water supply for heating the components required to control the heating circuit are also installed in the zone control panel:

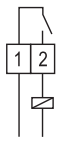
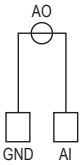
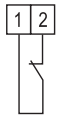
Enable heating	
Volt-free signal that reports the heating requirement to the heat production on site	 max. 230 VAC, 6 A max. 24 VDC, 6 A
Setpoint heating demand	
Analogue signal that reports the setpoint for the flow temperature to the heat production on site (2-10 V… 0-100 °C)	 0...10 VDC
Trouble input heating	
Alarm input signal that informs the system that the heat supply is not working	 24 VAC, max. 1 A

Table G11: Signals for controlling the heating mode mode

3.3 Design for cooling

For systems with indoor climate units connected to a water chiller for cooling the components required to control the cooling circuit are also installed in the zone control panel:

There are various possibilities for changeover between heating and cooling:

Automatic changeover (external enabling)

- The system switches between heating and cooling automatically, depending on the temperature conditions.
- Via an external signal either only heating operation or heating and cooling operation can be enabled. This way it is possible to block the cooling function temporarily e.g. in the transition period.
- For external enabling an optional switch can be installed in the door of the zone control panel (cooling lock switch).
- The system controls and monitors the changeover valves heating/cooling.

Manual changeover (external setting)

- The system switches between heating and cooling according to the external setting.
- In case the external setting does not correspond to the actual requirement a protection mode is activated, if necessary, and alarm is generated (e.g. if cooling operation is set at very low outdoor temperatures).
- The system controls and monitors the changeover valves heating/cooling.
- Alternatively, the changeover valves heating/cooling may be set manually. In this case, however, the correct valve position cannot be monitored by the system.

Hydraulics	Heating/cooling change-over	Changeover valves
4-pipe	automatic (external enabling)	–
2-wire	automatic (external enabling)	controlled and monitored
	manual (external setting)	controlled and monitored
		manual, not monitored

Table G12: Overview table of various possibilities for change-over between heating and cooling

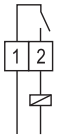
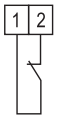
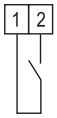
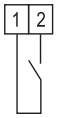
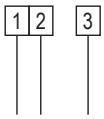
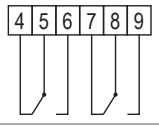
Enable cooling	
Volt-free output signal that reports the cooling requirement to the cold production on site	 max. 230 VAC, 6 A max. 24 VDC, 6 A
Trouble input cooling	
Alarm input signal that informs the system that the cold supply is not working 0 = Fault 1 = Normal operation	 24 VAC, max. 1 A
External enabling heating/cooling	
Input signal that reports on-site enabling of heating/cooling operation to the system: 0 = Heating 1 = Heating/Cooling	 24 VAC, max. 1 A
External setting heating/cooling	
Input signal that reports manual switch-over to the system: 0 = Heating 1 = Cooling	 24 VAC, max. 1 A
Changeover valves heating/cooling (1 x flow / 1 x return)	
Supply/control voltage: 0 V = Heating 24 V = Cooling	 24 VAC 0/24 VAC
Position response via limit switches	

Table G13: Signals for controlling the cooling mode

3.4 Options for the zone control panel

Alarm lamp
A lamp for displaying alarms is installed in the door of the zone control panel. The lamp flashes when new alarms have occurred, and it lights up if already acknowledged alarms are still present.

Notice
There is only 1 collective alarm lamp for each control zone. It shows the alarms of the whole system.

Socket
A 1-phase socket with a 2-pin circuit breaker is installed in the zone control panel. This socket serves for connecting maintenance tools. Its circuit is not cut out by the safety relay.

Additional room air temperature sensors
Instead of only 1 room air sensor, additional sensors are provided to determine the average value; the corresponding terminals are integrated. A maximum of 3 additional sensors are possible per control zone.

Combination sensor room air quality, temperature and humidity
A combination sensor is supplied instead of the room temperature sensor. It measures the relative humidity and quality (VOC content) of the room air in addition to its temperature. The sensor is installed on the wall in the occupied area, at a height of about 1.5 m.

Notice
Measurement of the room air humidity is a prerequisite for icing protection in applications with high extract air humidity. The use of the combination sensor enables the system to be operated without ice formation in the plate heat exchanger.

Notice
Measurement of the room air quality is a prerequisite for demand-based ventilation. The use of the combination sensor therefore enables the system to be operated in a particularly energy-saving manner.

External sensor values
It is possible to connect external sensors to the zone controller via additional inputs (input signal: 0…10 VDC or 4…20 mA):
- Room temperature
- Indoor air quality
- Room air humidity

External set values
It is possible to connect set value specifications from an external system to the zone controller via additional inputs (input signal: 0…10 VDC or 4…20 mA):
- Room temperature
- Indoor air quality
- Air flow rate (supply air/exhaust air)
- Proportion of fresh air

Load shedding input
The zone controller includes a digital input for load shedding by an external system.

Operating selector switch on terminal (analogue)
An operating mode can be specified for a control zone from an external system using an analogue operating mode signal connected to a terminal. Automatic mode according to the calendar is overridden.
The operating modes are switched using different voltage levels. If there is no voltage applied, an alarm is triggered and the units switch to standby (ST).

Voltage	Supply and extract air handling units	Supply air units	Recirculation units
1.2 VDC	ST	ST	ST
2.4 VDC	REC	REC	REC
3.7 VDC	SA	REC1	REC1
5.0 VDC	EA	SA1	–
6.2 VDC	VE	SA2	–
7.5 VDC	VEL	–	–
8.8 VDC	AQ	–	–
10.0 VDC	AUTO	AUTO	AUTO

Table G14: Voltage levels for external switching of operating modes

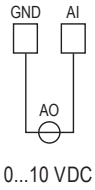
Operating selector switch on terminal (analogue)	

Table G15: Connection of the external operating selector switch

Operating selector switch on terminal (digital)
An operating mode can be specified for a control zone from an external system using digital operating mode signals connected to a terminal. Automatic mode according to the calendar is overridden.
The operating modes are switched using digital inputs. If there is no signal applied, an alarm is triggered and the units switch to standby (ST).

Input	Supply and extract air handling units	Supply air units	Recirculation units
1	ST	ST	ST
2	REC	REC	REC
3	SA	REC1	REC1
4	EA	SA1	–
5	VE	SA2	–
6	VEL	–	–
7	AQ	–	–
8	AUTO	AUTO	AUTO

Table G16: Digital inputs for external switching of the operating modes

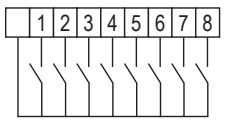
Operating selector switch on terminal (digital)	 0...10 VDC

Table G17: Connection of the external operating selector switch

Operating selector button on terminal
The operating selector button connected to a terminal makes it possible to specify a particular operating mode for a control zone using external illuminated pushbuttons (ST, VE or REC).

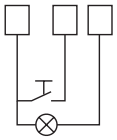
Operating selector button on terminal	 24 V AC

Table G18: Connection of the external operating selector button

Power supply and safety relay
The power supply for indoor climate units is integrated in the zone control panel. The following components are installed in the panel:
- the necessary circuit breakers and output terminals for each unit
- the safety relay (external)

The size of the safety relay depends on the rated current.

Rated current [1]	Type	Design
< 1 A [2]	NT-2	2-pin
1 – 32 A	NT-4/32	4-pin
33 – 63 A	NT-4/63	4-pin
64 – 100 A	NT-4/100	4-pin
101 – 125 A	NT-4/125	4-pin
126 – 160 A	NT-4/160	4-pin
161 – 250 A	NT-4/250	4-pin

1) Rated current = nominal current consumption of all indoor climate units
2) Safety relay for zone controller (without power supply for indoor climate units)

Table G19: Sizes of the safety relay

Control of distributor pump(s), incl. power supply
The components required for controlling and supplying power to the distributor pump(s) are installed in the zone control panel. The pumps can either be controlled via a release signal or switched directly.

Type	Pump		Output
1PSW	Heat supply	1-phase	max. 2 kW
1PSK	Heat/cold supply (2-pipe system)	1-phase	max. 2 kW
1PSB	Pump heat supply and pump cold supply (4-pipe system)	1-phase	max. 2 kW
3PSW	Heat supply	3-phase	max. 4 kW
3PSK	Heat/cold supply (2-pipe system)	3-phase	max. 4 kW
3PSB	Pump heat supply and pump cold supply (4-pipe system)	3-phase	max. 4 kW

Table G20: Technical data for the pump control

4 Control components in the units

In every RoofVent® unit the following is installed:
- 1 control block
- 1 connection box

4.1 Control block

The control block is located in the roof unit, in an easily accessible position behind the supply air access door. The unit controller and the high-voltage section are installed on a mounting plate:
- The unit controller controls the individual unit including the air distribution according to the specifications of the control zone and regulates the supply air temperature using cascade control.
- The high-voltage section contains:
  - Mains power terminals
  - Isolation switch (switches everything off except for the unit controller, the socket, the heating/cooling valve and sensors)
  - Button for stopping the fans during filter change
  - Automatic circuit breaker for supply air fan(s)
  - Automatic circuit breaker for exhaust air fan(s)
  - Fuse for the electronics
  - Transformer for the unit controller and the field units
  - Terminals for forced heating (recirculation heating without control)
  - Wire jumper for forced off

Notice
If the power supply for the unit controller is interrupted, frost protection and monitoring are not guaranteed.

4.2 Connection box

The connection box is located in the connection module, easily accessible behind the corresponding access panel, and has a direct plug connection to the control block in the roof unit via the laced wiring harness.
The connection box is used for connecting:
- Sensors and actuators of the below-roof unit (ready-to-connect)
- Power supply
- Zone bus
- Peripheral components (e.g. mixing valves, pumps, …)

5 Alarms and monitoring

The TopTronic® C control system monitors itself. Central alarm management records each alarm situation in the alarm list with a timestamp, priority and status. The alarms are displayed on the operator terminals and via the collective trouble indicator. Forwarding via e-mail is also possible.
If there is a failure of communication, bus stations, sensor systems or supply media, each part of the system transitions to a protection mode which safeguards operation.

System design

1 Design example

Notice
Use the 'HK-Select' program to design Hoval Indoor Climate Systems. You can download it free of charge on the Internet.

Design data		Example
■ Hall geometry (L x W x H) ■ Required fresh air flow rate ■ Internal heat gains (machines, lighting, etc.) ■ Heating and cooling in the 4-pipe system ■ Optimisation of the ventilation quality (no limitation on the number of units) ■ Minimum heat recovery efficiency according to ErP Directive 01.01.2018		52 x 42 x 9 m 32000 m³/h 33 kW → Unit type RHC → Unit size 6 → 73 % (RX)
Design conditions heating:	■ Fresh air temperature ■ Room temperature ■ Extract air conditions ■ Fabric heat losses ■ Temperature of the heating medium	-12 °C 18 °C 20 °C / 40 % rel. humidity 93 kW 60/40 °C
Design conditions cooling:	■ Fresh air conditions ■ Room temperature ■ Extract air conditions ■ Transmission sensible gains ■ Temperature of the cooling medium	32 °C / 50 % rel. humidity 26 °C 28 °C / 40 % rel. humidity 57 kW 8/14 °C
Number of units ■ Calculate the required number of units: n = Fresh air flow rate / nominal air flow rate		n = 32000 / 5500 = 5.8 → 6 units RHC-6
Type of heating coil ■ Calculate the required output for coverage of transmission sensible gains per unit: Q_{H_req} = (fabric heat losses – internal heat loads) / n ■ Use the 'Hoval HK-Select' selection program to calculate the output for coverage of transmission sensible gains under the given design conditions and select the suitable coil type.		(93 – 33) / 6 = 10 kW per unit RHC-6B..-RX: 21.7 kW RHC-6C..-RX: 40.6 kW → Heating coil type B
Type of cooling coil ■ Calculate the required output for coverage of transmission sensible gains per unit: Q_{C_req} = (Transmission sensible gains + internal heat loads) / n ■ Use the 'Hoval HK-Select' selection program to calculate the output for coverage of transmission sensible gains under the given design conditions and select the suitable coil type.		(57 + 33) / 6 = 15 kW per unit RHC-6..C-RX: 15.6 kW → Cooling coil type C

Checks	
■ Effective air flow rate V_{eff} = Nominal air flow rate x n	5500 x 6 = 33000 m³/h 33000 m³/h > 32000 m³/h → OK
■ Effective heat output $Q_{H\_effective}$ = Output for coverage of fabric heat losses x n	21.7 x 6 = 130.2 kW 130.2 kW > (93 - 33) kW → OK
■ Mounting height Calculate the actual mounting height (= distance between the floor and the bottom edge of the unit) and compare with the minimum and maximum mounting height. Y = Hall height – length of below-roof unit	9000 – 2320 = 6680 mm Y_{min} = 4.0 m < 6.68 m → OK Y_{max} = 15.3 m > 6.68 m → OK
■ Effective cooling capacity $Q_{c\_effective}$ = Output for coverage of transmission sensible gains x n	15.6 x 6 = 93.6 kW 93.6 kW > (57+33) kW → OK
■ Floor area reached Compare the floor area reached with the base area of the hall (L x W). A = Floor area reached x n	480 x 6 = 2880 m² 52 x 42 = 2184 m² 2880 m² > 2184 m² → OK
■ Minimum and maximum clearances Determine the positioning of the units according to the number of units and the base area of the hall; check the minimum and maximum clearances.	n = 6 = 3 x 2 Unit clearance in length: X = 52 / 3 = 17.3 m X_{max} = 21.0 ≥ 17.3 m X_{min} = 11.0 ≤ 17.3 m → OK Unit clearance in width: X = 42 / 2 = 21.0 m X_{max} = 21.0 ≥ 21.0 m X_{min} = 11.0 ≤ 21.0 m → OK

2 Maintenance schedule

Activity	Interval
Changing the fresh air and extract air filter	When the filter alarm is displayed, at least annually
Comprehensively checking function; cleaning and possibly repairing the unit	Annually by Hoval customer service

Table H1: Maintenance schedule

Checklist for project discussions

Hoval

Project		Name	
Project No.		Function	
		Address	
		Tel.	
		Fax	
Date		E-mail	

Information about the hall

Application		Length	
Type		Width	
Insulation		Height	

Is the roof strong enough?	○ yes	○ no			
Are there window areas?	○ yes	○ no	Percentage?		
Is there a crane?	○ yes	○ no	Height?		
Is there enough space for installation and servicing?	○ yes	○ no			
Are there any voluminous installations or machines?	○ yes	○ no			
Are pollutants present?	○ yes	○ no	Which?		
– If yes, are they heavier than air?	○ yes	○ no			
Is oil contained in the extract air?	○ yes	○ no			
Is dust present?	○ yes	○ no	Dust level?		
Is there high humidity?	○ yes	○ no	How much?		
Is the air volume balanced?	○ yes	○ no			
Are local machine extractions required?	○ yes	○ no			
Are any conditions imposed by public authorities?	○ yes	○ no	Which?		
Are sound level requirements to be fulfilled?	○ yes	○ no	Which?		

Design data

Fresh air flow rate?		m³/h
Fresh air / hall area		m³/h m²
Air change rate		
Internal heat gains (machines, ...)		kW
Heating and cooling		
Hydraulic system		
Temperature efficiency, dry		%
Unit size		
Control zones		

Design conditions heating

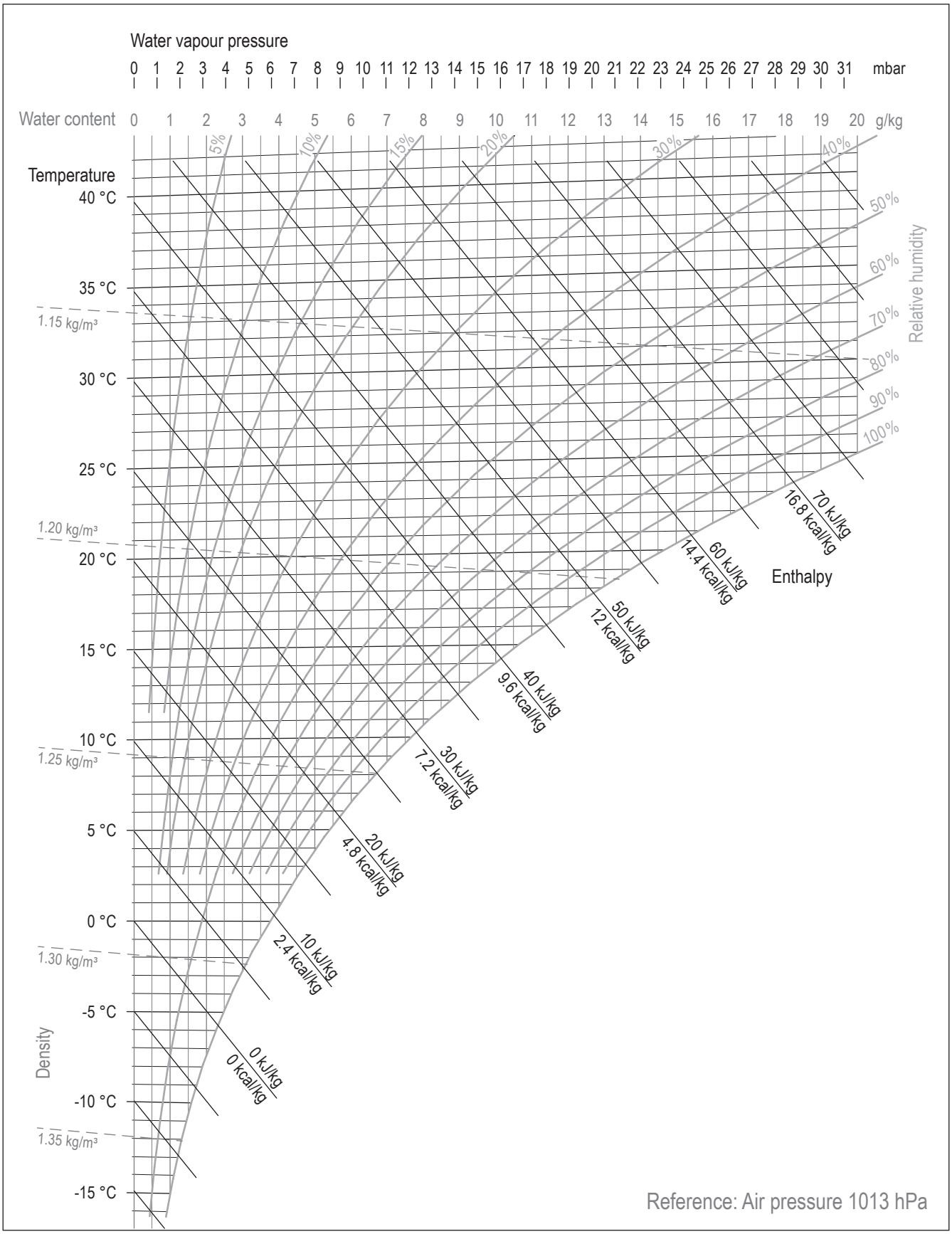
■ Lowest outside temperature and humidity		°C		%
■ Room temperature		°C		
■ Extract air temperature and humidity		°C		%
■ Fabric heat losses		kW		
■ Temperature of the heating medium	/	°C		

Design conditions cooling

■ Highest outside temperature and humidity		°C		%
■ Room temperature		°C		
■ Extract air temperature and humidity		°C		%
■ Transmission sensible gains		kW		
■ Temperature of the cooling medium	/	°C		

Further information

h,x diagram


Water vapour pressure
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 mbar
Water content 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 g/kg
Temperature
40 °C
35 °C
30 °C
25 °C
20 °C
15 °C
10 °C
5 °C
0 °C
-5 °C
-10 °C
-15 °C
1.15 kg/m³
1.20 kg/m³
1.25 kg/m³
1.30 kg/m³
1.35 kg/m³
Density
5%
10%
15%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Relative humidity
0 kJ/kg
0 kcal/kg
10 kJ/kg
2.4 kcal/kg
20 kJ/kg
4.8 kcal/kg
30 kJ/kg
7.2 kcal/kg
40 kJ/kg
9.6 kcal/kg
50 kJ/kg
12 kcal/kg
60 kJ/kg
14.4 kcal/kg
70 kJ/kg
16.8 kcal/kg
Enthalpy
Reference: Air pressure 1013 hPa

Notes

RoofVent® Design Handbook
Subject to technical alterations
Art.No. 4217574 – Edition 04/2018

Hoval

Responsibility for energy and environment

The Hoval brand is internationally known as one of the leading suppliers of indoor climate control solutions. More than 70 years of experience have given us the necessary capabilities and motivation to continuously develop exceptional solutions and technically advanced equipment. Maximising energy efficiency and thus protecting the environment are both our commitment and our incentive. Hoval has established itself as an expert provider of intelligent heating and ventilation systems that are exported to over 50 countries worldwide.

Hoval heating technology

As a full range supplier Hoval helps its customers to select innovative system solutions for a wide range of energy sources, such as heat pumps, biomass, solar energy, gas, oil and district heating. Services range from small commercial to large-scale industrial projects.

Hoval comfort ventilation

Increased comfort and more efficient use of energy from private housing to business premises: our comfort ventilation products provide fresh, clean air for living and working space. Our innovative system for a healthy room climate uses heat and moisture recovery, while at the same time protecting energy resources and providing a healthier environment.

Hoval indoor climate systems

Indoor climate systems ensure top air quality and economical usability. Hoval has been installing decentralised systems for many years. The key is to use combinations of multiple air-conditioning units, even those of different types, that can be controlled separately or together as a single system. This enables Hoval to respond flexibly to a wide range of requirements for heating, cooling and ventilation.

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