BS/BD SECTION AIR HANDLING UNITS

BO- 5x, BO-VESTA COMPACT AIR HANDLING UNITS

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GENERAL INFORMATION ABOUT THE PRODUCT

BS/BD section air handling units are supply, exhaust and supply-exhaust installations designed for ventilation and air conditioning of all types of public utility premises. BS units are indoor units, while BD units are adapted for outdoor assembly and operations.

The section configuration of BD/BD units allows:

- free selection of section setup configuration
- obtaining predefined parameters of the supplied air, using a broad range of subassemblies in particular functional modes
- flexible selection of functional sections, ensuring most sophisticated air processing techniques
- a possibility to combine functions in monosection solutions, extending selection potentials in economic and ergonomic aspects

The configuration of sections and the integrated automatic system ensure heat comfort at premises of any type.
This Catalogue presents the main sections of BS/BD air handling units with provided dimensions and examples of their practical configurations.

The series of types encompasses 21 sizes with performance range of 700 – 100.000 m3/h.

STRUCTURE

In VBW Engineering installations, two different technological solutions regarding the enclosure structure have been implemented, i.e. the to-date's solution based on flaming of aluminium posts and the latest solution being a self-supporting structure.

1. Frame structure

The range of BS/BD air handling unit sizes from 1 to 12-BIS. The enclosure of frame units is a structure consisting of aluminium profiles and corners, which make framing structure, to which the covers, removable panels and revision doors are fixed. The main feature of this structure is its universal character and high flexibility to tailor its dimensions in untypical applications. The outer covers, similarly as in the self-supporting variant, are made of two steel metal sheet layers: the outer layer made of aluzinc-coated sheet and the inner layer of sheet galvanised on both sides. Mineral wool, placed between the two metal sheet layers, provides insulation. The standard mineral wood layer is 50 mm, while 70 mm is available at the customer's request (applies to the entire range of BS/BD unit sizes); however, 25 mm insulation layer is used only in BS indoor units in 1, 2, 3 and 4 size.

2. Self-supported structure

It is used in BS/BD units in MINI, 1, 2, 3 and 4 size. The outer covers of the air handling units are made of aluzinc-coated steel sheet on the outside and of the inside steel sheet galvanised on both sides, with a mineral wood layer in between. The mineral wool insulation is characterised by good thermal and acoustic properties, its thickness being 50 mm. The main feature of air handling units with self-supported structure is leaving the internal unit cross-section, which corresponds in its dimensions to that in the type series of the frame structure units. The air handling units in such structural configuration have been released to production in order to enable their assembly of functional sections, which facilitates the repeatability of components and simplifies the assembly operations. Eventually, the overall dimensions and weight of air handling units could be reduced, as well as their noise levels and heat leakage bridges.

The application character of a given solution depends on the air supply demands, unit configuration and air processing parameters, defined for a given air handling unit model.

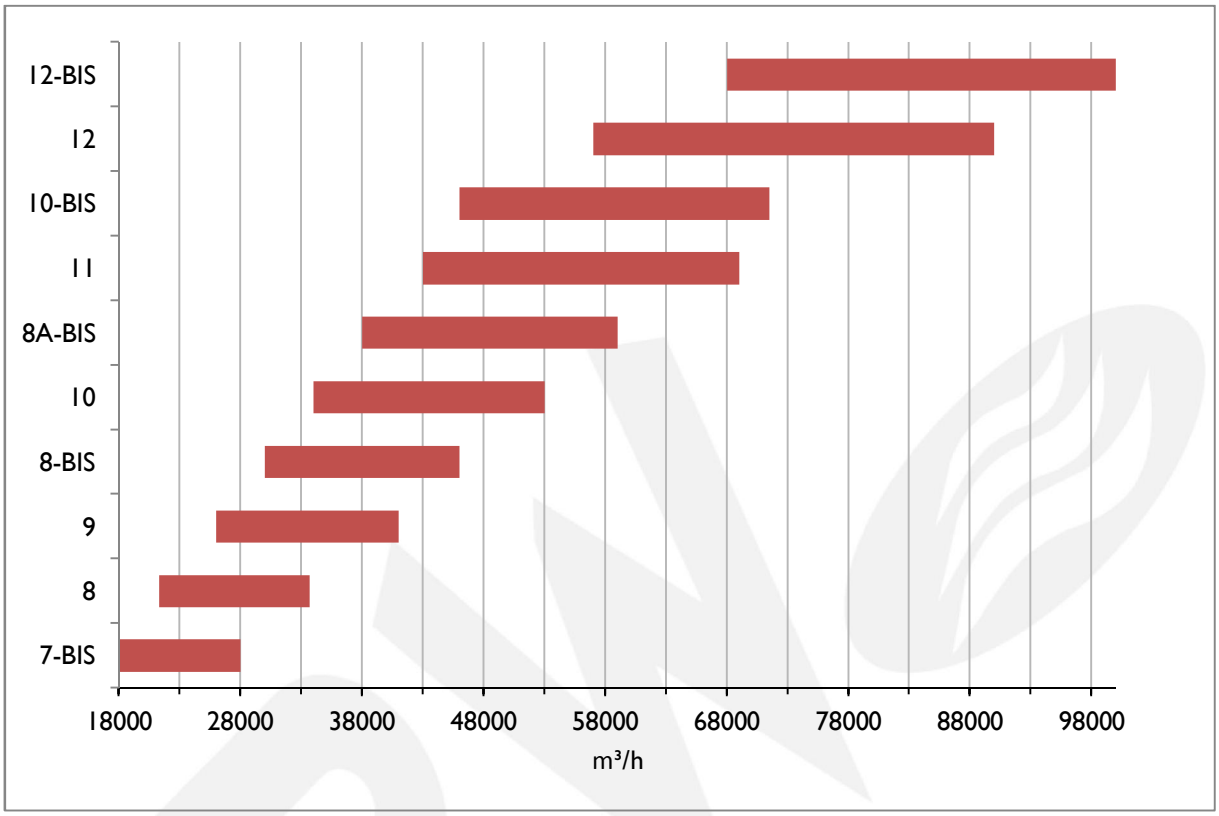
Floor in both structural solutions is insulated from the bottom with two-layer plates as in case of the outer covers. The plates are made of two steel sheet layers, filled with mineral wool insulation, both sheet layers being galvanised, which makes a difference with regard to the cover.

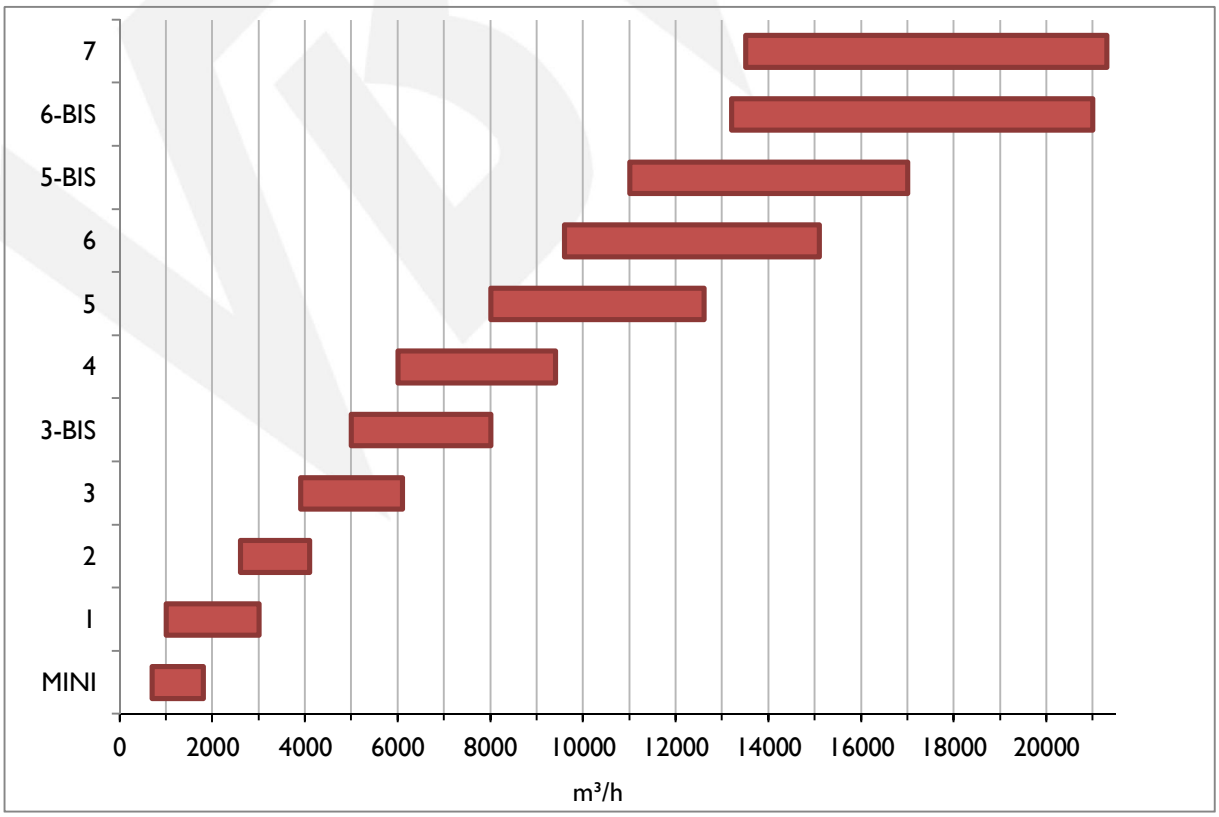
The units are provided with flexible pipe outlets, insulating them from vibrations transferred by the channels. Every unit has got its own frame, which is 80 mm high in smaller models and 120 mm in larger ones.

BD outdoor air handling units are additionally provided with air scoops and exhaust terminals and the roof. The throttle valves are placed inside the unit structure (frame solutions) or outside – In a special enclosure (self-supported units).

In order to facilitate unit selection, the catalogue provide presents the ranges of air flow rates for particular sizes of air handling units. The size of the air handling unit should be selected to ensure that the air flow rate (with reference to the internal air handling unit cross-section) is between 2.5 and 3.5 m/s for the required delivery. When the flow rate is 3 m/s, the operation of the air handling unit is silent and cost-effective.

A diagram of preliminary selection of air handling unit size

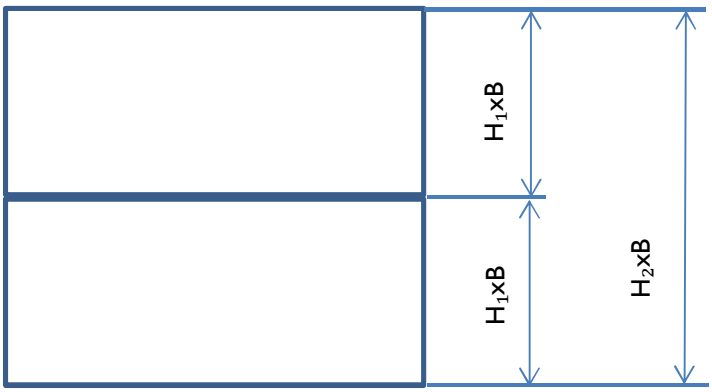




A table with air handling unit dimensions

Unit size BS/BD	Frame structure									Self-supported structure		Air flow rate	
	B [mm]			H1 [mm]			H2 [mm]			H1 [mm]	H2 [mm]	Vmin [m3/h]	Vmax [m3/h]
	Insulation layer thickness [mm]												
	25	50	70	25	50	70	25	50	70	50	50		
MINI	-	640	680	-	-		-	-		490	980	700	1800
1	650	690	730	600	640	640	1200	1280	1280	600	1200	1000	3000
2	700	740	780	700	740	740	1400	1480	1480	700	1400	2600	4100
3	940	980	1020	700	740	740	1400	1480	1480	700	1400	3900	6100
3-BIS	1250	1290	1330	700	740	740	1400	1480	1480	-	-	5000	8000
4	940	980	1020	1010	1050	740	2020	2100	2100	1010	2020	6000	9400
5	1250	1290	1330	1010	1050	1050	2020	2100	2100	-	-	8000	12600
6	-	1290	1330	-	1250	1250	-	2500	2500	-	-	9600	15100
5-BIS	-	1580	1620	-	1050	1050	-	2100	2100	-	-	11000	17000
6-BIS	-	1580	1620	-	1250	1250	-	2500	2500	-	-	13200	21000
7	-	1580	1620	-	1370	1370	-	2740	2740	-	-	13500	21300
7-BIS	-	1885	1925	-	1370	1370	-	2740	2740	-	-	18000	28000
8	-	1885	1925	-	1670	1670	-	3340	3340	-	-	21300	33700
9	-	1885	1925	-	2020	2020	-	4040	4040	-	-	26000	41000
8-BIS	-	2400	2440	-	1670	1670	-	3340	3340	-	-	30000	46000
10	-	2400	2440	-	2020	2020	-	4040	4040	-	-	34000	53000
8A-BIS	-	3000	3040	-	1670	1670	-	3340	3340	-	-	38000	59000
11	-	2400	2440	-	2500	2500	-	5000	5000	-	-	43000	69000
10-BIS	-	3000	3040	-	2020	2020	-	4040	4040	-	-	46000	71500
12	-	3000	3040	-	2500	2500	-	5000	5000	-	-	57000	90000
12-BIS**	-	4800	4840	-	2020	2020	-	-	-	-	-	68000	100000

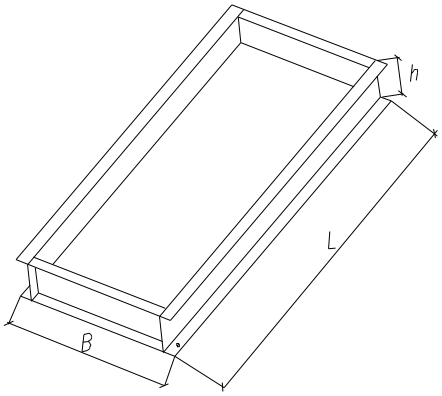
** The structure based on a double cross-section and with components of 10 in size

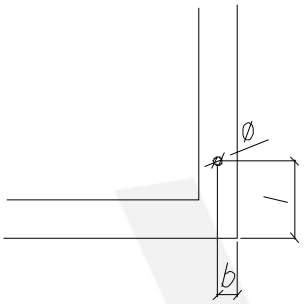


STANDARD EQUIPMENT.

Standard equipment of BS,BD air handling units includes:

- supporting frame





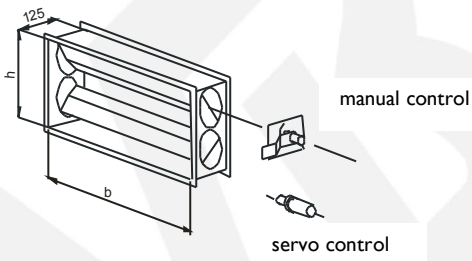
L – The block length
B – The block width

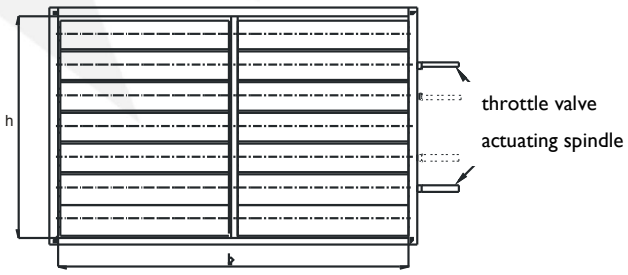
	h	b	l	Ø
Self-supported structure MINI, 1-4	80	45	100	18
Frame structure 1-7	80	21	101	11
Frame structure 7BIS-12BIS	120	35	115	14

Spacing of bores for frame mounting

Unit sizes from MINI to 7: frame height (h) = 80 mm
Unit sizes from 7BIS to 12BIS: frame height (h) = 120 mm

- multiplane control throttle valve:



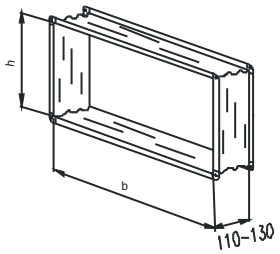


with spindle: servo control
with handle: manual control

b>1340 – vertically split throttle valve
h>1340 – throttle valve with two coupled spindles
h>2250 – throttle valve with four coupled spindles

Split throttle vales are used for large windows. The number of throttle valve actuation cylinders depends on the throttle valve dimensions. In the case of outdoor BD solutions, the throttle valves are mounted inside of the unit or in a special enclosure.

- flexible connection at the inlet and the outlet of the unit



- condensate draining trap

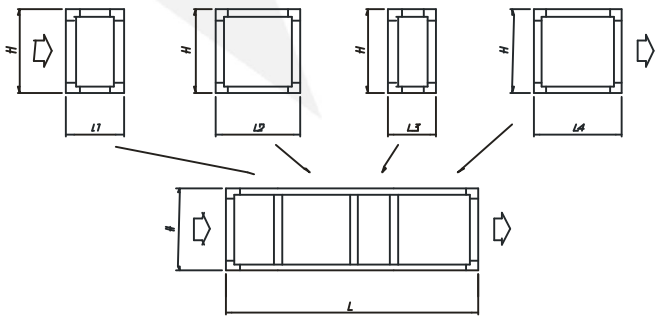
Standard accessories of outdoor air handling units, BD units:

- Roof – the unit enclosure is protected against rain with a roof made of aluzinc sheet
- Air scoop is mounted directly on the unit. It is equipped with a condenser and a screen or louvers, protecting the unit gear against contamination, dust or leaves. The scoop may be straight or lateral, depending on unit size;
- Air exhaust terminal is mounted directly on the unit, made as a shutter with louvers or as a lateral terminal;
- Fan sections equipped with a safety switch;

DIMENSIONING AND CONFIGURATION

While selecting an air handling unit, a design engineer takes into account its size, the number and the sequence of air processing sections. Depending on the mounting site and transport limitations, the functional assemblies can be mounted in the enclosure (applied to the frame structure:

a) Compact structure – all sections in one monoblock



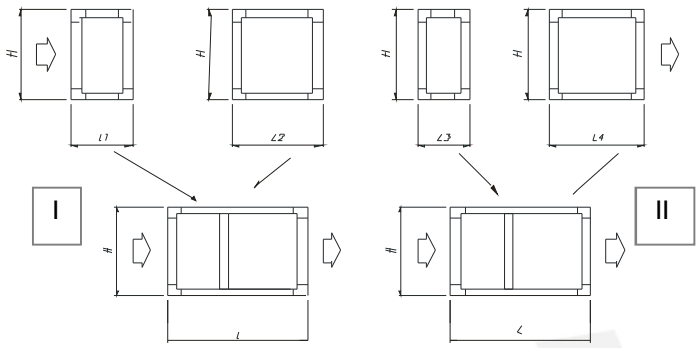
The unit length calculation

Insulation 25 mm L= (L1+L2+L3+L4) – 30x(n-1)

Insulation 50 mm L= (L1+L2+L3+L4) – 50x(n-1)

n - a number of sections

b) A structure with several enclosures



The unit length calculation – with a 25 mm insulation

I) L= (L1+L2)-30x(n-1)

II) L= (L1+L2)-30x(n-1)

Lc = I+II

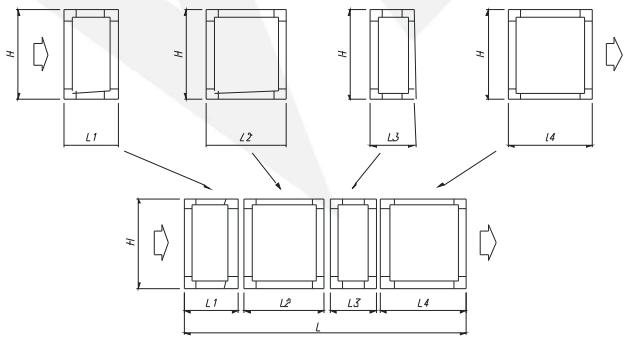
The unit length calculation – with a 50 mm insulation

I) L= (L1+L2)-50x(n-1)

II) L= (L1+L2)-50x(n-1)

Lc = I+II

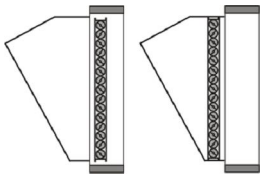
c) Single sections



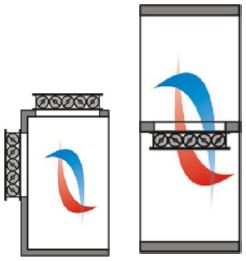
The unit length calculation

L = L1+L2+L3+L4

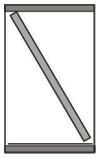
FUNCTIONAL SECTIONS



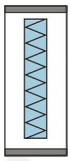
An air scoop/exhaust terminal with a throttle valve



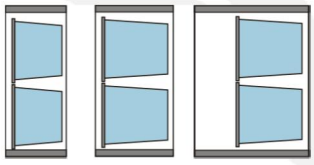
Mixing chamber



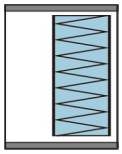
Fat filter G2



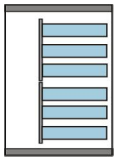
Cassette *filter G4*



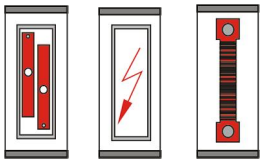
Pocket filter F5, F7, F9



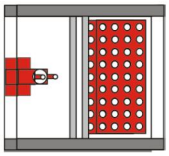
Absolute filter H10, H11, H13, H14



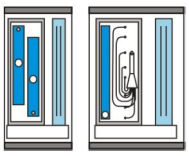
Coal filter



Water, electric and steam heater

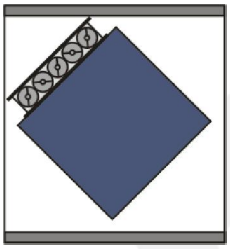


Pegaz gas (oil) heating section

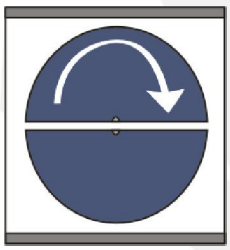


Water, Freon cooler, condenser-vaporiser

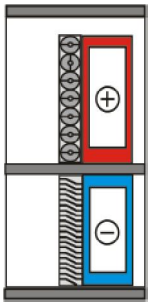
Drop separator with a tank



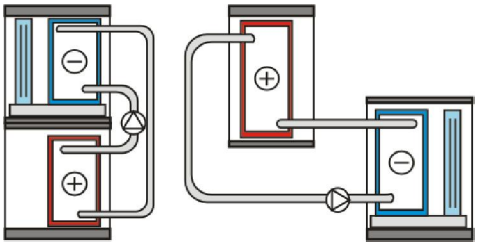
Cross-flow heat exchanger – single, double



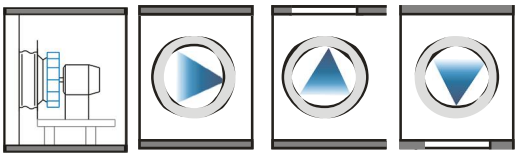
Rotating heat exchanger



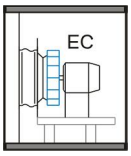
Heat pipe



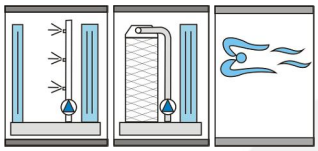
Heat exchanger using a mediating factor



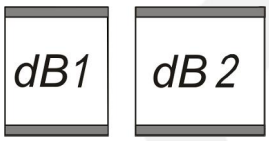
Axial radial fan, radial fan



Electronically commuted fan

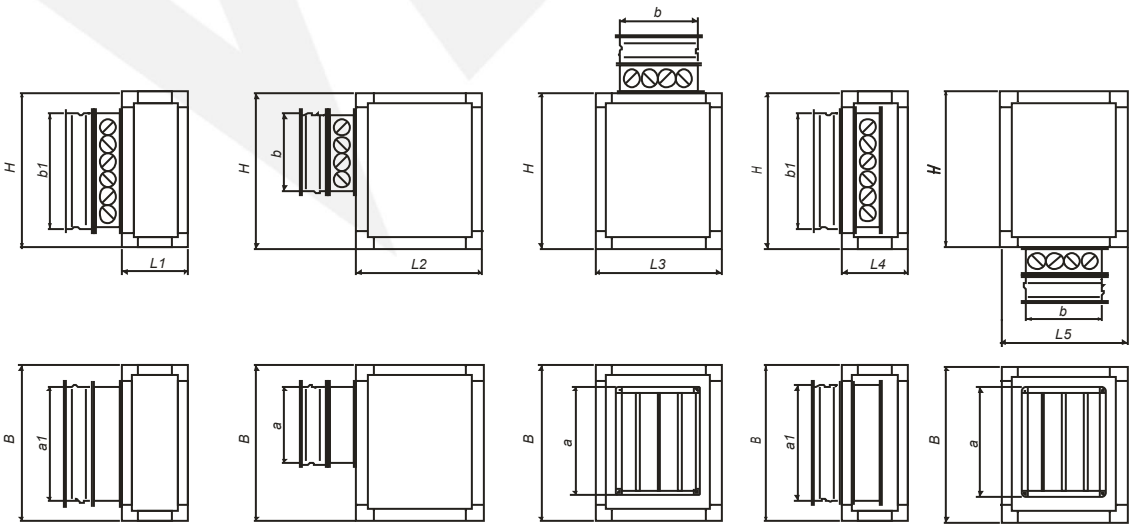


Water humidifier, steam humidifier



Noise suppressors

Throttle valves



DR1 DR2 DR3 DR4 DR5

The throttle enclosure and the blades are made of aluminium profiles. There is a sealing placed on the blades. The mutual blade coupling in a counter-rotating system operates by means of plastic gears. The throttle control can be performed manually, with a lever, or by an electric servo motor.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1	L2	L3	L4	L5	a1	b1	a	b
	[mm]										
DR – MINI	640	490	-	500	500	300	500	500	315	400	315
DR – 1	690	600	-	500	500	300	500	500	400	400	315
DR – 2	740	700	-	500	550	300	600	600	500	630	315
DR – 3	980	700	-	500	550	300	600	800	500	630	400
DR – 4	980	1010	-	500	550	300	600	800	800	800	400

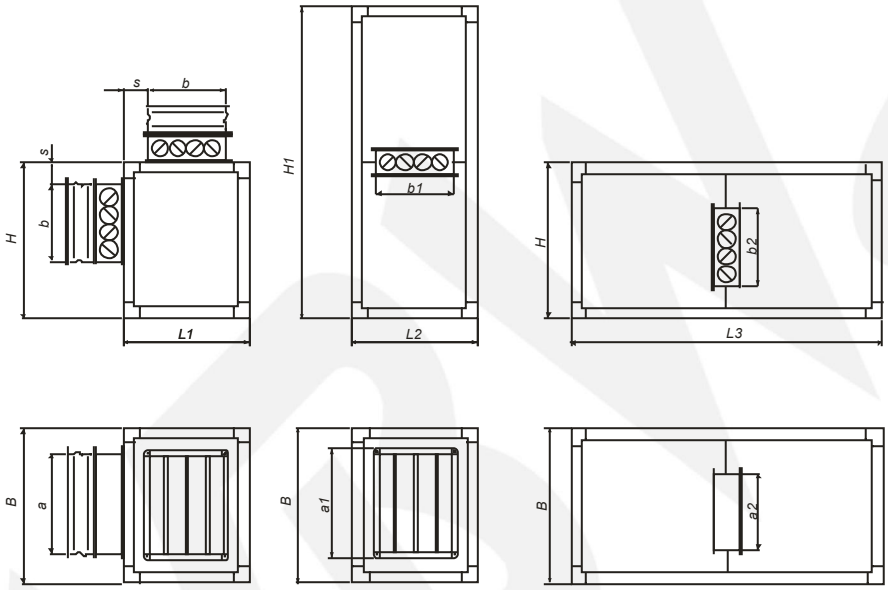
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1	L2	L3=L5	L4	a1	b1	a	b
	[mm]									
DR – 1	690	640	-	500	500	300	500	500	400	315
DR – 2	740	740	-	500	500	300	600	600	630	315
DR – 3	980	740	-	500	600	300	800	600	630	400
DR – 3-BIS	1290	740	-	500	600	300	1000	600	1000	400
DR – 4	980	1050	-	500	600	300	800	800	800	400
DR – 5	1290	1050	-	500	700	300	1000	800	1000	500
DR – 6	1290	1250	-	500	850	300	1000	1000	1000	630
DR – 5-BIS	1580	1050	-	500	700	300	1250	800	1250	500
DR – 6-BIS	1580	1250	-	500	850	300	1250	1000	1250	630
DR – 7	1580	1370	-	500	1000	300	1250	1250	1250	800
DR – 7-BIS	1885	1370	-	500	1000	300	1500	1250	1500	800
DR – 8	1885	1670	-	600	1000	300	1500	1500	1500	800
DR – 9	1885	2020	-	700	1200	300	1500	1800	1500	1000
DR – 8-BIS	2400	1670	-	600	1000	300	2250	1500	2000	800
DR – 10	2400	2020	-	700	1200	300	2250	1800	2000	1000
DR – 8A-BIS	3000	1670	-	600	1200	300	2500	1500	2000	1000
DR – 11	2400	2500	-	800	1700	300	2250	2250	2000	1500
DR – 10-BIS	3000	2020	-	800	2000	300	2500	1800	2000	1000
DR – 12	3000	2500	-	800	2000	300	2500	2250	2000	1800

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L1	L2	L3=L5	L4	a1	b1	a	b
	[mm]									
DR – 1	650	600	-	460	460	260	500	500	400	315
DR – 2	700	700	-	460	460	260	600	600	630	315
DR – 3	940	700	-	460	560	260	800	600	630	400
DR – 4	940	1010	-	460	560	260	800	800	800	400

Mixing chamber



DRM1 DRM2 DRM3

A mixing chamber is equipped with multiplane control throttles, which are used to mix outdoor air with recirculation air sucked from the air conditioned premises. The throttles are provided with automatically controlled servo motors.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	H1	L1	L2	a	b	a1	b1	s
	[mm]									
DRM – MINI	640	490	980	500	400	500	315	300	212	100
DRM – 1	690	600	1200	500	400	500	400	400	212	100
DRM – 2	740	700	1400	550	500	600	500	370	312	100
DRM – 3	980	700	1400	550	500	800	500	550	312	100
DRM – 4	980	1010	2020	550	600	800	800	640	412	100

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	H1	L1	L2	L3	a	b	a1	b1	a2	b2	s
	[mm]												
DRM – 1	690	640	1280	500	400	600	500	500	400	212	270	312	100
DRM – 2	740	740	1480	500	500	600	600	600	370	312	280	412	100
DRM – 3	980	740	1480	600	500	650	800	600	550	312	330	512	100
DRM – 3-BIS	1290	740	1480	600	500	750	1000	600	720	312	440	512	100
DRM – 4	980	1050	2100	600	600	700	800	800	640	412	370	712	100
DRM – 5	1290	1050	2100	700	600	750	1000	800	860	412	440	812	100
DRM – 6	1290	1250	2500	850	700	850	1000	1000	820	512	520	812	100
DRM – 5-BIS	1580	1050	2100	700	600	900	1250	800	1150	412	590	812	100
DRM – 6-BIS	1580	1250	2500	850	700	900	1250	1000	1140	512	580	1012	100
DRM – 7	1580	1370	2740	1000	700	900	1250	1250	1160	512	590	1012	100
DRM – 7-BIS	1885	1370	2740	1000	700	1050	1500	1250	1530	512	700	1112	100
DRM – 8	1885	1670	3340	1000	800	1000	1500	1500	1540	612	670	1412	100
DRM – 9	1885	2020		1200	1000	1000	1500	1800	1410	812	630	1812	100
DRM – 8-BIS	2400	1670	3340	1000	800	1250	2250	1500	2100	612	900	1412	100
DRM –10	2400	2020		1200	900	1150	2250	1800	2090	712	820	1812	100
DRM – 8A-BIS	3000	1670	3340	1200	800	1500	2500	1500	2700	612	1170	1412	100
DRM –11	2400	2500		1700	1100	1200	2250	2250	2100	912	870	2212	100
DRM – 10-BIS	3000	2020		2000	1000	1450	2500	1800	2450	812	1100	1812	100
DRM –12	3000	2500		2000	1200	1450	2500	2250	2500	1012	1140	2212	100

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	H1	L1	L2	L3	a	B	a1	b1	a2	b2	s
	[mm]												
DRM – 1	650	600	1200	460	360	560	500	500	400	212	270	312	100
DRM – 2	700	700	1400	460	460	560	600	600	370	312	280	412	100
DRM – 3	940	700	1400	560	460	610	800	600	550	312	330	512	100
DRM – 4	940	1010	2020	560	560	660	800	800	640	412	370	712	100

Filtration sections

The series of BS/BD air handling unit types includes 21 sizes, the design of which is based on the normalised air filter dimensions. The air filter dimensions, applied in the air handling unit of a given size, cover its internal cross-section. The outer dimensions of the air handling unit are the sum of the internal cross-section and the enclosure insulation thickness. The maximum capacity of particular unit sizes is limited by the maximum air flow rate of the applied filters.

A division of filters:

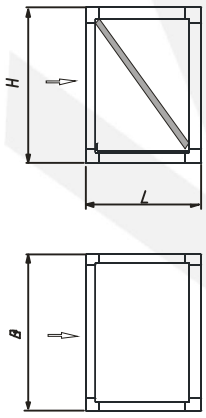
G1-G4 – preliminary filters
F5-F9 – precision filters
H10-H14 – absolute filters

Preliminary pressure differences:

- for preliminary filters: from 30 to 50 Pa
- for precision filters: from 50 to 150 Pa
- for absolute filters: from 100 to 250 Pa

Preliminary filters.

Metal filters.



FT

Metal filters in G2 filtration class are used as fat filters. Filter housing and screen are made of galvanised steel sheet. The filter is inclined under a certain angle. This facilitates fat drops falling into a container, in which the filter is seated. Such a filter mounting protects from fat drop uptake into the installation.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
FT – MINI	640	490	450
FT – 1	690	600	600
FT – 2	740	700	650
FT – 3	980	700	650
FT – 4	980	1010	800

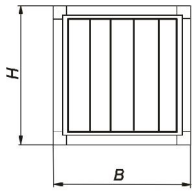
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
FT – 1	690	640	500
FT – 2	740	740	550
FT – 3	980	740	550
FT – 3 – BIS	1290	740	550
FT – 4	980	1050	700
FT – 5	1290	1050	700
FT – 6	1290	1250	850
FT – 5 – BIS	1580	1050	700
FT – 6 – BIS	1580	1250	850
FT – 7	1580	1370	900
FT – 7 – BIS	1885	1370	900
FT – 8	1885	1670	1100
FT – 9	1885	2020	1300
FT – 8 – BIS	2400	1670	1100
FT – 10	2400	2020	1300
FT – 8A – BIS	3000	1670	1200
FT – 11	2400	2500	1200
FT – 10 – BIS	3000	2020	1300
FT – 12	3000	2500	1200

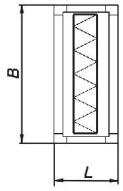
The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
FT – 1	650	600	460
FT – 2	700	700	510
FT – 3	940	700	510
FT – 4	940	1010	660

Casette filters



Cassette filter. G4 filtration class. Filter housing made of galvanised steel sheet. Filter fabric folded and protected with a screen.



FD4

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
FD4 – MINI	640	490	350
FD4 – 1	690	600	350
FD4 – 2	740	700	350
FD4 – 3	980	700	350
FD4 – 4	980	1010	350

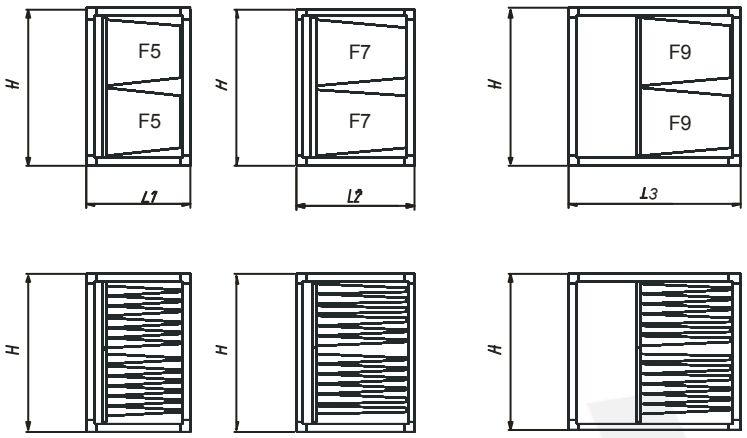
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
FD4 – 1	690	640	350
FD4 – 2	740	740	350
FD4 – 3	980	740	350
FD4 – 3 – BIS	1290	740	350
FD4 – 4	980	1050	350
FD4 – 5	1290	1050	350
FD4 – 6	1290	1250	350
FD4 – 5 – BIS	1580	1050	350
FD4 – 6 – BIS	1580	1250	350
FD4 – 7	1580	1370	350
FD4 – 7 – BIS	1885	1370	350
FD4 – 8	1885	1670	400
FD4 – 9	1885	2020	400
FD4 – 8 – BIS	2400	1670	400
FD4 – 10	2400	2020	400
FD4 – 8A – BIS	3000	1670	400
FD4 – 11	2400	2500	400
FD4 – 10 – BIS	3000	2020	400
FD4 – 12	3000	2500	400

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
FD4 – 1	650	600	310
FD4 – 2	700	700	310
FD4 – 3	940	700	310
FD4 – 4	940	1010	310

Pocket filters



FB5 FB7 FB9

Pocket filters of synthetic fabric in steel sheet frames are mounted to the unit with special clamps, ensuring required the tightness and facilitating replacement.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1*	L2	L3
	[mm]				
FB – MINI	640	490	600/700	800	1050
FB – 1	690	600	600/700	800	1050
FB – 2	740	700	600/700	800	1050
FB – 3	980	700	600/700	800	1150
FB – 4	980	1010	600/700	800	1150

*L1 – the length of a filter section with filter pockets 360 mm/500 mm long

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1*	L2	L3**
	[mm]				
FB – 1	690	640	550/700	800	1050/1050
FB – 2	740	740	550/700	800	1050/1050
FB – 3	980	740	550/700	800	1150/1150
FB – 3 – BIS	1290	740	550/700	800	1250/1250
FB – 4	980	1050	550/700	800	1150/1150
FB – 5	1290	1050	550/700	800	1250/1250
FB – 6	1290	1250	550/700	800	1250/1250
FB – 5 – BIS	1580	1050	550/700	800	1400/1250
FB – 6 – BIS	1580	1250	550/700	800	1400/1250
FB – 7	1580	1370	550/700	800	1400/1250
FB – 7 – BIS	1885	1370	550/700	800	1500/1350
FB – 8	1885	1670	550/700	800	1500/1350

The section type BS/BD	B	H	L1*	L2	L3**
	[mm]				
FB – 9	1885	2020	550/700	800	1600/1350
FB – 8 – BIS	2400	1670	550/700	800	1800/1350
FB – 10	2400	2020	550/700	800	1700/1350
FB – 8A – BIS	3000	1670	550/700	800	2100/1350
FB – 11	2400	2500	550/700	800	1800/1350
FB – 10 – BIS	3000	2020	550/700	800	2100/1350
FB – 12	3000	2500	550/700	800	2000/1350

* L1- the length of a filter section with filter pockets 360 mm/500 mm long

** L3 – the length of a section behind the radial fan/the length of the section behind other subassemblies

850 mm: the length of F9 filter section but only in combination with axial-radial fan (in one block)

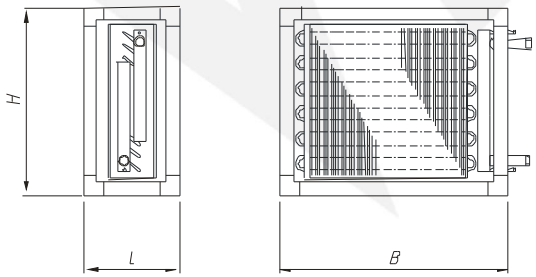
The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L1*	L2	L3
	[mm]				
FB – 1	650	600	510/660	760	1010
FB – 2	700	700	510/660	760	1010
FB – 3	940	700	510/660	760	1110
FB – 4	940	1010	510/660	760	1110

*L1 – the length of a filter section with filter pockets 360 mm/500 mm long

Heaters

Water heaters



HW

Water heaters consist of a package of aluminium slats and copper tubes. Heater housing is made of galvanized steel; the collectors are made of copper or steel. Heater collectors have additional connections for venting and draining heating medium from the heater. Heating parameter of heaters typically used in the air handling units equals up to 130°C.

Two typical water heaters have been applied in each size of air the conditioning unit: double-row with higher power and single-row with lower power. The heaters are selected by the manufacturer in consideration of the parameters provided by the ordering party. The section lengths in tables are specified for maximum three-row heat exchangers.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HW – MINI	640	490	400
HW – 1	690	600	400
HW – 2	740	700	400
HW – 3	980	700	400
HW – 4	980	1010	400

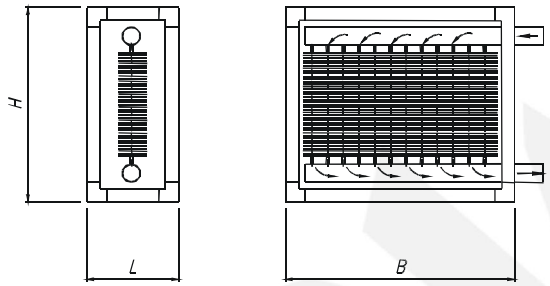
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HW – 1	690	640	450
HW – 2	740	740	450
HW – 3	980	740	450
HW – 3 – BIS	1290	740	450
HW – 4	980	1050	450
HW – 5	1290	1050	450
HW – 6	1290	1250	550
HW – 5 – BIS	1580	1050	450
HW – 6 – BIS	1580	1250	550
HW – 7	1580	1370	550
HW – 7 – BIS	1885	1370	550
HW – 8	1885	1670	600
HW – 9	1885	2020	600
HW – 8 – BIS	2400	1670	600
HW – 10	2400	2020	650
HW – 8A – BIS	3000	1670	650
HW – 11	2400	2500	650
HW – 10 – BIS	3000	2020	650
HW – 12	3000	2500	650

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
HW – 1	650	600	410
HW – 2	700	700	410
HW – 3	940	700	410
HW – 4	940	1010	410

Steam heaters



HS

Steam heaters consist of an aluminium lamella package and copper pipes. The heater enclosure is made of galvanised steel sheet. The supply collector is made of steel, while the return collector (for condensate) is made of copper. The maximum temperature of the heating medium is 180 °C.

The maximum operating pressure is 1.0 MPa. The steam pH coefficient should be within the range of 8/5-9.5. The steam heaters are selected by the manufacturer in consideration of the parameters provided by the ordering party.

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HS – 1	690	640	500
HS – 2	740	740	500
HS – 3	980	740	500
HS – 3 – BIS	1290	740	500
HS – 4	980	1050	500
HS – 5	1290	1050	500
HS – 6	1290	1250	550
HS – 5 – BIS	1580	1050	500
HS – 6 – BIS	1580	1250	550
HS – 7	1580	1370	550
HS – 7 – BIS	1885	1370	550
HS – 8	1885	1670	550
HS – 9	1885	2020	550
HS – 8 – BIS	2400	1670	600
HS – 10	2400	2020	600
HS – 8A – BIS	3000	1670	600

The section type BS/BD	B	H	L
	[mm]		
HS – 11	2400	2500	600
HS – 10 – BIS	3000	2020	600
HS – 12	3000	2500	600

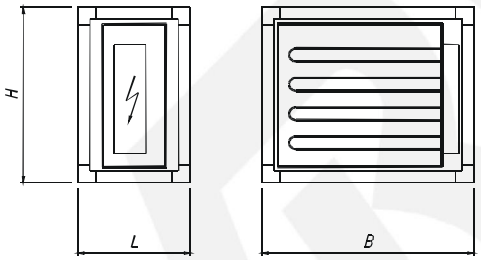
For steam temperatures above 130 °C, the L dimension for air handling units of the size up to 8-BIS is 600 mm.

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
HS – 1	650	600	460
HS – 2	700	700	460
HS – 3	940	700	460
HS – 4	940	1010	460

For steam temperatures above 130 °C, the „L" dimension for all sizes air handling units is 600 mm.

Nagrzewnice elektryczne



HE

An electric heater consists of a support with fixed heating elements (tubular heaters in stainless-steel enclosure), a thermostat and temperature limit switches installed on the housing and a terminal strip. The internal electric connections are manufactured of wires in silicone insulation.

The terminal strip is located on the front wall of the heater (accessible after removing the cover plate from the unit enclosure) to connect cables supplying particular heater sections, while another terminal strip includes connections to the thermostats.

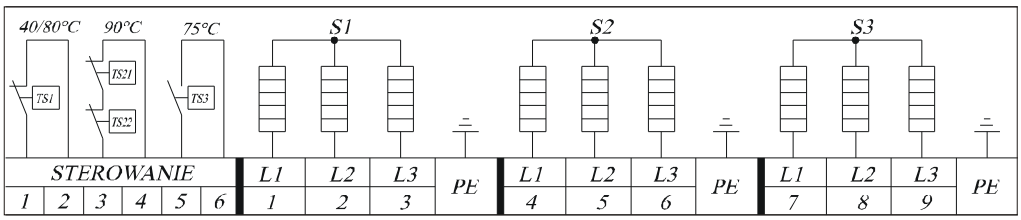
The number and power of particular air conditioning sections depend on the required total heater power and the mode of its control.

The temperature safety elements mounted on the heater should be used in the automatic control system of the air handling unit.

The heater safety elements include a thermostat and the temperature limit switches:

- The thermostat TS1 cuts off the circuit when the outlet air temperature behind the heater exceeds 40°C
- TS2-1 and TS2-2 limit switches cut off the circuit when the heater housing temperature exceeds 90 °C (in the automatic system, a manual reset is recommended to switch the heater on again in order to identify the cause of temperature failure)
- TS3 limit switch offers short-circuiting when the heater housing temperature exceeds 75 °C, (in the automatic system, it is used to block fan switch off till housing temperature drop).

An example of a terminal strip of a 3-section electric heater



The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HE – MINI	640	490	600
HE – 1	690	600	600
HE – 2	740	700	600
HE – 3	980	700	600
HE – 4	980	1010	600

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HE – 1	690	640	800/1050*
HE – 2	740	740	800/1050*
HE – 3	980	740	800/1050*
HE – 3 - BIS	1290	740	800
HE – 4	980	1050	800
HE – 5	1290	1050	800
HE – 6	1290	1250	900
HE – 5 – BIS	1580	1050	800
HE – 6 – BIS	1580	1250	900
HE – 7	1580	1370	900
HE – 7 – BIS	1885	1370	900
HE – 8	1885	1670	900
HE – 9	1885	2020	900
HE – 8 – BIS	2400	1670	900
HE – 10	2400	2020	900
HE – 8A – BIS	3000	1670	1000
HE – 11	2400	2500	1000
HE – 10 – BIS	3000	2020	1000
HE – 12	3000	2500	1000

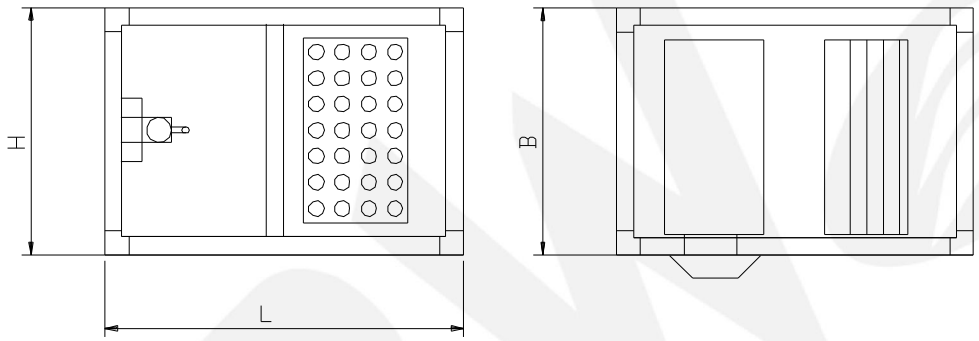
* the length of the electric heater section with higher power (BS/BD-1 30-42 kW; BS/BD-2 39-63 kW; BS/BD-3 39-81 kW)

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
HE – 1	650	600	760/1010*
HE – 2	700	700	760/1010*
HE – 3	940	700	760/1010*
HE – 4	940	1010	760

* the length of the electric heater section with higher power (BS/BD-1 30-42 kW; BS/BD-2 39-63 kW; BS/BD-3 39-81 kW)

Pegaz heating section

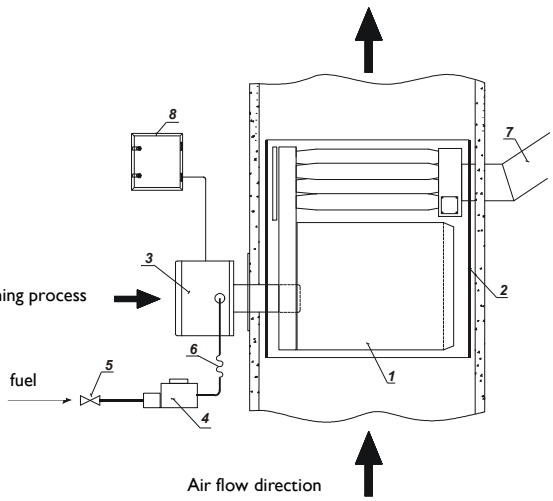


The PEGAZ flow, the heat exchanging air heater (a gas heater of premises), includes:

- a heat exchanger, where combustion gases generated from gas fuel burning are used to heat ventilation air;
- gas burners – designed for the following gas fuels: natural gases (E, Lw, Ls) and liquid gases (liquefied): P (technical propane), B/P (propane-butane). Gas symbols – according to PN-C-04750 standard. PEGAZ heating section in the standard configuration is adapted to be supplied with E high methane natural gas.

The PEGAZ air heater includes:

1. A combustion chamber with a "combustion gases-air heat exchanger"
2. A sheet enclosure.
3. A gas burner.
4. Gas fittings (include a set of solenoid valves, a gas filter and a pressure control valve).
5. A cut-off ball valve.
6. A compensator (for flange fittings of the diameters amounting to DN = 65 and bigger).
7. An exhaust system of combustion gases (an insulated chimney delivered when specified in the order).
8. A supply-control cassette.



Pegaz heating section with a burner is individually selected based on the parameters and specified by the ordering party.

The section dimensions in the frame structure (insulation thickness 50 mm)

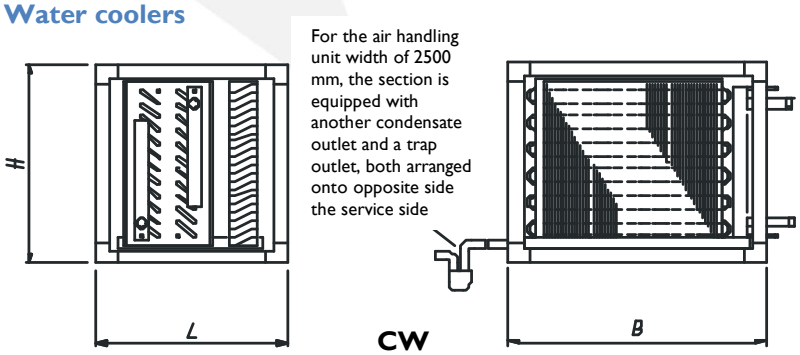
The section type BS/BD	B	H	L
	[mm]		
PEGAZ – 1	780	600	950
PEGAZ – 2	780	600	950
PEGAZ – 3	1070	720	1040
PEGAZ – 4	1130	860	1250
PEGAZ – 5	1370	970	1300
PEGAZ – 6	1500	1070	1450
PEGAZ – 7	1790	1140	1600
PEGAZ – 8	2000	1170	1600
PEGAZ – 9	2200	1360	1850
PEGAZ – 10	2600	1360	1900
PEGAZ – 11	3000	1580	2250
PEGAZ – 12	3550	1720	2450

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
PEGAZ – 1	740	560	910
PEGAZ – 2	740	560	910
PEGAZ – 3	1030	680	1000
PEGAZ – 4	1090	820	1210

Coolers

Water coolers



For the air handling unit width of 2500 mm, the section is equipped with another condensate outlet and a trap outlet, both arranged onto opposite side the service side

Water coolers are made of an aluminium lamella package and copper pipes. The cooler enclosure is made of galvanised steel sheet. The cooler manifolds are made of copper or steel. The manifolds have additional pipe connections for heat exchanger venting and water draining. The cooling section includes a condensate tank, a drop separator to prevent water drop intake with air flow, and a trap. The maximum working pressure is 1.6 MPa.

The specified section length applies to a maximally 8-row cooler with a tank and a droplet separator.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
CW – MINI	640	490	550
CW – 1	690	600	550
CW – 2	740	700	550
CW – 3	980	700	550
CW – 4	980	1010	600

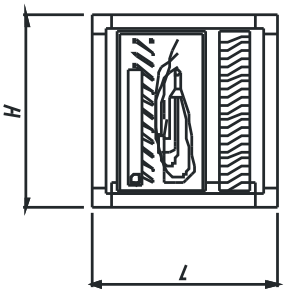
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
CW – 1	690	640	650
CW – 2	740	740	650
CW – 3	980	740	650
CW – 3 – BIS	1290	740	650
CW – 4	980	1050	650
CW – 5	1290	1050	650
CW – 6	1290	1250	700
CW – 5 – BIS	1580	1050	650
CW – 6 – BIS	1580	1250	700
CW – 7	1580	1370	700
CW – 7 – BIS	1885	1370	700
CW – 8	1885	1670	700
CW – 9	1885	2020	700
CW – 8 – BIS	2400	1670	700
CW – 10	2400	2020	750
CW – 8A – BIS	3000	1670	750
CW – 11	2400	2500	900
CW – 10 – BIS	3000	2020	750
CW – 12	3000	2500	950

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

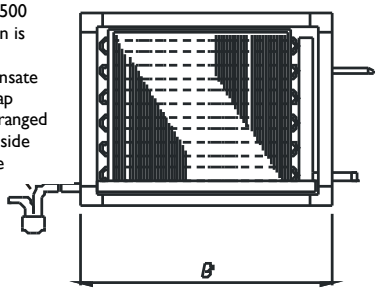
The section type BS	B	H	L
	[mm]		
CW – 1	650	600	610
CW – 2	700	700	610
CW – 3	940	700	610
CW – 4	940	1010	610

Freon coolers (condenser, vaporiser)



For the air handling unit width of 2500 mm, the section is equipped with another condensate outlet and a trap outlet, both arranged onto opposite side the service side

CDX



Freon coolers are made of an aluminium lamella package and copper pipes. The droplet separator is made of brass and the return manifold of copper. The cooling section is equipped with a tank for condensate, a droplet separator to prevent droplet uptake by air flow, and a trap. Maximum operating pressure is 2.2 MPa.

Depending on size and power, freon coolers are available as:

- single
- double with 1/2 + 1/2 power distribution
- double with 1/3 + 2/3 power distribution

The specified section length applies to a maximum 8-row cooler.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
CF – MINI	640	490	550
CF – 1	690	600	550
CF – 2	740	700	550
CF – 3	980	700	550
CF – 4	980	1010	600

The section dimensions in the frame structure (insulation thickness 50 mm)

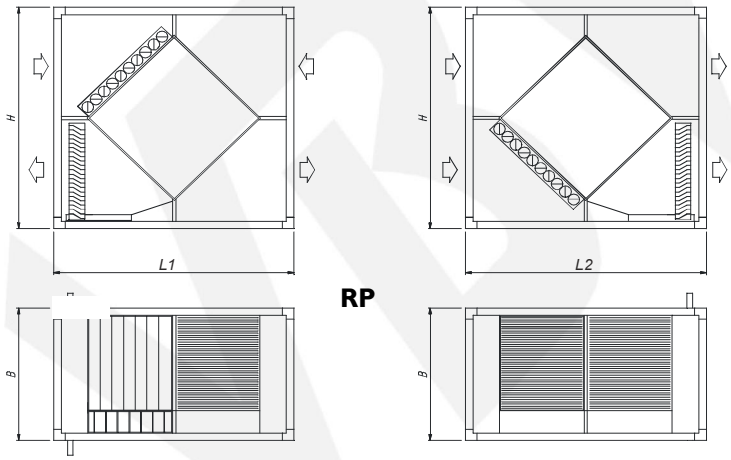
The section type BS/BD	B	H	L
	[mm]		
CF – 1	690	640	650
CF – 2	740	740	650
CF – 3	980	740	650
CF – 3 – BIS	1290	740	650
CF – 4	980	1050	650
CF – 5	1290	1050	650
CF – 6	1290	1250	700
CF – 5 – BIS	1580	1050	650
CF – 6 – BIS	1580	1250	700
CF – 7	1580	1370	700
CF – 7 – BIS	1885	1370	700
CF – 8	1885	1670	700
CF – 9	1885	2020	700
CF – 8 – BIS	2400	1670	700

The section type BS/BD	B	H	L
	[mm]		
CF – 10	2400	2020	750
CF – 8A – BIS	3000	1670	750
CF – 11	2400	2500	900
CF – 10 – BIS	3000	2020	750
CF – 12	3000	2500	950

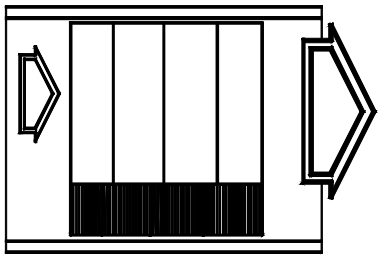
The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
CF – 1	650	600	610
CF – 2	700	700	610
CF – 3	940	700	610
CF – 4	940	1010	610

Wymiennik krzyżowy



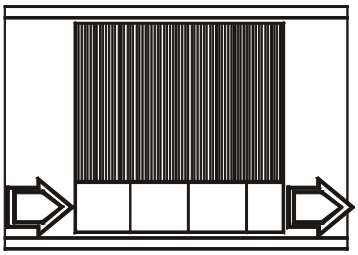
The cross-flow exchanger is made of thin aluminium plates that make up air intake and exhaust ducts. The stream of warm air sucked from a room environment flows through every second channel of the heat exchanger, warming its panels. The stream of the supplied air flows across the other part of the channel, taking over the heat from the heat exchanger panels. A degree of the achieved capacity amounts to 70%. Heat recovery with a cross-flow heat exchanger does not need any power supply from the outside. This type of heat exchangers has no moving parts, such as a motor or bearings, which ensures its long life. The section consists of a heat exchanger with a throttle valve, a by-pass, a tank for condensate, a droplet separator to stop droplet uptake by air flow, and a trap (delivered separately), ensuring proper water drain from the tank when the air handling unit is active. The drainage connector for draining water from the container is led out on the opposite side to the operating side. In the air intake part, at the inlet to the heat exchanger, there is a damper consisting of two sections: on the exchanger, and the on the by-pass. Both sections are coupled together so that at the opening of the flow through the heat exchanger, the by-pass is closed. The air flows through the by-pass when the further recovery of heat is undesirable. This occurs during summer, when the outside temperature is equal to or higher than the temperature in the hall, and heat gains are considerable; and in winter - as frost protection, as shown in the following figures.



The flow through the heat exchanger is open:

Heat recovery

By-pass closed



The flow through the heat exchanger is closed:

By-pass open - in summer and heat exchanger frosting in winter

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	Air flow rate	B	H	L1
	[m³/h]	[mm]		
RP – MINI	800-1600	640	980	900
RP – 1	1000-3000	690	1200	1150
RP – 2	2500-3200	740	1400	1150
	3200-4100	740	1400	1350
RP – 3	3600-4500	980	1400	1350
	4500-6100	980	1400	1350
RP – 4	5500-6500	980	2020	1350
	6500-9400	980	2020	1700

A section of cross-flow heat exchanger

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	Air flow rate	B	H	L1	L2
	[m³/h]	[mm]			
RP – 1	1000-3000	690	1280	1150	1250
RP – 2	2500-3200	740	1480	1150	1250
	3200-4100	740	1480	1350	1450
RP – 3	3600-4500	980	1480	1350	1450
	4500-6100	980	1480	1350	1450
RP – 3-BIS	5000-8000	1290	1480	1150	1250
RP – 4	5500-6500	980	2100	1350	1450
	6500-9400	980	2100	1750	1850
RP – 5	8000-10000	1290	2100	1750	1850
	10000-12600	1290	2100	2000	2100
RP – 6	12000-14000	1290	2500	2000	2100
	14000-15100	1290	2500	2000	2100
RP – 5-BIS	13000-16000	1580	2100	1750	1850
	16000-18000	1580	2100	1750	1850

The section type BS/BD	Air flow rate	B	H	L1	L2
	[m³/h]	[mm]			
RP – 6-BIS	16000-19000	1580	2500	1750	1850
	19000-22000	1580	2500	2000	2100
RP – 7	15100-18000	1580	2740	2000	2100
	18000-21300	1580	2740	2000	2100
RP – 7-BIS	21000-25000	1885	1370	2000	2100
	25000-29500	1885	1370	2000	2100
RP – 8	18000-25000	1885	3340	2000	2100
	25000-33700	1885	3340	2300	2400
RP – 8-BIS	35000-45000	2400	3340	2300	2400
RP – 8A-BIS	44000-55000	3000	3340	2000	2100
	55000-62000	3000	3340	2600	2700

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	Air flow rate	B	H	L1	L2
	[m³/h]	[mm]			
RP – 1	1000-3000	650	1200	1110	1210
RP – 2	2500-3200	700	1400	1110	1210
	3200-4100	700	1400	1310	1410
RP – 3	3600-4500	940	1400	1310	1410
	4500-6100	940	1400	1310	1410
RP – 4	5500-6500	940	2020	1310	1410
	6500-9400	940	2020	1710	1810

A section of lying cross-flow heat exchanger

The section dimensions in the frame structure (insulation thickness 50 mm)

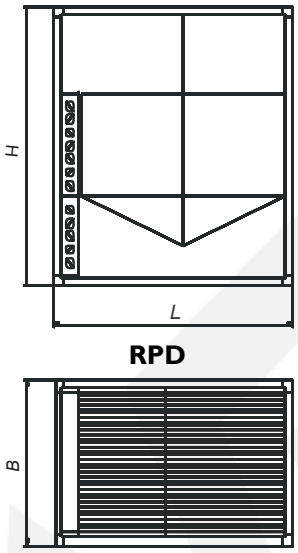
The section type BS/BD	Air flow rate	B	H	L1	L2
	[m³/h]	[mm]			
RP – 1	1000-3000	1380	640	1350	1450
RP – 2	2500-4100	1480	740	1350	1450
RP – 3	3200-6100	1960	740	1700	1800
RP – 4	3600-9400	1960	1050	1700	1800
RP – 5	8000-10000	2580	1050	2300	2400
RP – 6	12000-15100	2580	1250	2300	2400
RP – 7	15000-21300	3160	1370	2000	2100
RP – 8	20000-33700	3770	1670	2600	2700
RP – 9	25000-41000	3770	2020	2300	2400
RP – 10	35000-53000	4800	2020	3750	3850
RP – 11	55000-69000	4800	2500	3750	3850
RP – 12	60000-90000	6000	2500	3750	3850

A section of lying cross-flow heat exchanger

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

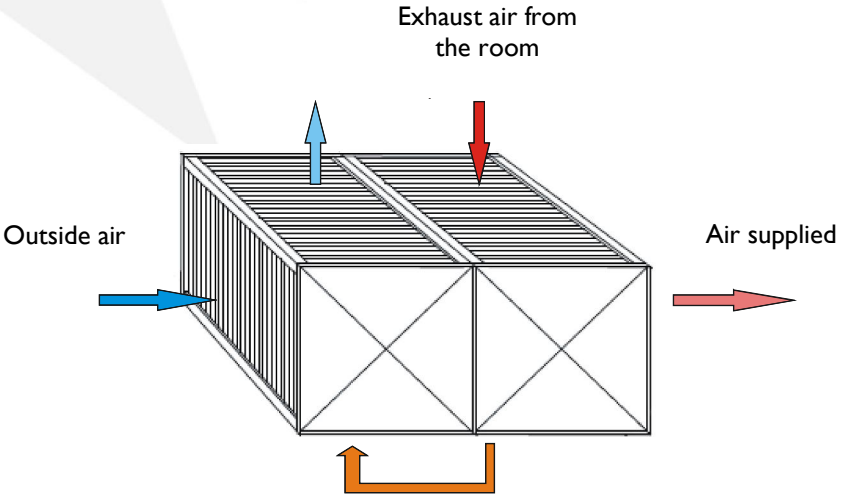
The section type BS	Air flow rate	B	H	L1	L2
	[m³/h]	[mm]			
RP – 1	1000-3000	1300	600	1310	1410
RP – 2	2500-4100	1400	700	1310	1410
RP – 3	3200-6100	1880	700	1660	1760
RP – 4	3600-9400	1880	1010	1660	1760

Double cross-flow heat exchanger



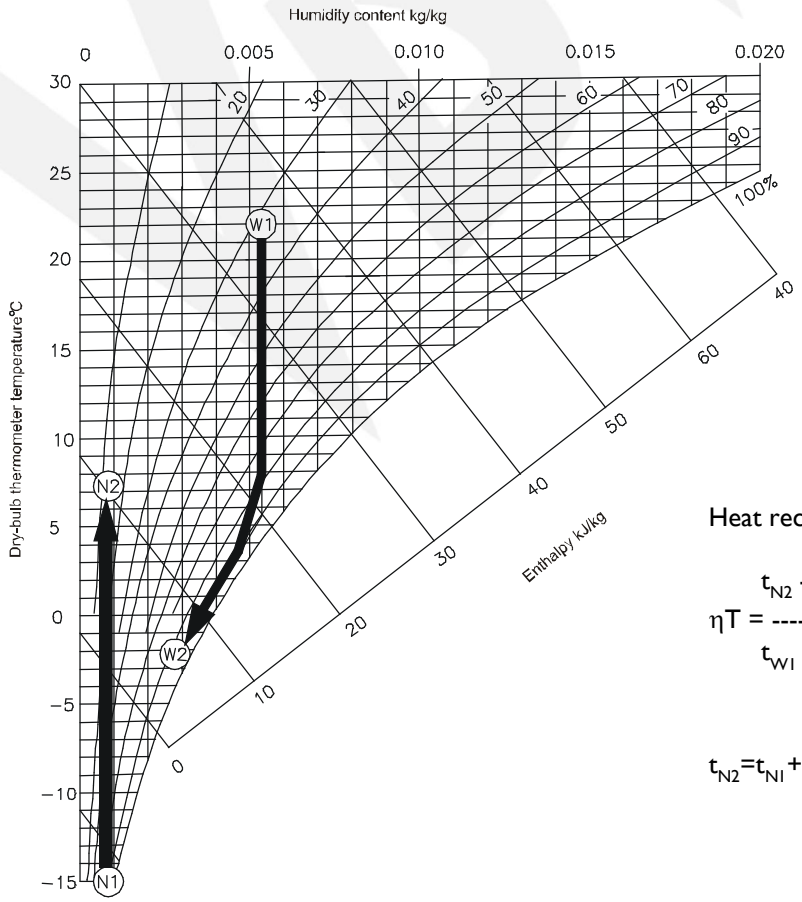
RPD

Dual cross-flow exchanger consists of two cross-flow exchangers, arranged in series. Dimensions of the heat exchanger are optimally adapted to the size the air handling unit both in terms of construction and in terms of high efficiency of heat recovery. The achieved efficiency is up to 85%. In order to enable heat exchanger use throughout the entire year, it is additionally provided with a double throttle valve, a tank for condensate and a trap (delivered separately), ensuring proper water draining in the course of air handling unit operation. The draining pipe from the water tank is delivered at the opposite side, to the service side of the unit. In the air intake part, at the inlet to the heat exchanger, there is a damper consisting of two sections: on the exchanger, and the on the by-pass. Both sections are coupled together so that at the opening of the flow through the heat exchanger, the by-pass is closed. The air flows through the by-pass when the further recovery of heat is undesirable. This occurs during summer, when the outside temperature is equal to or higher than the temperature in the hall, and heat gains are considerable; and in winter - as frost protection.



The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	Zakres wydajności	B	H	L
	[m³/h]	[mm]		
RPD – 1	1000-3000	690	1280	1300
RPD – 2	2500-3000	740	1480	1300
	3000-4000	740	1480	1500
RPD – 3	3600-4500	980	1480	1500
	4500-6100	980	1480	1800
RPD – 4	5500-7000	980	2100	1800
	7000-9000	980	2100	2300
RPD – 5	8000-10000	1290	2100	2300
	10000-12500	1290	2100	2300
RPD – 6	12000-14000	1290	2500	2700
	14000-15000	1290	2500	3300
RPD – 5-BIS	13000-15000	1580	2100	2300
	16000-17000	1580	2100	2700
RPD – 6-BIS	14000-18500	1580	2500	3300
RPD – 7	15000-20000	1580	2740	3300
RPD – 7-BIS	19000-25000	1885	3340	3300
RPD – 8	21000-27000	2400	3340	3300

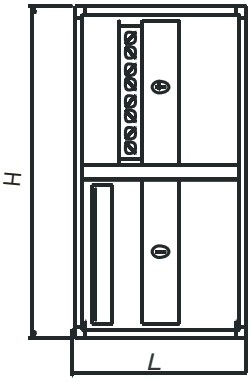


Heat recovery efficiency

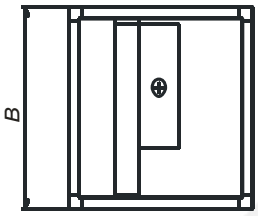
$$\eta T = \frac{t_{N2} - t_{N1}}{t_{W1} - t_{N1}}$$

$$t_{N2} = t_{N1} + \eta T \times (t_{W1} - t_{N1})$$

Tube heat exchanger



HP



The heat exchanger consists of copper tubes filled with refrigerant in liquid state and aluminium slats. The tube heat exchanger is divided into two parts.

Exhausted warm air causes vaporisation of the refrigerant in the lower part of the heat exchanger. In the upper part of the exchanger, the cold outside air causes condensation of the refrigerant vapour and condensate flow downwards under gravity. Exhausted air is cooled; the outside air is warmed up. The heat pipe is additionally equipped with a bypass damper, located inside the air handling unit on the side of the heat exchanger, a tank for condensate, a drop separator to retain water droplets taken with air, and a trap (delivered separately), ensuring proper water draining in the course of air handling unit operation. The draining pipe from the water tank is delivered at the opposite side, to the service side of the unit. By-pass is used as a frost protection and to adjust the intake air temperature. Heat recovery through the tube heat exchanger does not require input of energy from the outside. An additional advantage of the tube heat exchanger compared to the cross-flow exchanger is that the risk of frosting occurs at lower temperatures than in case of the cross-flow exchanger.

The degree of achieved efficiency is 65%.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HP – MINI	640	980	700
HP – 1	690	1200	700
HP – 2	740	1400	700
HP – 3	980	1400	700
HP – 4	980	2020	700

The section dimensions in the frame structure (insulation thickness 50 mm)

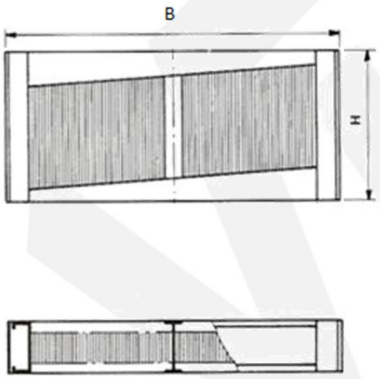
The section type BS/BD	B	H	L
	[mm]		
HP – 1	690	1280	800
HP – 2	740	1480	850
HP – 3	980	1480	950
HP – 3 – BIS	1290	1280	1050
HP – 4	980	2100	950
HP – 5	1290	2100	1050
HP – 6	1290	2500	1050
HP – 5 – BIS	1580	2100	1150

The section type BS/BD	B	H	L
	[mm]		
HP – 6 – BIS	1580	2500	1200
HP – 7	1580	2740	1200
HP – 7 – BIS	1885	2740	1350
HP – 8	1885	3340	1350
HP – 8 – BIS	2400	3340	1600
HP – 8A – BIS	3000	3340	1900

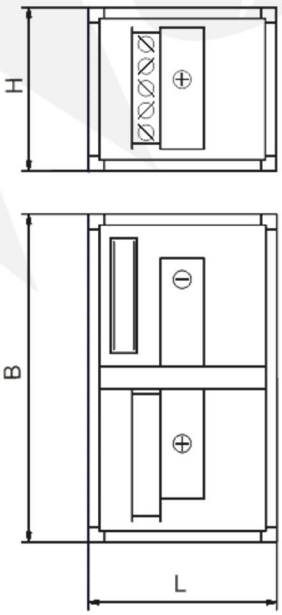
The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
HP – 1	650	1200	760
HP – 2	700	1400	810
HP – 3	940	1400	910
HP – 4	940	2020	910

Lying heat pipe.



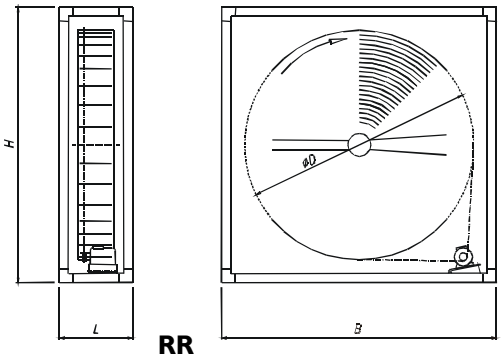
HP



The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
HP – 1	1380	640	800
HP – 2	1480	740	850
HP – 3	1960	740	950
HP – 4	1960	1050	950
HP – 5	2580	1050	1050
HP – 6	2580	1250	1050
HP – 7	3160	1370	1200
HP – 8	3770	1670	1350

Rotating heat exchanger



RR

This section consists of a rotor, a transmission, a driving belt and an electric motor. The rotor of a rotating heat exchanger is made of a thin aluminium strip with folds, which is reeled onto a cylinder, making tiny channels. The strip forms an accumulation structure of the heat exchanger, which allows storing considerable energy volumes. Fresh and exhausted air streams, while flowing through the heat exchanger channels, either give away or take over the heat energy. The stream of the exhausted air flows through a half of the rotor housing, making the rotor turn slowly. The stream of the supplied air flows through the other part of the housing, in the opposite direction to the sucked air. The supplied air takes over the heat of the rotating, warm rotor. In order to increase the effectiveness of latent heat recovery, the rotor is covered with a hygroscopic coating..

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L	D
	[mm]			
RR – MINI	850	980	400	650
RR – 1	1150	1200	400	950
RR – 2	1300	1400	400	1100
RR – 3	1400	1400	400	1200
RR – 4	1600	2020	400	1400
	1700	2020	400	1500
	1800	2020	400	1600

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L	D max
	[mm]			
RR – 1	1150	1280	500	950
RR – 2	1400	1480	500	1200
RR – 3	1400	1480	500	1200
RR – 3 – BIS	1400	1480	500	1200
RR – 4	2000	2100	500	1800
RR – 5	2000	2100	500	1800
RR – 6	2400	2500	500	2200
RR – 5 – BIS	2000	2100	500	1800
RR – 6 – BIS	2400	2500	500	2200
RR – 7	2700	2740	500	2500
RR – 7 – BIS	2600	2740	500	2400
RR – 8	2800	3340	500	2600

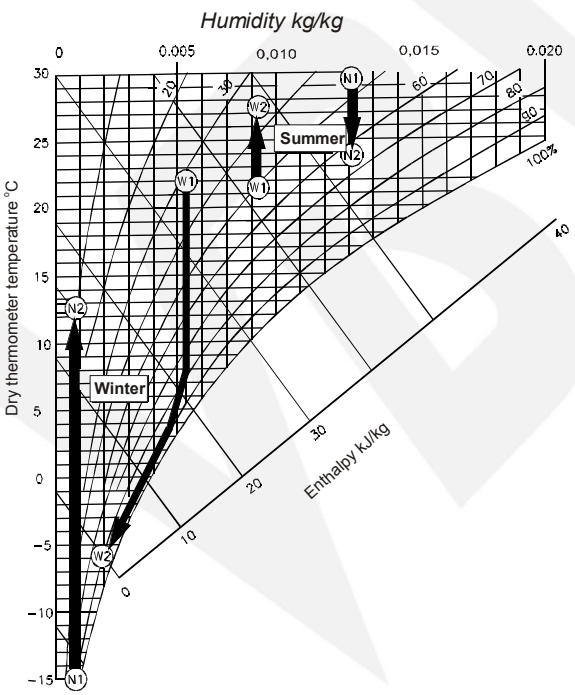
The section type BS/BD	B	H	L	D max
	[mm]			
RR – 8 – BIS	2800	3340	550	2600
RR – 8A – BIS	3100	3340	550	2900

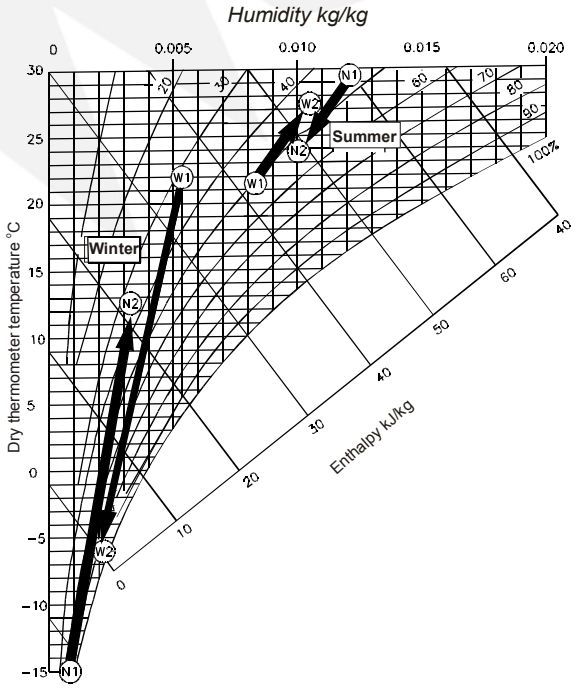
Rotating heat exchangers with diameters above 2900 mm are individually selected by the manufacturer, following the parameters provided by the ordering party.

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L	D max
	[mm]			
RR – 1	1110	1200	460	950
RR – 2	1360	1400	460	1200
RR – 3	1360	1400	460	1200
RR – 4	1960	2020	460	1800

The process of air exchange in the diagram i-x

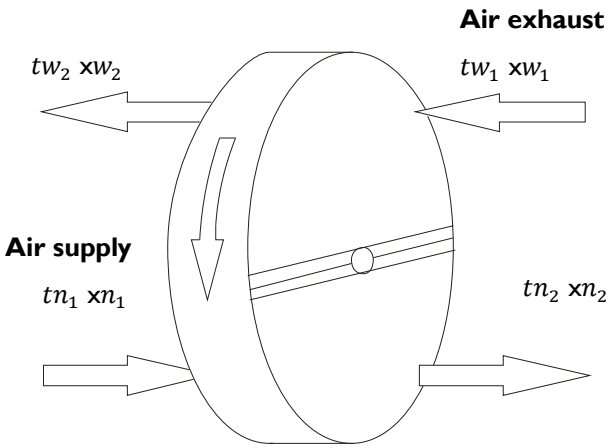




Non-hygroscopic heat exchanger

Hygroscopic heat exchanger

tN1 - outdoor air temperature
tN2 - temperature of supplied air behind the heat exchanger (after heating)
tW1 - temperature of the air sucked from room environment
xN1 - outdoor air humidity
xN2 - humidity of supplied air behind the heat exchanger
xW1 - humidity of the air sucked from room environment



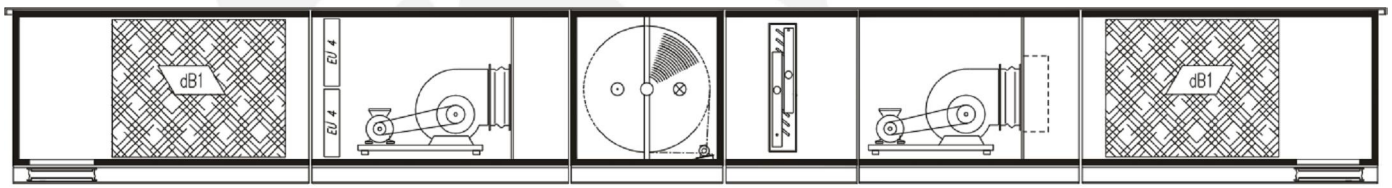
Heat recovery efficiency

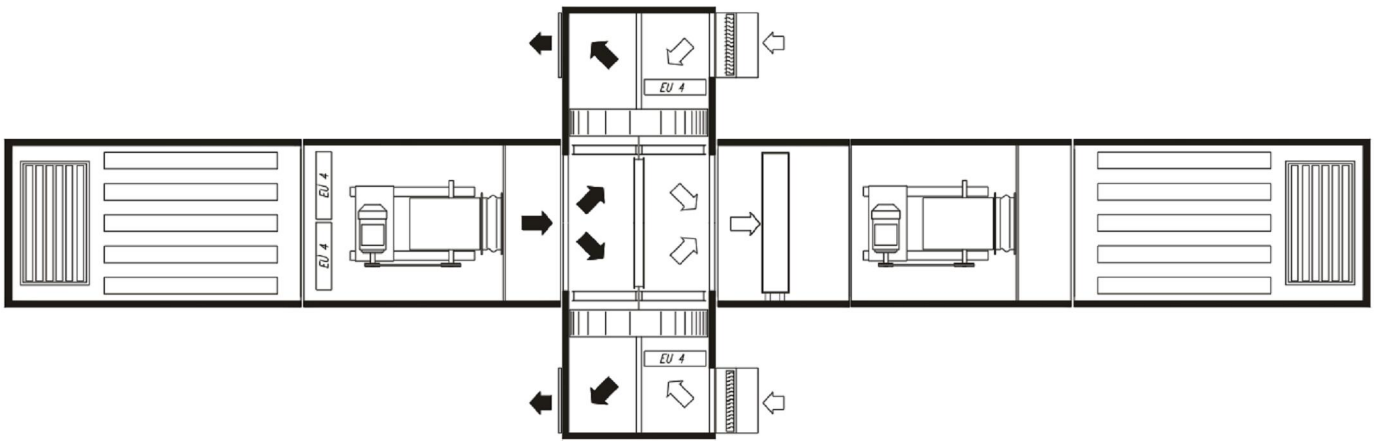
$$\eta_T = \frac{t_{N2} - t_{N1}}{t_{W1} - t_{N1}} \qquad t_{N2} = t_{N1} + \eta_T \times (t_{W1} - t_{N1})$$

Moisture recovery effectiveness

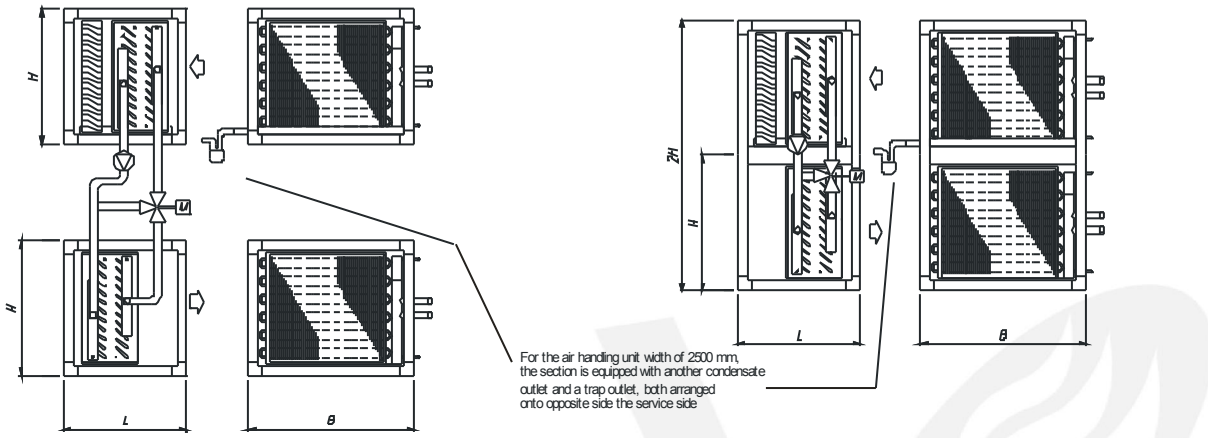
$$\eta_X = \frac{x_{N2} - x_{N1}}{x_{W1} - x_{N1}} \qquad x_{N2} = x_{N1} + \eta_X \times (x_{W1} - x_{N1})$$

An example of air handling unit with two rotating heat exchangers





Heat recovery system with intermediate medium



RCD

The system of heat recovery using intermediate medium consists of two tubular-lamellar heat exchangers. The heat exchanger, placed in the stream of the supplied air, plays the role of a preliminary heater transferring heat from an intermediate medium out into the air. The heat exchanger placed in the stream of exhausted air takes over heat from the air and transfers it to the intermediate medium. The intermediate medium (water with a small addition of ethylene or propylene glycol) circulates in the pipelines connecting both heat exchangers. The outlet section consists of a heat exchanger (cooler), a condensate tank, a droplet separator to stop water droplet uptake with air flow, and a trap.

The possibility to separate the supply and exhaust parts is the advantage of this type of heat recovery.

The specified section length applies to a maximum 8-row exchanger.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

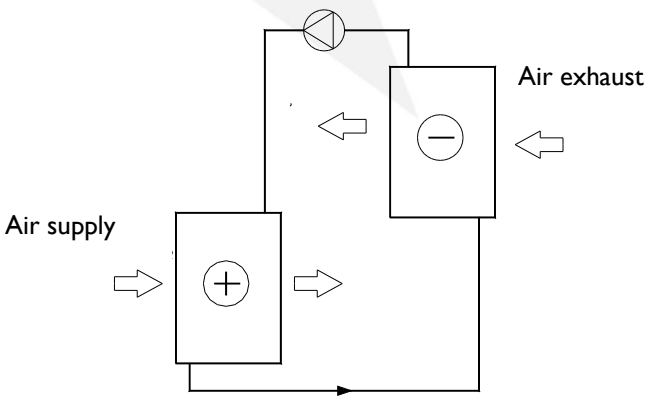
The section type BS/BD	B	2H	L
	[mm]		
RCD – MINI	640	980	600
RCD – 1	690	1200	600
RCD – 2	740	1400	600
RCD – 3	980	1400	600
RCD – 4	980	2020	600

The specified section length applies to a maximum 8-row exchanger.
The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
RCD – 1	690	640	650
RCD – 2	740	740	650
RCD – 3	980	740	650
RCD – 3 – BIS	1290	740	650
RCD – 4	980	1050	650
RCD – 5	1290	1050	650
RCD – 6	1290	1250	700
RCD – 5 – BIS	1580	1050	650
RCD – 6 – BIS	1580	1250	700
RCD – 7	1580	1370	700
RCD – 7 – BIS	1885	1370	700
RCD – 8	1885	1670	700
RCD – 9	1885	2020	700
RCD – 8 – BIS	2400	1670	700
RCD – 10	2400	2020	750
RCD – 8A – BIS	3000	1670	750
RCD – 11	2400	2500	900
RCD – 10 – BIS	3000	2020	750
RCD – 12	3000	2500	950

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L
	[mm]		
RCD – 1	650	600	610
RCD – 2	700	700	610
RCD – 3	940	700	610
RCD – 4	940	1010	610



Heat recovery efficiency

$$h_T = \frac{t_{N2} - t_{N1}}{t_{N2} - t_{n1}}$$

$$t_{N2} = t_{N1} + h_T \times (t_{W1} - t_{W2})$$

t_{N1} – outdoor air temperature

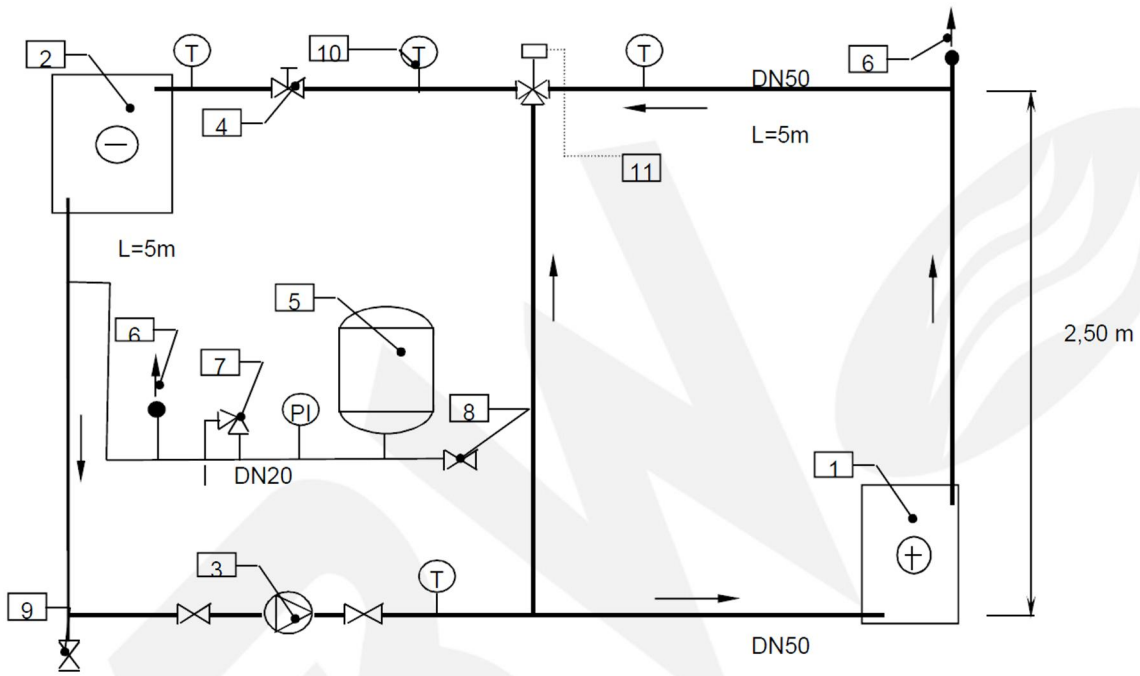
t_{N2} – temperature of supplied air behind the heat exchanger (after heating)

t_{W1} – temperature of the air sucked from room environment

The volume of intermediate medium (ethylene glycol), depending on outdoor air temperatures:

Outdoor air temperature [°C]	-5	-10	-15	-20	-25
Glycol weight content [%]	20	25	30	35	40

Diagram of an exemplary glycol heat recovery system



1. Heater
2. Cooler
3. Circulating pump
4. Compensating valve
5. Membrane expansion vessel
6. Automatic venting system
7. Safety valve
8. Valve with an installation filling pipe
9. Draining valve with a union piece for a hose
10. Clip-on temperature sensor
11. Control valve with a servo

PI - Pressure gauge
T - Disk thermometer

* The delivery does not include pipes, fittings, insulation, cut-off valves at the pump, glycol or assembly works.

Refrigerating gear in air handling unit

Referring to their functions in air processing, the refrigerating units are available as:

- cooling systems (cooling of supplied air)
- heat pump systems (heating of supplied air)
- reversing systems (cooling or heating of supplied air)

The refrigerating units are designed to use Freon R407C as the refrigerant (other refrigerant types at the Customer's request).

Depending on the required cooling performance, the set parameters and the design functionality, a series of types of standard refrigerating units is available. The non-standard units are selected by VBW Engineering, taking into account the parameters provided by the ordering party.

Protection against frosting and the control of refrigerating unit performance are achieved by means of pressure controls. The customer may also order a vaporising pressure control or a circulation capacity control.

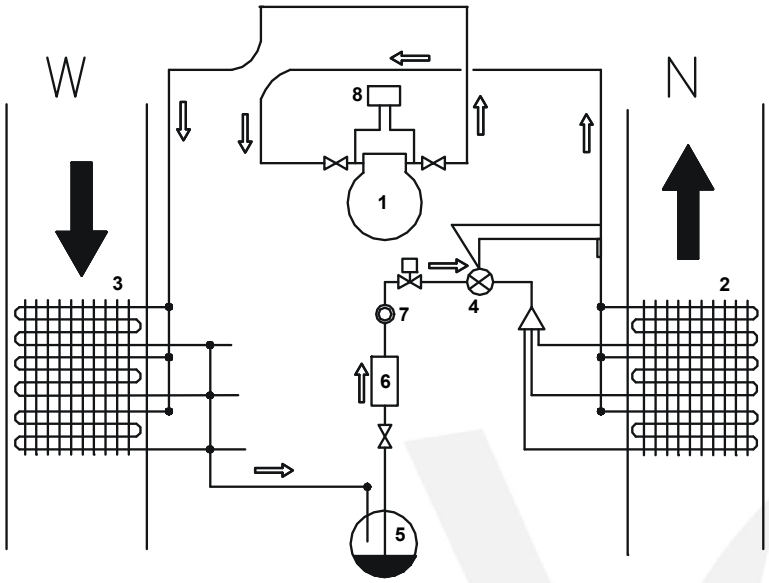
Descriptions of refrigerating units with reference to their functions

Description of refrigerating system

The cooling assembly consists of the following:

- a hermetic compressor (or compressors): a screw or piston compressor
- an evaporator
- an air-cooled condenser of the coolant
- a coolant tank with a safety valve
- automatic control and measurement system and fittings plus copper pipelines that connect components together.

A refrigerating unit, working in the cooling mode, is used for cooling of the supplied air. In the vaporiser, the vaporised freon takes over the heat from the supplied air, cooling it down. The refrigerant is sucked by a compressor, which pumps it into the condenser, where it is condensed. In the course of the condensation process, the heat is given away to the exhausted or outdoor air. The condensed refrigerant flows to the Freon reservoir and then through a steam trap, a cut-off solenoid valve and an expansion valve to the cooler, where it is vaporised again. This circulation cycle is repeated.



Symbols:

1. Compressor
2. Air-cooled condenser
3. Evaporator
4. Thermostatic expansion valve
5. Freon tank
6. Freon steam trap
7. Sight-glass with an indicator of freon humidity
8. Pressure controls that protect the compressor

Heat pump

The cooling assembly of the heat pump consists of the following:

- a hermetic compressor (or compressors): a screw or piston compressor
- an evaporator
- an air-cooled condenser of the coolant
- a coolant tank with a safety valve
- automatic control and measurement system and fittings plus copper pipelines that connect components together.

The cooling system with additional components may also comprise:

- a water-cooled condenser for heating swimming pool water up
- a water-cooled condenser for heating tap water up.

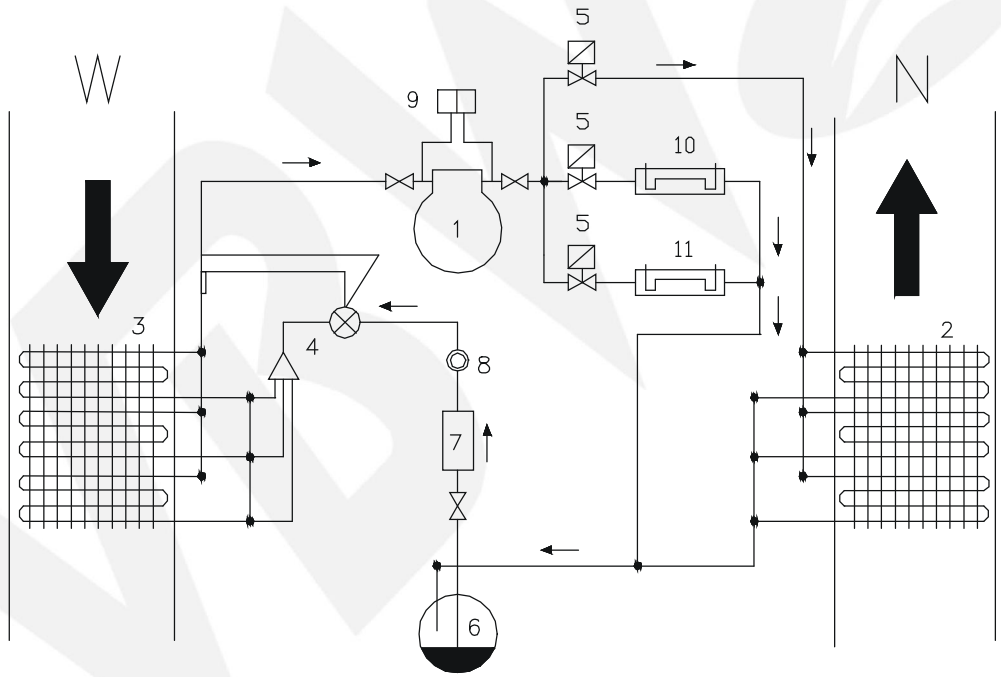
The heat pump operates as a cooling device and it is used primarily to recover heat. Thanks to the implementation of the heat pump, it is possible to recover large amounts of sensible and latent heat, contained in warm and humid exhaust air.

In the evaporator, evaporating freon receives heat from the exhaust air. This heat – increased by the energy used to drive the compressor – is transferred to the supply air in the air-cooled evaporator or to the swimming-pool water or tap water in the water-cooled evaporator.

In order to ensure the optimum use of the heat pump operating in the dehumidification mode, only a part of the recirculated air flows through the evaporator. The air is cooled down and dried. Then the air is heated up in the condenser of the heat pump.

Thanks to the implementation of a heat pump as the second stage of heat recovery behind the recuperator, it is possible to use a compressor with lower power, which ensures the same energy performance and the same dehumidification efficiency, while the demand for electric energy to power the compressor drive is reduced, compared to a single-stage heat recovery process realized only by means of a heat pump.

Heat pump assembly fitted with additional condensers for heating up swimming-pool water and hot tap water.



Symbols:

1 - Compressor
2 - Air-cooled condenser (cooled with supply air)
3 - Evaporator (cooled with exhaust air)
4 - Thermostatic expansion valve
5 - Cut-off solenoid valves
6 - Freon tank
7 - Freon steam trap
8 - Sight-glass with an indicator of freon humidity
9 - Pressure controls that protect the compressor
10 - Water-cooled condenser that heats swimming-pool water up (additional equipment)
11 - Water-cooled condenser for heating tap water up (additional equipment)

Reversing system

The reversible assembly allows the device to realize the function of both a heat pump and a cooling system.

The reversible assembly consist of:

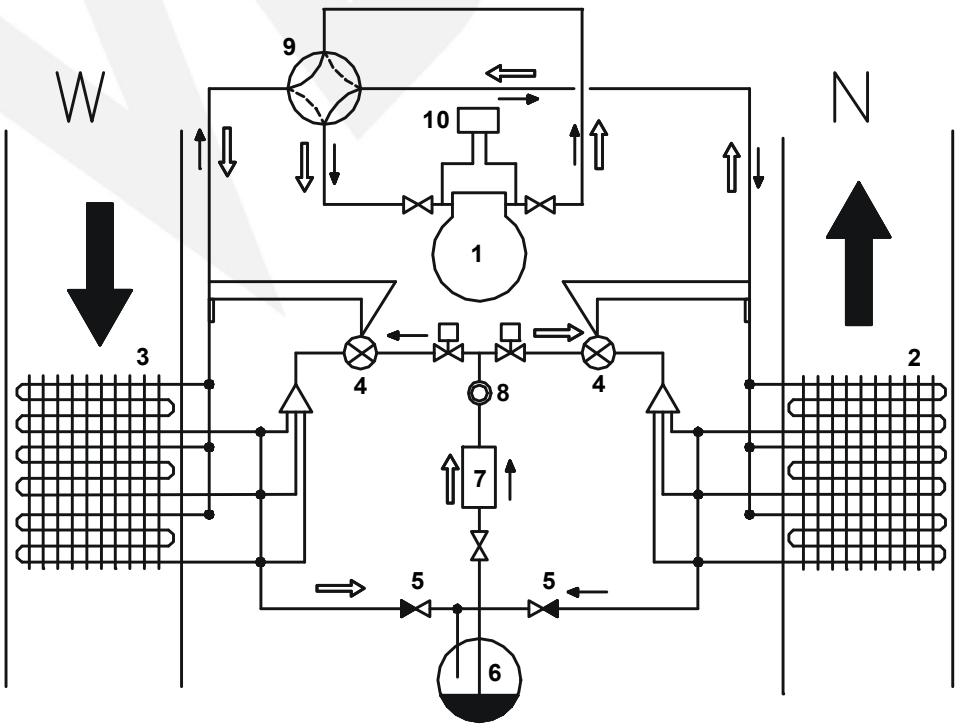
- heat exchangers of the cooling system (evaporator/condenser)
- a hermetic compressor (or compressors): a screw or piston compressor
- a coolant tank with a safety valve
- automatic control and measurement system and fittings plus copper pipelines that connect components together

The reversible unit of the heat pump is a complete cooling device, designed to cool and dehumidify the supply air in the summer and heat the supply air in the winter.

The operation of the reversible heat pump is based on combining the operation of the cooling section and the heat pump section. During summer time, the exchanger on the supply air line functions as a cooler and the one on the exhaust air line - as a heater. During winter time, the exchanger on the supply air line functions as a heater and the one on the exhaust air line - as a cooler. This is possible thanks to the implementation of a four-way solenoid valve and to appropriate arrangement of pipelines, as well as appropriate construction of heat exchanger collector.

The fittings of the reversible heat pump unit are analogous to the fittings of a freon cooling unit. Additionally, it is fitted with a four-way solenoid valve that switches from the cooling mode of operation to the heating mode of operation.

A diagram of the reversible assembly is presented below.



Symbols:

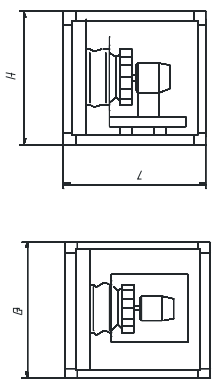
1 - Compressor
2 - Supply-air heat exchanger
3 - Exhaust-air heat exchanger
4 - Thermostatic expansion valve
5 - Non-return valve
6 - Freon tank
7 - Steam trap
8 - Coolant humidity sensor
9 - Four-way solenoid valve
10 - Low/high pressure control that protects the compressor

Operation of refrigerating units.

Refrigerating units are automatic and thus do not require continuous monitoring. Operation of the refrigerating unit is limited to the control of the refrigerant moisturising in the installation and the oil level checking in the compressor. For this purpose, it is necessary to switch the air handling unit with a switch in the control panel and then open the revision covers in the heat pump section. The refrigerant moisture level is indicated by a humidity gauge installed behind the dehydrator. Green colour in the sight glass means no water content in the refrigerant. Yellow colour means water presence in the refrigerant, which is associated with calling a service to carry out technical inspection, repair any leaks or replace the dehydrator, as well as top the refrigerant in the installation, if necessary. The oil level in the compressor may be checked in the sight-glass (if installed) on the compressor body. Proper oil level corresponds to 1/3 to 2/3 of the sight glass diameter. If during normal work the compressor is switched off by the emergency high/low pressure control, which is signalled by an alarm lamp on the control panel, service should be called to trouble shoot and repair the cause of pressure control activation.

Fans

Axial-radial fan unit.



WOP

The axial radial fan unit comprises the following axial radial fan mounted by means of a hub mounted on motor shaft, controlled by an inverter, frame. The fan outlet is connected to the housing of the air handling unit by means of a flexible plastic connection, and the whole assembly is mounted on the floor of the air handling unit by means of special cushioning chosen individually to match operating parameters. An electric motor supplied with voltage of 3~380 V (50 Hz) of IP54 protection class is used.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L
	[mm]		
WOP– MINI	640	490	700
WOP– 1	690	600	850
WOP– 2	740	700	850
WOP– 3	980	700	950
WOP– 4	980	1010	1150

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L**	D***
	[mm]			
WOP – 1	690	640	800/800	280/310
WOP – 2	740	740	800/1000	310/400
WOP – 3	980	740	850/1000	350/400
WOP – 3 - BIS*	1290	740	1000	400
WOP – 4	980	1050	1050/1350	450/630
WOP – 5	1290	1050	1250/1350	500/630
WOP – 6	1290	1250	1250/1350	560/630
WOP – 5 – BIS*	1580	1050	1250/1350	500/630
WOP – 6 – BIS*	1580	1250	1350	630
WOP – 7	1580	1370	1550	710
WOP – 7 – BIS*	1885	1370	1550/1700	710/800
WOP – 8	1885	1670	900	1950
WOP – 9	1885	2020	2200	1000
WOP – 8 – BIS*	2400	1670	2200	1000
WOP – 10	2400	2020	2600	1100
WOP – 8A – BIS*	3000	1670	2600	1100
WOP – 11	2400	2500	2600	1100
WOP – 10 – BIS*	3000	2020	2600	1100
WOP – 12	3000	2500	2600	1100

* Double fan units are also used in BIS air handling units.

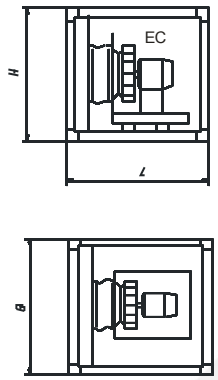
** The section length depends on fan diameter

*** Fan diameter

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L**	D***
	[mm]			
WOP – 1	650	600	760/760	280/310
WOP – 2	700	700	760/960	310/400
WOP – 3	940	700	810/960	350/400
WOP – 4	940	1010	1010/1310	450/630

Fans with electronically commuted motors.



WEC

A fan unit with electronically commutated motors consists of an axial-radial fan and an electronically commutated motor. An EC motor is a synchronous, anti-slip motor with a permanent magnet rotor mounted on a rotating housing, encompassing a set of coils. In order to induce motor rotation at the required speed, the electronic commutating system has to switch the current in the stator coils to generate rotating magnetic field, thus activating the rotor magnet field. The actual shaft rotation angle is monitored by a special sensor and transmitted to the control system. The control system acts in a similar way as an inverter controlling the current in the stator coils and, consequently, the stator magnetic field. The control signal may come from an incorporated controller or from an external control system.

An integrated electronic system in the EC motors ensures infinitely variable rotation speed control, while maintaining high efficiency levels. Fans with EC motors are characterised by very high efficiency values through the entire performance, often exceeding the value of 90%. It is estimated that, depending on control type, EC fans consume 25-50% less power than standard AC motors.

The section dimensions in the frame structure (insulation thickness 50 mm)

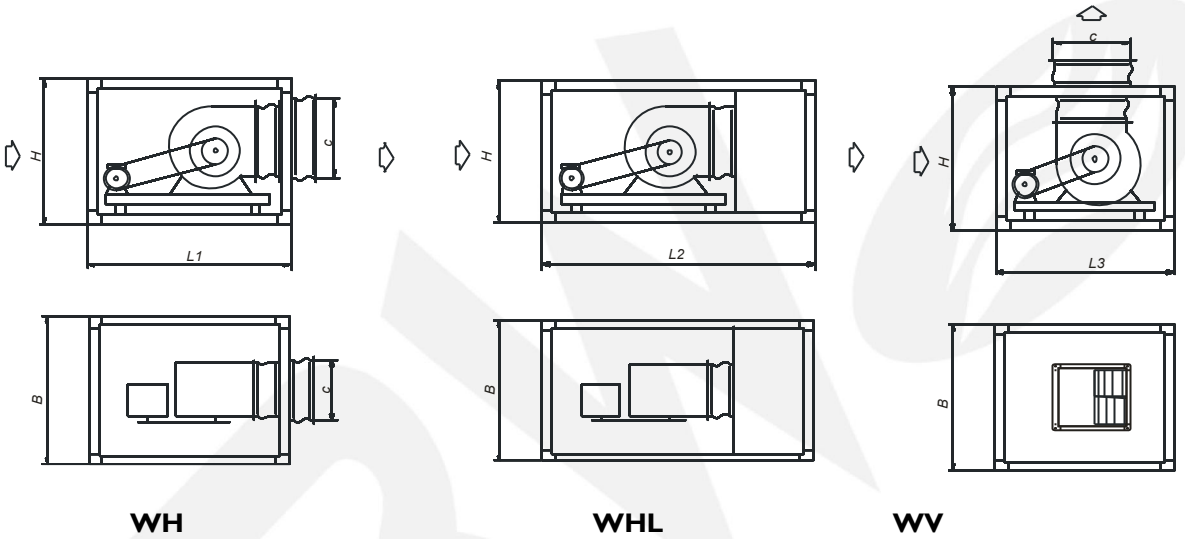
The section type BS/BD	B	H	L*	D**
	[mm]			
WEC – 1	690	640	700/750	250/280
WEC – 2	740	740	800	310
WEC – 3	980	740	800/850	310/350
WEC – 3 – BIS	1290	740	850/900	350/400
WEC – 4	980	1050	900/950	400/450
WEC – 5	1290	1050	950/1100	450/500
WEC – 6	1290	1250	1100	500/560
WEC – 5 – BIS	1580	1050	1100	500
WEC – 6 – BIS	1580	1250	1100/1350	560/630
WEC – 7	1580	1370	1350	630

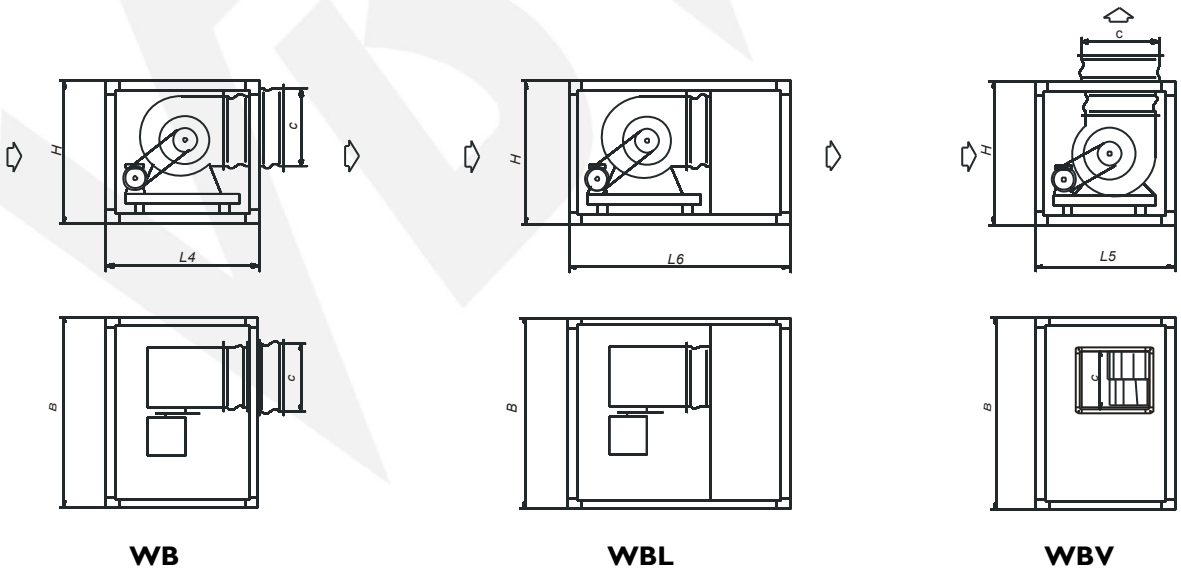
* The section length depends on fan diameter
** Fan diameter

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L*	D**
	[mm]			
WEC – 1	650	600	660/710	250/280
WEC – 2	700	700	760	310
WEC – 3	940	700	760/810	310/350
WEC – 4	940	1010	860/910	400/450

Radial fans





The radial fan unit comprises the following:

- fan,
- electric motor,
- belt drive,
- frame

The fan outlet is connected to the housing of the air handling unit by means of a flexible plastic connection, and the whole assembly is mounted on the floor of the air handling unit by means of special cushioning chosen individually to match operating parameters. An electric motor supplied with voltage of 3~380 V (50 Hz) of IP54 protection class is used. The fan bearings are self-lubricating and guarantee 40,000 hours of service life at maximum speed. With regard to the standard configurations, single-speed or inverter-controlled motors are used. Fan performance is infinitely variably controlled by a frequency converter and a belt transmission is used for a fan drive. The type and the number of belts as well as the diameters of belt pulleys are selected by the manufacturer, properly to the operation parameters. The fans, mounted on the air handling units, are available in two versions: with the blades bent outwards and the blades bent inwards.

The fan sections are equipped with an emergency switch (BD units as standard), through which the supply installation is to be connected. The emergency switch cuts off power supply for the periods of maintenance and repairs, regardless of the switch on the control panel. The emergency switch is located in the vision field of the fan operator.

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1	L2	L3
	[mm]				
WH,WHL,WV– MINI	640	490	900	1100	900
WH,WHL,WV – 1	690	600	950	1150	950
WH,WHL,WV – 2	740	700	950	1150	950
WH,WHL,WV – 3	980	700	1000	1200	-
WH,WHL,WV – 4	980	1010	1100	1350	-

The section dimensions in the frame structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1*/L4*	L2*/L6*	L3*/L5*	c
	[mm]					
WH,WHL,WV – 1	690	640	800	1050	750	250
WH,WHL,WV – 2	740	740	900	1150	850	315
WH,WHL,WV – 3	980	740	1000	1350	900	400
WH,WHL,WV – 3 – BIS	1290	740	900	1450	800	400
WH,WHL,WV – 4	980	1050	1150	1500	1100	500
WH,WHL,WV – 5	1290	1050	1250	1750	1150	500
WH,WHL,WV – 6	1290	1250	1500	1950	1550	630
WH,WHL,WV – 5 – BIS	1580	1050	1150	1800	1150	630
WH,WHL,WV – 6 – BIS	1580	1250	1200	1850	1300	800
WH,WHL,WV – 7	1580	1370	1650	2250	1700	800
WH,WHL,WV – 7 – BIS	1885	1370	1350	2100	1450	800
WH,WHL,WV – 8	1885	1670	2050	2750	2150	800
WH,WHL,WV – 9	1885	2020	2400	3200	2500	1000
WH,WHL,WV – 8 – BIS	2400	1670	1800	2850	1950	1000
WH,WHL,WV – 10	2400	2020	2550	3450	2650	1000
WH,WHL,WV – 8A – BIS	3000	1670	1900	3250	2050	1000

The section type BS/BD	B	H	L1*/L4*	L2*/L6*	L3*/L5*	C
	[mm]					
WH,WHL,WV – 11	2400	2500	2700	3700	2800	1250
WH,WHL,WV – 10 – BIS	3000	2020	2350	3700	2300	1250
WH,WHL,WV – 12	3000	2500	2800	3750	3050	1500

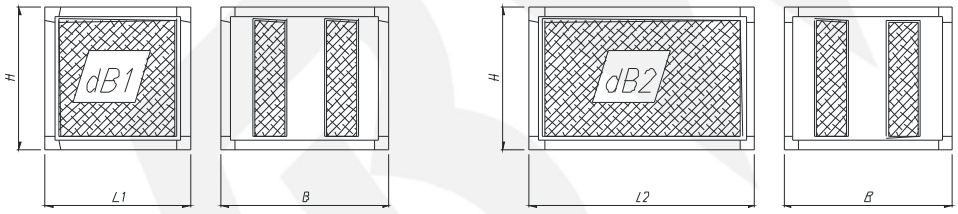
* The maximum fan section length for the largest fan diameter and motor size

Boxer WB, WBL and WBV type sections are applied only in BIS air handling units, where a special arrangement of the motor when compared with the fan allows to reduce the length of the fan section.

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L1	L2	L3	c
	[mm]					
WH,WHL,WV – 1	650	600	760	1010	710	250
WH,WHL,WV – 2	700	700	860	1110	810	315
WH,WHL,WV – 3	940	700	960	1310	860	400
WH,WHL,WV – 4	940	1010	1110	1460	1060	500

Suppressors



DB1, DB2

Noise suppressors consist of a set of slotted levers, filled with mineral wool, protected with glass fibre. Noise suppressors are produced in two standard lengths for each air conditioning size..

The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

The section type BS/BD	B	H	L1	L2
	[mm]			
DB1,DB2– MINI	640	490	1000	1300
DB1,DB2 – 1	690	600	1000	1300
DB1,DB2 – 2	740	700	1000	1300
DB1,DB2 – 3	980	700	1000	1300
DB1,DB2 – 4	980	1010	1000	1300

The section dimensions in the frame structure (insulation thickness 50 mm)

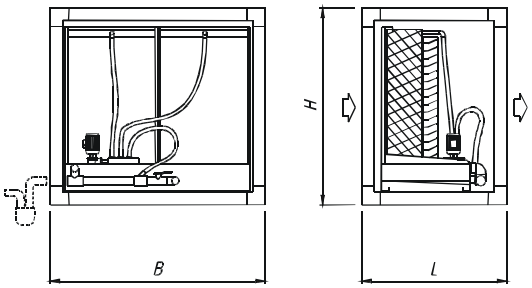
The section type BS/BD	B	H	L1	L2
	[mm]			
DB – 1	690	640	1000	1300
DB – 2	740	740	1000	1300
DB – 3	980	740	1000	1300
DB – 3 – BIS	1290	740	1000	1300
DB – 4	980	1050	1000	1300
DB – 5	1290	1050	1000	1300
DB – 6	1290	1250	1000	1300
DB – 5 – BIS	1580	1050	1000	1300
DB – 6 – BIS	1580	1250	1000	1300
DB – 7	1580	1370	1000	1300
DB – 7 – BIS	1885	1370	1000	1300
DB – 8	1885	1670	1000	1300
DB – 9	1885	2020	1100	1450
DB – 8 – BIS	2400	1670	1100	1450
DB – 10	2400	2020	1100	1450
DB – 8A – BIS	3000	1670	1650	2150
DB – 11	2400	2500	1400	1900
DB – 10 – BIS	3000	2020	1650	2150
DB – 12	3000	2500	1650	2150

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS	B	H	L1	L2
	[mm]			
DB – 1	650	600	960	1260
DB – 2	700	700	960	1260
DB – 3	940	700	960	1260
DB – 4	940	1010	960	1260

Humidifiers

Water humidifier



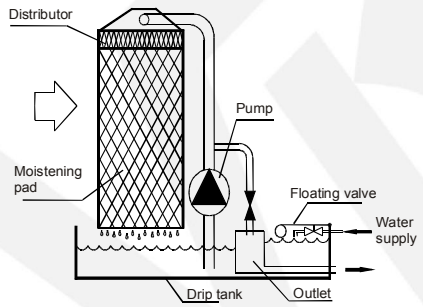
MW

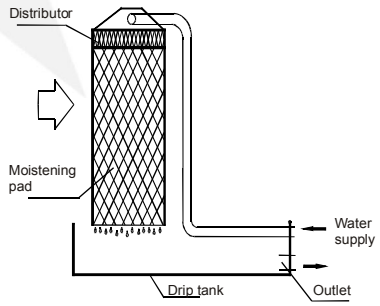
MWC recirculation system

Water humidifier consists of a GLASdek humidifying pad, a drop separator preventing drop uptake, a water distributor, a water pump, lines and a floating valve to maintain constant water level in the tank. All the metal elements are made of stainless steel. The humidifier structure allows its quick and easy removal for cleaning or maintenance.

Direct MWD system

The humidifier is designed the same way as for the recirculation system; however, it does not have either a water pump or a floating valve. The water supply is provided from a pipeline with mains water pressure.





Recirculation system – the principle of operation

The floating valve, installed on the water inlet, maintains constant water level in the tank. The water pump, pumping water from the tank, delivers it to the distributor. Water flows down over the humidifying pad. The air, which flows horizontally onto the GLASdek pad, is humidified by direct contact with the wet surface. Humidity is picked up by the air via water vaporising. No water spraying takes place. Water excess flows down to the tank. The system consumes only necessary water volumes.

Direct system – the principle of operation

The water supplied from water mains is delivered to the distributor. Water flows down over the humidifying pad. The air, which flows horizontally onto the GLASdek pad, is humidified by direct contact with the wet surface. Humidity is picked up by the air via water vaporising.

No water spraying takes place. Water excess flows down through an overflow pipe. The system is useful when water contains high concentrations of mineral components and salts.

Available configurations

MW-85 humidifier with approximately 85 % performance

MW-95 humidifier with approximately 95 % performance

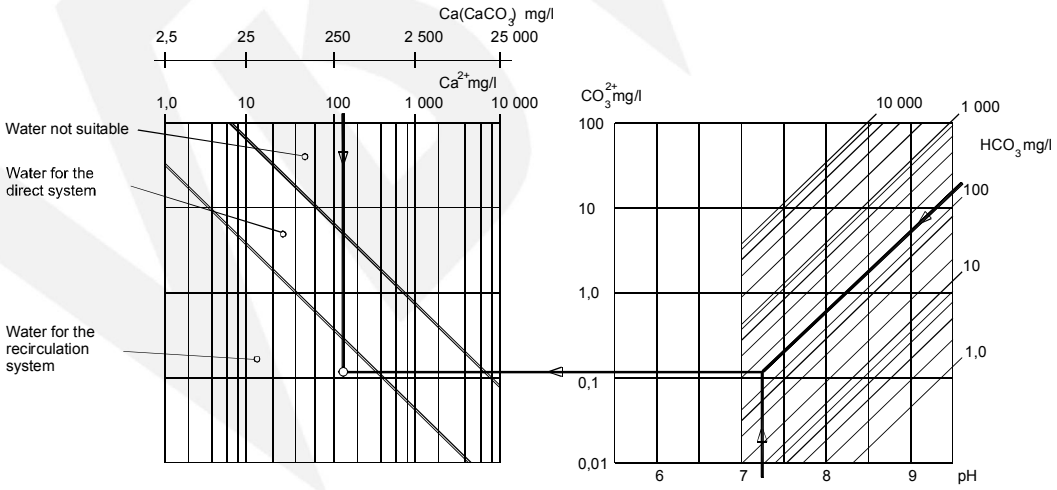
Installation

Depending on air humidifying demands, install a cut-off valve on the water supply line, a filter with gradation below 500 mm, and a solenoid valve closing and opening water supply.

A trap should be mounted on the overflow connection pipe.

Plug the water pump motor into 3~380 V power mains.

The mains water is used to supply the humidifier. Recirculation or direct humidifying is applied, depending on the content of salts and minerals in the water. The curve below determines which system is appropriate for the supplied water.



The section dimensions in the frame structure (insulation thickness 50 mm)

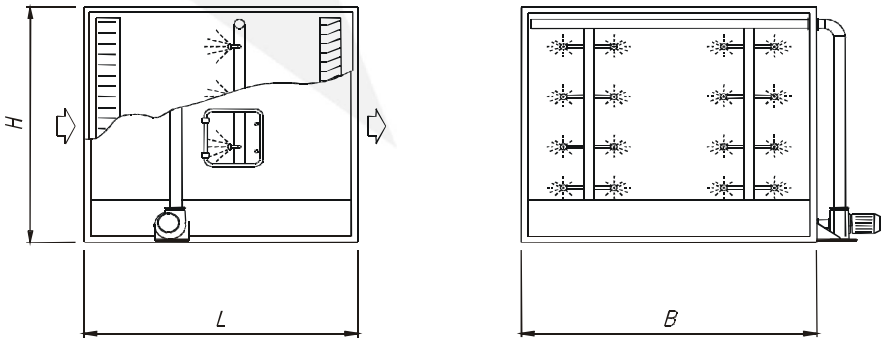
The section type BS/BD	B	H	L1
	[mm]		
MW-85, MW-95 – 1	690	640	1250
MW-85, MW-95 – 2	740	740	1250
MW-85, MW-95 – 3	980	740	1250
MW-85, MW-95 – 3 – BIS	1290	740	1250
MW-85, MW-95 – 4	980	1050	1250

The section type BS/BD	B	H	L1
	[mm]		
MW-85, MW-95 – 5	1290	1050	1250
MW-85, MW-95 – 6	1290	1370	1250
MW-85, MW-95 – 5 – BIS	1580	1370	1250
MW-85, MW-95 – 6 – BIS	1580	1370	1250
MW-85, MW-95 – 7	1580	1370	1250
MW-85, MW-95 – 7 – BIS	1885	1370	1250
MW-85, MW-95 – 8	1885	1670	1250
MW-85, MW-95 – 9	1885	2020	1250
MW-85, MW-95 – 8 – BIS	2400	1670	1250
MW-85, MW-95 – 10	2400	2020	1250
MW-85, MW-95 – 8A – BIS	3000	1670	1250
MW-85, MW-95 – 11	2400	2500	1250
MW-85, MW-95 – 10 – BIS	3000	2020	1250
MW-85, MW-95 – 12	3000	2500	1250

The section dimensions in the frame structure (insulation thickness 25 mm, only the BS units)

The section type BS/BD	B	H	L
	[mm]		
MW-85, MW-95 – 1	650	600	1210
MW-85, MW-95 – 2	700	700	1210
MW-85, MW-95 – 3	940	700	1210
MW-85, MW-95 – 4	940	1010	1210

Water humidifier – sprinkling nozzle chamber



A sprinkling nozzle chamber consists of an air distributor on the inlet, water distribution pipes, a set of water nozzles, a droplet separator to protect from droplet uptake, a water pump, water lines and a floating valve to maintain constant water level in the tank. All the metal elements are made of corrosion resistant materials.

The chamber casing has got a revision window, which may be opened. The sprinkling nozzle chamber is a very robust structure and is characterised by high humidifying performance.

Available versions

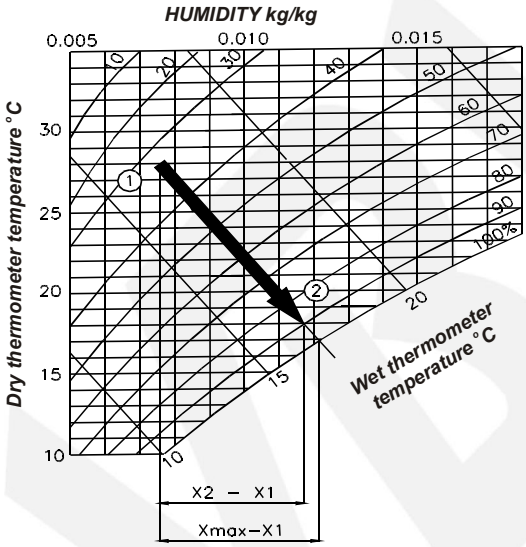
Standard – maximum operating temperature: 60 °C.

PP – maximum operating temperature: 90 °C.

Installation

Install a cut-off valve on the water supply line, a filter with gradation below 500 mm, a solenoid valve closing and opening the water supply, depending on air humidifying demands. A trap should be mounted on the overflow connection pipe. Plug the water pump motor into 3~380 V power mains.

Water humidifiers of a nozzle chamber type are individually selected according to the parameters of the ordering party.



The process of air exchange in the diagram i-x

h - humidifying performance
X1 - air humidity level before the humidifier [kg/h]
X2 - air humidity level after the humidifier [kg/h]
Xmax - maximal humidity content in the air [kg/h]
X2 = X1 + h (Xmax - X1)

Humidifier with steam generator

A steam humidifier consists of an electric steam generating unit, a spraying lance (mounted on the air handling unit), a flexible hose connecting the lance with a steam generator tank, and a hygrostat. The steam generator can be mounted on the front panel of the unit enclosure or on the wall nearby of the unit.

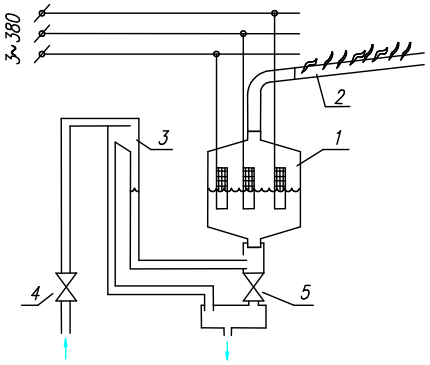
Steam humidifiers are designed to use the mains water or partially softened water.

The supply water parameters should be as follows:

- supply water hardness: 160 do 450 mg/l CaCO3
- water conductivity: 250 - 1300 µS/cm
- water pressure: 1 - 10 bar
- water temperature 1°C - 40°C

The principle of operation.

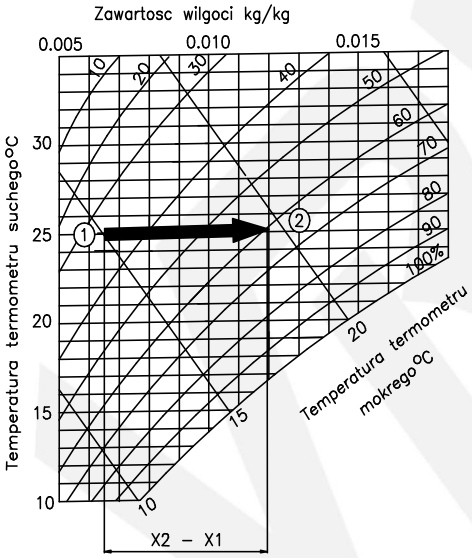
The steam generator tank is filled with water. Electric current, which flows through the electrodes, brings water to boiling. Obtained water steam is distributed in the air handling unit by the injection lance connected with the steam generator tank with a flexible hose. Water steam generation is controlled by a microprocessor controller with a connected hygrostat.



1. Water tank with electrodes
2. Injection lance
3. Overflow tank
4. Solenoid filling valve
5. Draining valve

The steam generator type is selected by the manufacturer on the basis of the parameters provided by the ordering party.

The course of transition illustrated by the i-x curve



$$E=V\times 1.2 \times (x2 - x1)$$

E - The steam demand [kg/h]

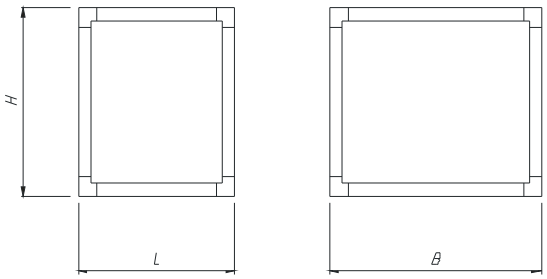
V - Air delivery [m3/h]

x1 - air humidity level before the humidifier [kg/kg]

x2 - air humidity level after the humidifier [kg/kg]

Steam humidifiers mounted on the roof of air handling units are provided in special, heated and ventilated enclosures.

Transient section

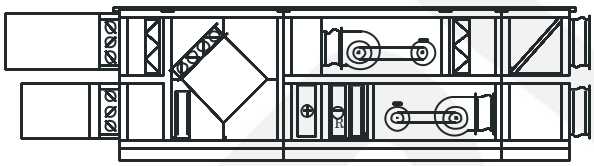


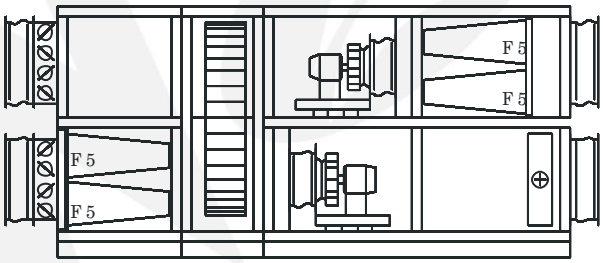
The transition section is an empty section used to connect the unit sections if it becomes necessary to increase the distance between particular subassemblies or when non-standard accessories are to be installed. The transition sections are produced in lengths of 300 and bigger, with 100 mm increments.

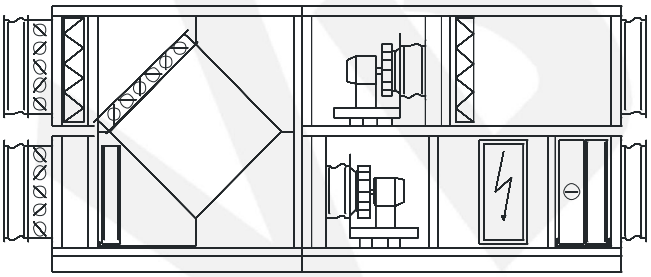
The section dimensions of BS/BD air handling units in self-supported structure (insulation thickness 50 mm)

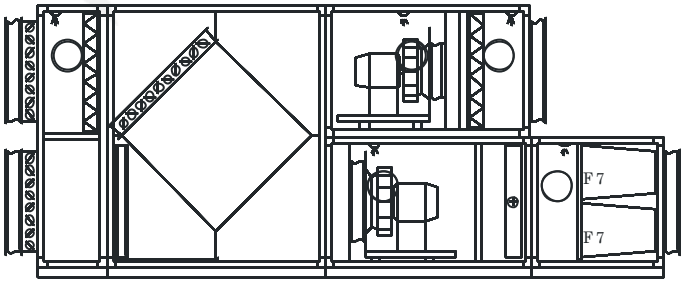
The section type BS/BD	B	H	L
	[mm]		
L– MINI	640	490	300
L – 1	690	600	300
L – 2	740	700	300
L – 3	980	700	300
L – 4	980	1010	300

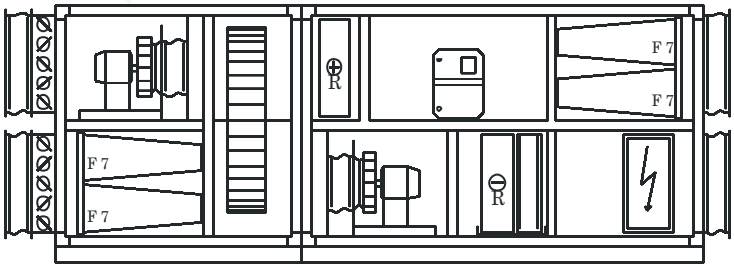
Exemplary configurations of functional sections in BS/BD air handling units.

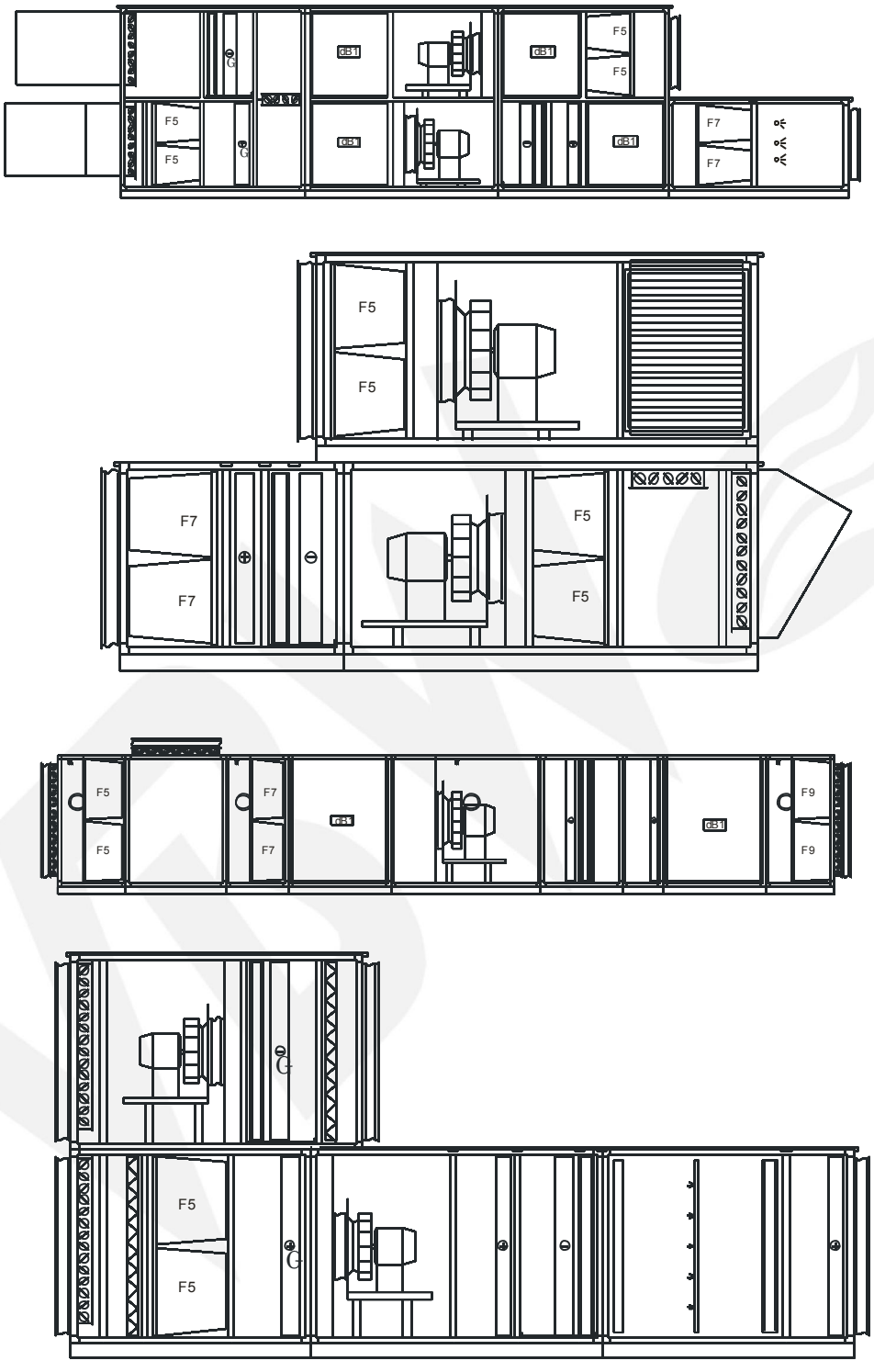











F5
F5
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F9
F9
F5
F5

SPECIAL VERSIONS OF AIR HANDLING UNITS

While fulfilling individual expectations of our Customers, VBW Engineering is ready to deliver air handling units tailored to particular needs, regarding such specifications as:

- colours

- dimensions

- specific air processing

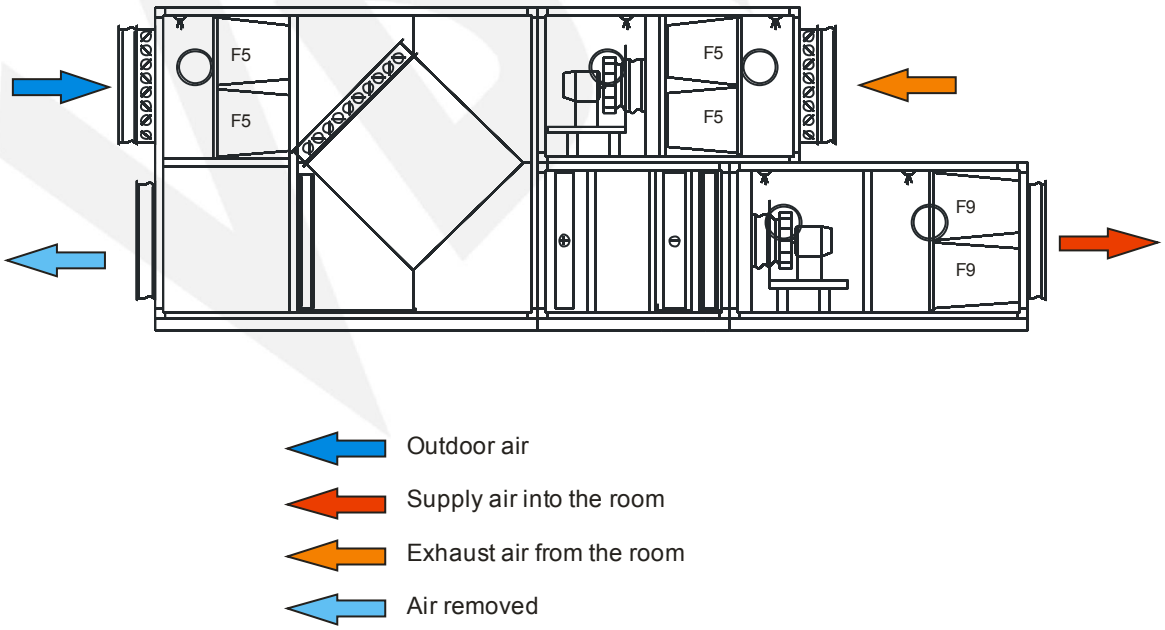
- design

- materials used for the unit construction.

Special versions of air handling units include hygienic, swimming pool, foodstuffs handling and anti-explosive solutions.

Hygienic version

Hygienic air handling units are designed to maintain cleanliness and sterility at hospital buildings, operation theatres, pharmaceutical plants, laboratories and other premises requiring special maintenance conditions. Hygienic air handling units offered be VBW Engineering meet the restrictive requirements of the standard German DIN 1946-4 regarding specific air processing and applied high quality materials, confirmed by a TÜV Certificate and a Hygienic Certificate.



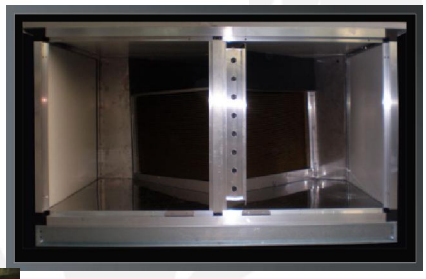
Engineering and structural features distinguishing hygienic air handling units:

- Oblique floors made of stainless steel
- Heat exchanger enclosure (heaters, coolers, condensers, vaporiser, heat pipe, cross-flow heat exchangers) is made of stainless steel or aluminium sheet, aluminium lamellas, copper manifolds or of any other material of identical properties;
- IP54 splash-proof, painted motors;
- Painted or epoxidised fans with a draining pipe or a revision flap to enable cleaning;
- All the fixing elements are made of stainless steel;
- Provided portholes and lighting in the fan, filter and humidifier sections;
- The space between heat exchangers allows easy washing and maintenance;
- Rounded corners and recesses prevent from dirt accumulation;
- Removed covers (panels) and revision doors ensure access to all spaces, facilitating – together with oblique floors – washing and disinfection of the unit interior parts;

The restrictive requirements of hospital premises impose a specified sequence of components in the air handling units.

1. With regard to the two-stage air filtration, the first filtration level should correspond at least to the F5 class (recommended F7), while the second filtration level should be in line with the F7 class (recommended F9). The first filtration stage should be on the fan suction side, as close to the fresh air inlet as possible. The second filtration stage should be installed on the pressure side.
2. In order to restrict microbial growth on the second stage filter, the relative humidity within its area should not exceed 90%.
3. In order to prevent filters from water soaking, the coolers having drying function and humidifiers should not be installed directly before the filters.
4. The second stage filters should be installed as the last element, i.e. after the last air processing component and before the air supply system.
5. In order to ensure access for inspection from either side of heat exchanger, neither air coolers nor coolers operating in humid conditions (humidity condensing) can be located directly before the filters or air traps. In order to limit the relative humidity, a cooler should be located between the fan and the heater.
6. W centralach higienicznych stosujemy tylko nawilżanie parowe.

An example of hygienic air handling units



BO-5x COMPACT AIR HANDLING UNIT

BO compact air handling units are air supply-exhaust systems with heat recovery in cross-flow heat exchangers. The presented configurations provide the following air processing possibilities: filtration, heat recovery, heating and cooling. The compact structure of the units allows all the components to be mounted on one enclosure. The unit is a monoblock of small overall dimensions, which can be used in spatially limited premises.

BO compact air handling units presented in the Catalogue include the following functional subassemblies for air processing, depending on the required combination:

Controlled throttle

Multiplane throttle with aluminium blades, where the blades are mutually coupled by plastic gears.

Preliminary cassette filter

Filtration class: G4. The filter housing made of galvanised steel sheet. Filtration fabric folded and protected with a screen.

Water heater

Copper-aluminium heat exchangers with copper piping and lamellas made of thin aluminium sheet. Two typical water heaters may be used in each air handling unit size.

Water cooler

Copper-aluminium heat exchangers with copper piping and lamellas made of thin aluminium sheet. The cooler is mounted on the condensate tank. A drop separator is installed behind the cooler. Two 3R and 4R, typical water coolers, may be used for each air handling unit size.

Freon refrigerator

Copper-aluminium heat exchangers with copper piping and lamellas made of thin aluminium sheet. The return manifold made of copper and the distributor of brass. The refrigerator is mounted on the condensate tank. A drop separator is installed behind the cooler. Two 3R and 4R, typical Freon refrigerators, may be used for each air handling unit size.

Radial fan

Radial fan with bilateral suction, driven with a belt transmission. A fan unit, consisting of a fan, a motor and a belt transmission, is fixed to the air handling units by means of special vibroinsulators, individually selected according to the operation parameters.

Cross-flow heat exchanger

The cross-flow heat exchanger is made of thin aluminium panels, making supply and exhaust channels.

Air handling unit structure

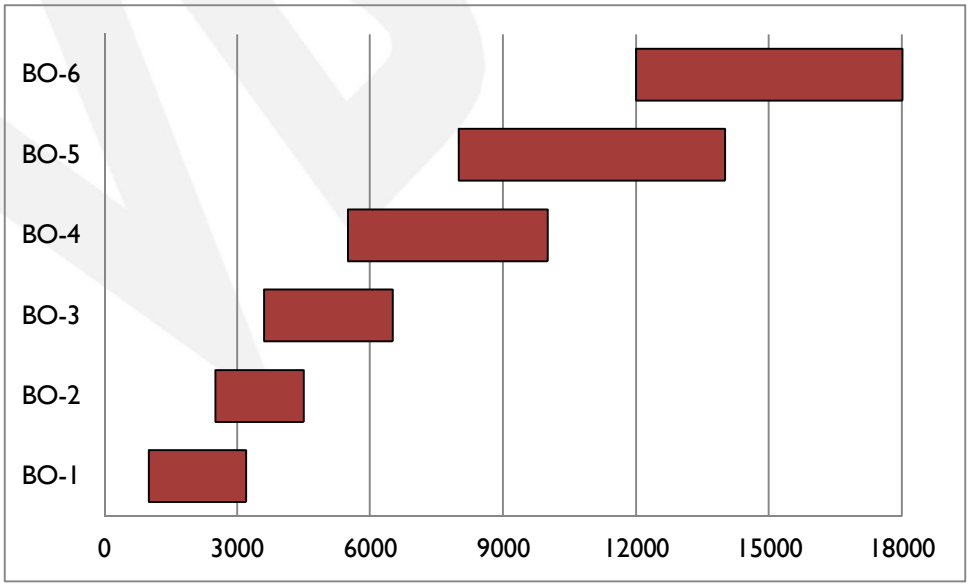
Air handling unit is a frame structure of aluminium profiles with covers: an outer cover made of steel aluzinc coated sheet and an inner cover made of galvanised steel sheet and filled with mineral wool in between. The enclosures are made in two versions: 25 mm and 50 mm covers.

For a detailed description, see the catalogue part on BS/BD air handling units.

BO air handling units are available in six (6) sizes, with a range of the air delivery from 1000 to 18000 m³/h.
With 25 mm insulation – 1-4 size; and with 50 mm insulation – 1-6 size

Selection of air handling unit size.

In order to facilitate the unit size selection, air delivery ranges are specified for particular unit sizes. The air handling unit size should be selected in such a way that at the required performance, the air flow rate (with regards to the internal unit cross-section) was 2.5 – 3.5 m/s. Having the air flow speed at 3 m/s, the air handling unit operation is silent and economical. At higher air flow rates, the unit operation becomes louder and less economical.



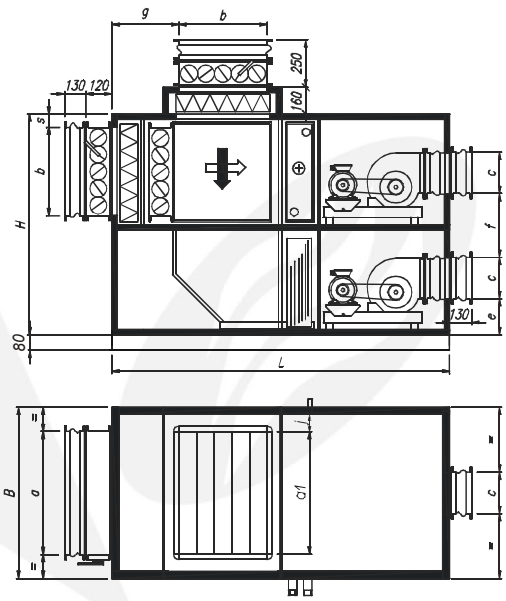
Supply and exhaust air handling units with cross-heat exchanger

BO-51 COMPACT AIR HANDLING UNITS

BO-51 air handling unit consists of the following components:

Air supply:

- Horizontal fresh air inlet
- Controlled throttle valve
- G4 preliminary filter
- Throttle with a by-pass on the cross-flow heat exchanger
- Cross-flow heat exchanger
- Heater
- Fan unit
- Horizontal air outlet



Air exhaust:

- Vertical air inlet
- Controlled throttle valve
- G4 preliminary filter
- Cross-flow heat exchanger
- Drop separator
- Fan unit
- Horizontal outlet of the air exhausted to the outside

Unit type	Air flow rate [m³/h]	Weight [kg]
BO-51-1	1 000 – 3 200	447
BO-51-2	2 500 – 4 500	630
BO-51-3	3 600 – 6 500	855
BO-51-4	5 500 – 10 000	1163
BO-51-5	8 000 – 14 000	1492
BO-51-6	12 000 – 18 000	1756

Dimensions of BO-51units (insulation thickness 25 mm)

Unit type	B	H	L	a	b	c	e	f	g	s	j	a1
	[mm]											
BO-51-1	700	1100	1900	640	400	250	220	230	385	80	50	500
BO-51-2	940	1300	2110	840	600	315	230	280				600
BO-51-3	1100	1560	2390	1040	800	400	220	260				800
BO-51-4	1400	1670	2510	1340	800	500	230	260				1000

Dimensions of BO-51units (insulation thickness 50 mm)

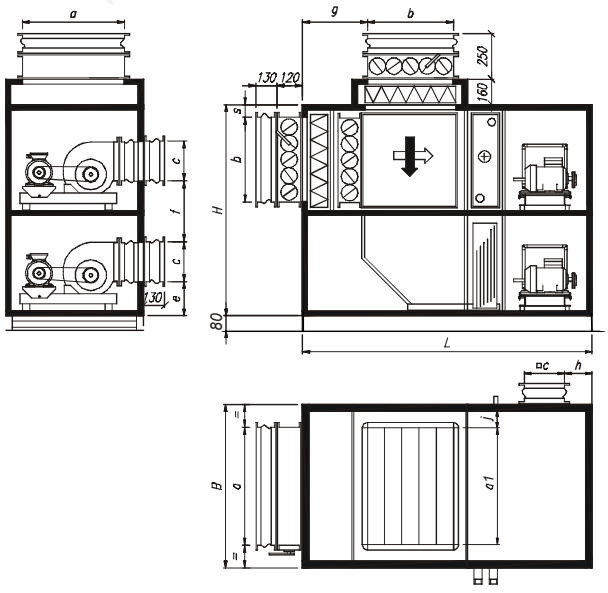
Unit type	B	H	L	a	b	c	e	f	g	s	j	a1
	[mm]											
BO-51-1	740	1160	2000	640	500	250	240	250	425	100	70	500
BO-51-2	980	1360	2210	840	600	315	250	300				600
BO-51-3	1140	1620	2490	1040	800	400	240	280				800
BO-51-4	1440	1730	2610	1340	800	500	250	280				1000
BO-51-5	1440	2000	2950	1340	1000	500	325	335				1000
BO-51-6	1440	2400	3310	1340	1200	630	380	420				1000

BO-52 COMPACT AIR HANDLING UNITS

BO-52 air handling unit consists of the following components:

Air supply:

- Horizontal fresh air inlet
- Controlled throttle valve
- G4 preliminary filter
- Throttle with a by-pass on the cross-flow heat exchanger
- Cross-flow heat exchanger
- Heater
- Fan unit
- Lateral air outlet



Air exhaust:

- Vertical air inlet
- Controlled throttle valve
- G4 preliminary filter
- Cross-flow heat exchanger
- Drop separator
- Fan unit
- Horizontal outlet of the air exhausted to the outside

Unit type	Air flow rate [m³/h]	Weight [kg]
BO-52-1	1 000 – 3 200	433
BO-52-2	2 500 – 4 500	591
BO-52-3	3 600 – 6 500	786
BO-52-4	5 500 – 10 000	1095
BO-52-5	8 000 – 14 000	1411
BO-52-6	12 000 – 18 000	1700

Dimensions of BO-52units (insulation thickness 25 mm)

Unit type	B	H	L	a	b	c	e	f	g	h	s	j	al
	[mm]												
BO-52-1	700	1100	1650	640	500	250	220	270	385	190	80	50	500
BO-52-2	940	1300	1800	840	600	315	230	280		220			600
BO-52-3	1100	1560	2100	1040	800	400	220	260		180			800
BO-52-4	1400	1670	2200	1340	800	500	230	260		250			1000

Dimensions of BO-52units (insulation thickness 50 mm)

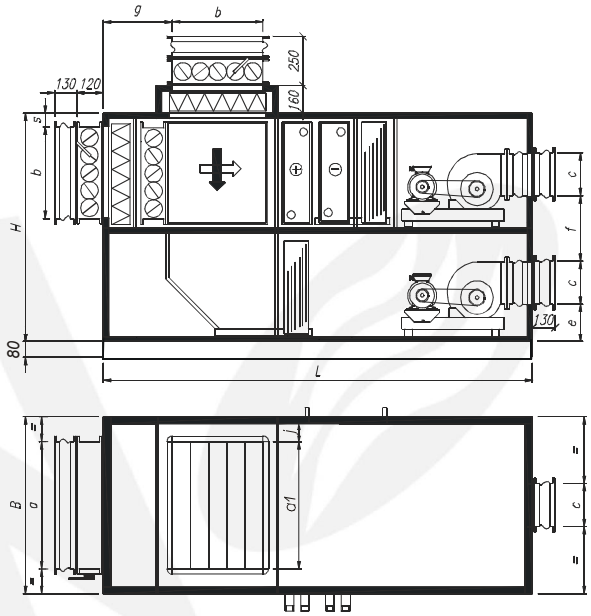
Unit type	B	H	L	a	b	c	e	f	g	h	s	j	al
	[mm]												
BO-52-1	740	1160	1750	640	500	250	240	250	425	210	100	70	500
BO-52-2	980	1360	1900	840	600	315	250	300		240			600
BO-52-3	1140	1620	2200	1040	800	400	240	280		200			800
BO-52-4	1440	1730	2300	1340	800	500	250	280		270			1000
BO-52-5	1440	2000	2600	1340	1000	500	325	335		290			1000
BO-52-6	1440	2400	2990	1340	1200	630	380	420		330			1000

BO-53 COMPACT AIR HANDLING UNITS

BO-53 air handling unit consists of the following components:

Air supply:

- Horizontal fresh air inlet
- Controlled throttle valve
- G4 preliminary filter
- Throttle with a by-pass on the cross-flow heat exchanger
- Cross-flow heat exchanger
- Heater
- Cooler with drop separator
- Fan unit
- Horizontal air outlet



Air exhaust:

- Vertical air inlet
- Controlled throttle valve
- G4 preliminary filter
- Cross-flow heat exchanger
- Drop separator
- Fan unit
- Horizontal outlet of the air exhausted to the outside

Unit type	Air flow rate [m³/h]	Weight [kg]
BO-53-1	1 000 – 3 200	545
BO-53-2	2 500 – 4 500	771
BO-53-3	3 600 – 6 500	1034
BO-53-4	5 500 – 10 000	1409
BO-53-5	8 000 – 14 000	1751
BO-53-6	12 000 – 18 000	2054

Dimensions of BO-53units (insulation thickness 25 mm)

Unit type	B	H	L	a	b	c	e	f	g	s	j	a1
BO-53-1	700	1100	2380	640	500	250	220	230	385	80	50	500
BO-53-2	940	1300	2590	840	600	315	230	280				600
BO-53-3	1100	1560	2870	1040	800	400	220	260				800
BO-53-4	1400	1670	2990	1340	800	500	230	260				1000

Dimensions of BO-53 units (insulation thickness 50 mm)

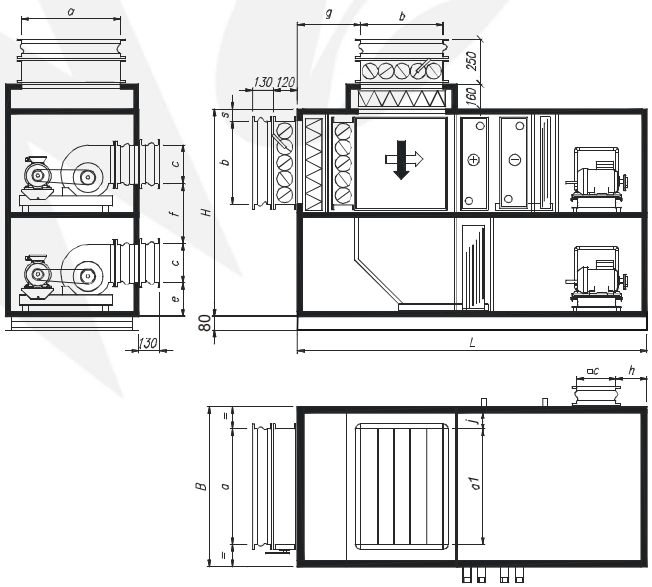
Unit type	B	H	L	a	b	c	e	f	g	s	j	al
	[mm]											
BO-53-1	740	1160	2500	640	500	250	240	250	425	100	70	500
BO-53-2	980	1360	2710	840	600	315	250	300				600
BO-53-3	1140	1620	2990	1040	800	400	240	280				800
BO-53-4	1440	1730	3110	1340	800	500	250	280				1000
BO-53-5	1440	2000	3450	1340	1000	500	325	335				1000
BO-53-6	1440	2400	3820	1340	1200	630	380	420				1000

BO-54 COMPACT AIR HANDLING UNITS

BO-54 air handling unit consists of the following components:

Air supply:

- Horizontal fresh air inlet
- Controlled throttle valve
- G4 preliminary filter
- Throttle with a by-pass on the cross-flow heat exchanger
- Cross-flow heat exchanger
- Heater
- Cooler with drop separator
- Fan unit



Lateral air outletAir exhaust:

- Vertical air inlet
- Controlled throttle valve
- G4 preliminary filter
- Cross-flow heat exchanger
- Drop separator
- Fan unit
- The outlet of air exhausted to the outside

Unit type	Air flow rate [m³/h]	Weight [kg]
BO-54-1	1 000 – 3 200	531
BO-54-2	2 500 – 4 500	732
BO-54-3	3 600 – 6 500	973
BO-54-4	5 500 – 10 000	1342
BO-54-5	8 000 – 14 000	1687
BO-54-6	12 000 – 18 000	1999

Dimensions of BO-54 units (insulation thickness 25 mm)

Unit type	B	H	L	a	b	c	e	f	g	h	s	j	al
	[mm]												
BO-54-1	700	1100	2130	640	500	250	220	230	385	190	80	50	500
BO-54-2	940	1300	2380	840	600	315	230	280		220			600
BO-54-3	1100	1560	2580	1040	800	400	220	260		180			800
BO-54-4	1400	1670	2680	1340	800	500	230	260		250			1000

Dimensions of BO-54 units (insulation thickness 50 mm)

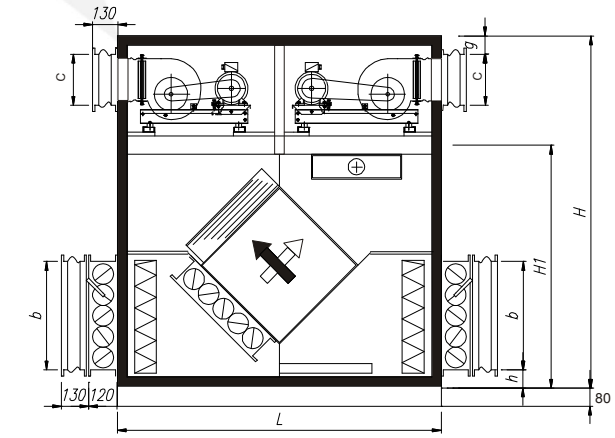
Unit type	B	H	L	a	b	c	e	f	g	h	s	j	al
	[mm]												
BO-54-1	740	1160	2250	640	500	250	240	250	425	210	100	70	500
BO-54-2	980	1360	2400	840	600	315	250	300		240			600
BO-54-3	1140	1620	2700	1040	800	400	240	280		200			800
BO-54-4	1440	1730	2800	1340	800	500	250	280		270			1000
BO-54-5	1440	2000	3100	1340	1000	500	325	335		290			1000
BO-54-6	1440	2400	3500	1340	1200	630	380	420		330			1000

BO-55 COMPACT AIR HANDLING UNITS

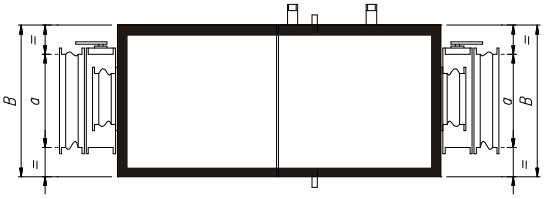
BO-55 air handling unit consists of the following components:

Air supply:

- Horizontal fresh air inlet
- Controlled throttle valve
- G4 preliminary filter
- Throttle with a by-pass on the cross-flow heat exchanger
- Cross-flow heat exchanger
- Heater
- Fan unit
- Horizontal air outlet



Air exhaust:



- Horizontal air inlet
- Controlled throttle valve
- G4 preliminary filter
- Cross-flow heat exchanger
- Drop separator
- Fan unit
- Horizontal outlet of the air exhausted to the outside

Dimensions of BO-55 units (insulation thickness 50 mm)

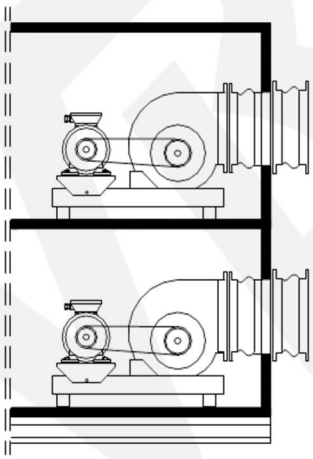
Unit type	Air flow rate	B	H	H1	L	a	b	c	g	h
	[m³/h]	[mm]								
BO-55-1	1 000 – 3 200	690	1840	-	1750	600	600	250	112,5	80
BO-55-2	2 500 – 4 500	740	2100	-	1900	630	600	315	160	65
BO-55-3	3 600 – 6 500	980	2150	-	2000	630	800	400	80	80
BO-55-4	5 500 – 10 000	980	2650	-	2400	800	800	500	120	100
BO-55-5	8 000 – 14 000	1280	3000	2100	2550	1000	900	500	130	100
BO-55-6	12 000 – 18 000	1280	3550	2500	2950	1000	1150	630	75	80

Outlet pipe configurations

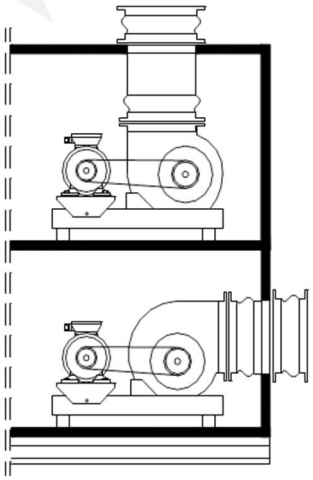
Depending on requirements, the fan exhaust pipes in BO air handling units are arranged in various ways:

- Horizontal fan exhaust outlets
- Vertical outlet of the air supply fan
- Horizontal outlet of the exhaust fan

BO-51
BO-53

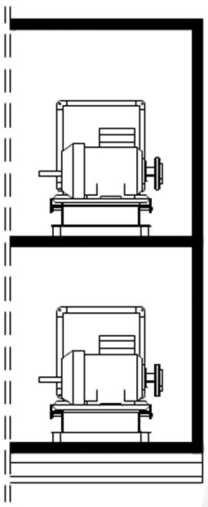


BO-51A
BO-53A



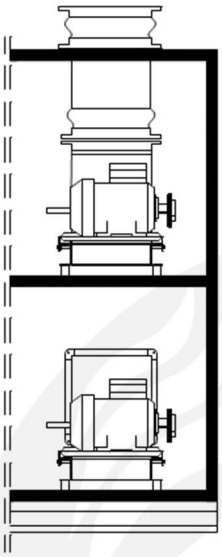
- Fan outlets laterally oriented

BO-52
BO-54



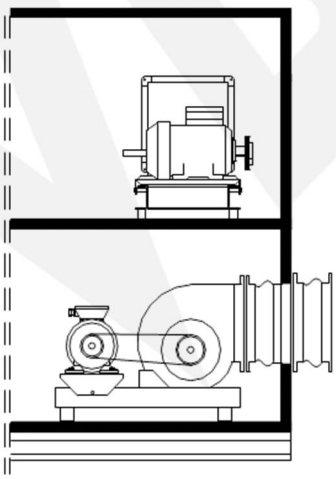
- Vertical outlet of the air supply fan
- Lateral outlet of the exhaust fan

BO-52A
BO-54A



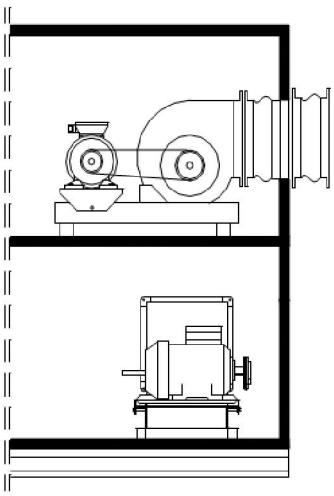
- Lateral outlet of the supply fan
- Horizontal outlet of the exhaust fan

BO-51B
BO-53B



- Horizontal outlet of the air supply fan
- Lateral outlet of the exhaust fan

BO-51C
BO-53C



BO – VESTA COMPACT AIR HANDLING UNITS

BO–VESTA is an air supply-exhaust air handling unit with heat recovery in a (BO-VESTA-1) counter current heat exchanger and a (BO-VESTA-2, 3, 4) cross-flow heat exchanger. The use of a highly efficient heat recovery system provides considerable cost reductions. In the case of the countercurrent heat exchanger, heat recovery amounts to 91%. A simultaneous application of a heat recovery heat exchanger by-pass allows the operation without recovery. Thus, the unit can be more effectively used in various functional conditions.

BO–Vesta air handling units have been designed for small premises, such as office rooms, kindergartens, small houses, shops and other public utility buildings.

An air handling unit structure.

It is a self-supported structure without aluminium profiles. The outer covers of the unit are made of two layer steel sheets: the outer aluzinc, and the inner – galvanised on both sides with mineral wool filling the space in between. The mineral wool insulation is characterised by good thermal and acoustic properties; the insulation layer is 50 mm thick. The enclosing of all functional components in one structure and upward channel connection ensure a small overall size of the unit, which facilitates its assembly and operation. This unit is delivered as a complete air conditioning unit with automatic control and cabling. It is also possible to order a unit without the automatic control system.

The plug & play arrangement safes labour and time in on-site unit setup.

The principle of operation

BO-VESTA – 2, 3, 4 compact air handling unit includes two axial-radial fan, where one removes contaminated, warm air from the room, while the other supplies fresh, cold air from the outside. Both air streams, after cleaning the air filters, flow through a cross-flow heat exchanger, where the heat exchange process between the two air flows takes place. Additionally, fresh air, after passing through the cross-flow heat exchanger, is heated by an electric or water heater to the required air supply temperature.

The heat recovery exchanger has a by-pass line.

By-pass functions:

- 1) night cooling of premises in summer – by-passing the cross-flow heat exchanger when the outdoor temperatures are lower from those in the rooms
- 2) heat exchanger defrosting

Accessories:

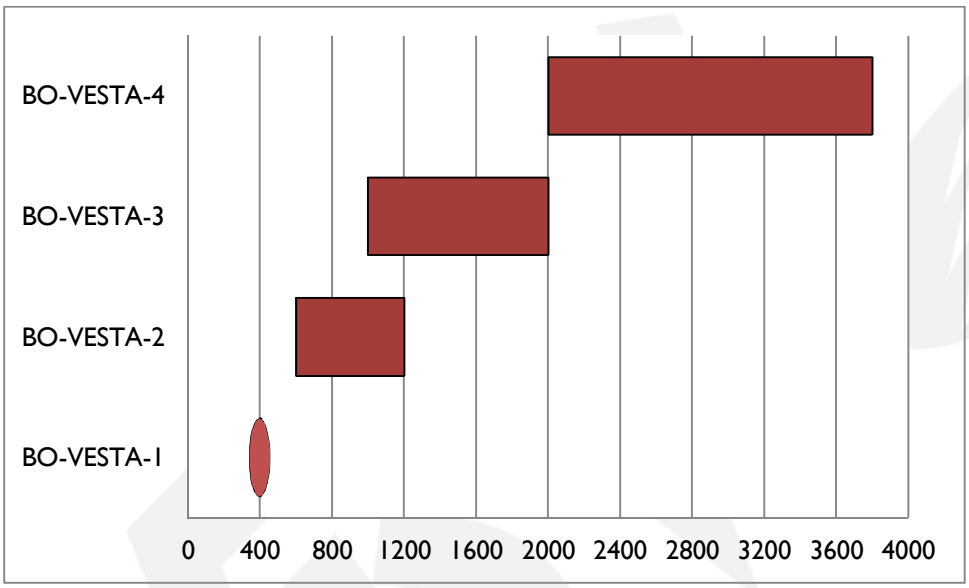
G4 filters

Heat recovery exchanger

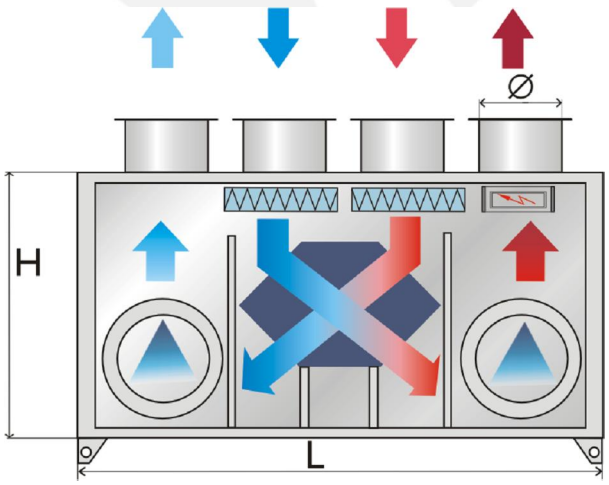
Water or electric heater

Fans with direct drives; at the Customer's request, the fans are provided with electronically commutated motors.

Diagram of unit size selection



BO-VESTA -1



BO-VESTA-1 consists of the following components:

Air supply:

G4 filter

By-pass throttle

Counter current heat exchanger

Fan unit

Electric heater

Air exhaust:

G4 filter

Counter current heat exchanger

Fan unit

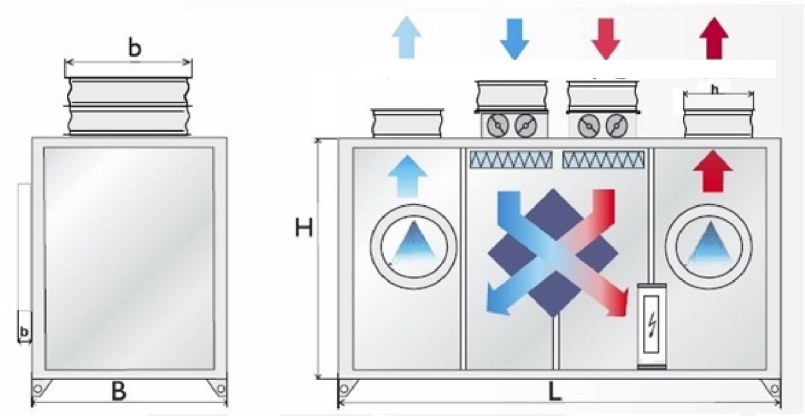
Delivery of the air handling units: 400 m³/h

Heat recovery efficiency: 91%

Dimensions of unit

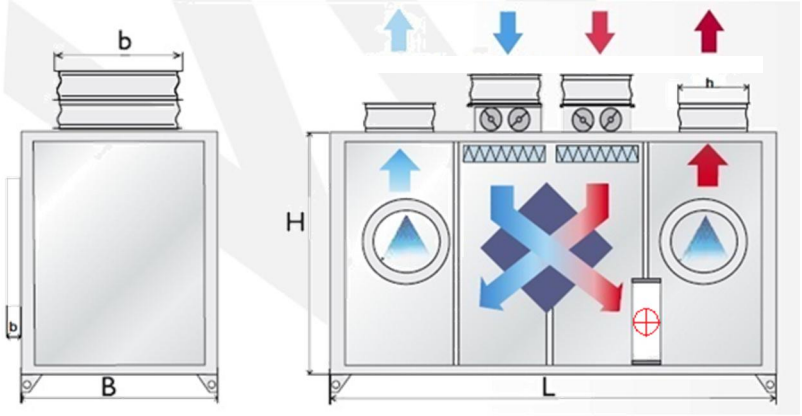
	L [mm]	B [mm]	H [mm]	Ø [mm]	Weight[kg]
BO-VESTA-1	1100	550	550	160	85

BO-VESTA-2,3,4



BO-VESTA-2,3,4 consists of the following components:

Air supply
G4 filter
By-pass throttle
Cross-flow heat exchanger
Fan unit
Electric or water heater



Air exhaust:
G4 filter
Cross-flow heat exchanger
Fan unit

Unit type	Air flow rate [m³/h]	Heat recovery efficiency [%]
BO-VESTA-2	600 – 1200	72
BO-VESTA-3	1000 – 2000	78
BO-VESTA-4	2000 – 3800	70

Dimensions of unit

Unit type	L [mm]	B [mm]	H [mm]	bxh [mm]	Weight [kg]
BO-VESTA-2	1300	750	850	400x200	180
BO-VESTA-3	1600	800	1000	500x315	240
BO-VESTA-4	2200	880	1300	630x400	380

The principles of operation of the automatic system in BO-VESTA air handling units

Switching on the system activates the supply and exhaust fans. Depending on the heat demands, the system automatically switches on the heater.

Protection against the heat exchanger frosting is provided by its by-passing, when the heat exchanger pressure control is activated. The use of a by-pass also provides night cooling of the premises in summer, by-passing the cross-flow heat exchanger, when the outdoor temperatures are lower from those in the rooms.

The fan driving motors are supplied by inverters mounted on air handling units and used for the mains control. A room sensor plays the role of a control panel, switching on or off the unit, switching to the automatic mode and setting the required temperature. The indoor temperatures are measured with a channel sensor mounted on the air outlet. It is possible to choose the leading sensor (air supply or exhaust).

Automatics

VBW Engineering delivers air handling units with complete automatic packages. The company also provides services for unit assemblies, setup and service by qualified and experienced personnel. Following consultations with the Customer, the control systems are adjusted to specific application circumstances and the end-user's needs.

Examples of the functions provided by the automatic systems delivered by VBW Engineering:

1. The control system operation can be local – from the operator's panel, or remote – via the IRC (Individual Room Controller)//controller, the controller's website or a supreme control system.

2. Depending on the demands, the control algorithms provide a possibility of selecting differentiated mode of operations, such as:
   - continuous operation mode,
   - thermostatic operation mode,
   - economic modes,
   - time-related switching schedules,
   - presence or high concentrations of gases.

3. The automatic systems ensure precise regulation of air parameters, including the temperature and humidity of the supplied or indoor air and the air quality. The use of a modern and technically advanced version of the automatic system allows to use controllers with the "self-control" function – an automatic selection of optimal control settings.

   The algorithms, which control the **heating/cooling** processes, have been designed to provide maximum **heat/cold recovery** from the air exhausted from the air conditioned room, which considerably reduces the costs of operation.

   The automatic system supports such **recovery systems** as:

   - cross-flow heat exchanger,
   - heat pipe (heat recovery only),
   - rotating heat exchanger,
   - mixing chamber,
   - heat recovery system with intermediate medium.

   The heat recovery depends on the exhausted air temperature and the outdoor air temperature.

   The automatic systems ensure full control and protection of the condensing systems produced and incorporated by VBW Engineering, offering step-wise or infinitely variable control. They also support condensing systems of other vendors.

When the recovery function is complete, then – depending on the current demand – heating/cooling is executed by the installed heaters/coolers, using the outside energy. In the case of high indoor temperature and low outdoor temperature levels, additional cost savings are brought up by the cooler blocking. The "free cooling" function is activated instead, taking the advantage of the cold outdoor air.

When air humidification is required, the automatic systems continuously control the performance of steam humidifiers, process steam humidifiers and provide step-wise control of humidifiers with sprinkled pads.

The process of air drying consists in an appropriate cooler setting to drop out water from the air, plus appropriate heater activation to decrease the relative humidity.

Indoor air cleaning from excessive carbon dioxide contents, in a situation of air handling unit configuration with a mixing chamber, involves the supply of proper fresh air volumes by infinitely variable control of throttle servo motors. Another way of air cleaning is the increase of the fan performance. The application of a carbon dioxide processor provides additional reduction of the operations costs.

4. The control system allows to precisely regulate the frequency in motor- and fan-controlling inverters. This regulation allows, for example, to maintain constant air delivery or constant overpressure in the supply channel with constant underpressure in the exhaust channel, or to maintain constant air flow speed in the channels. When an appropriate controller is applied, remote control is possible (e.g. via the Internet) of transducer ranges and of frequency inverter parameters. The VBW Engineering's automatic systems may support or control air flow controllers installed at the air conditioned premises

5. The automatic systems include devices, fully protecting and communicating any malfunctions or defects of the air handling unit components. The devices include:

   - thermal and overload protections of motors,
   - anti-frost thermostats,
   - thermostats of electric heaters,
   - heat exchanger frosting protecting systems
   - filter choking alarms.

Emergency and alarm situations are identified on the controller display. Appropriate configuration allows alarm communicates and information about pending service to be texted by phone or sent by e-mail.

6. The controllers offered by VBW Engineering offer transmission of the required signals to the central control system or visualisation and data storage /SCADA/. This communication is supported by such protocols as Modbus, BACnet, CAN, Profibus, LonWorks and many others.
   Proper controller models can hold "Master" or "Client" functions in the buildings networks, communicating with other devices, such as power meters, frequency converters, generators, pumps, regulatory flow controls or boilers, by Modbus, M-Bus, MP-Bus or Opentherm protocols. Full information about the air handling units and other facilities can be visualised via the Web Server (the controller's website) or sent to another system.

7. It is possible to extend the control system by expanding I/O sections, both within the supply-control panel and the remote peripheral installations.

8. Technically advanced models of the offered controllers allow:

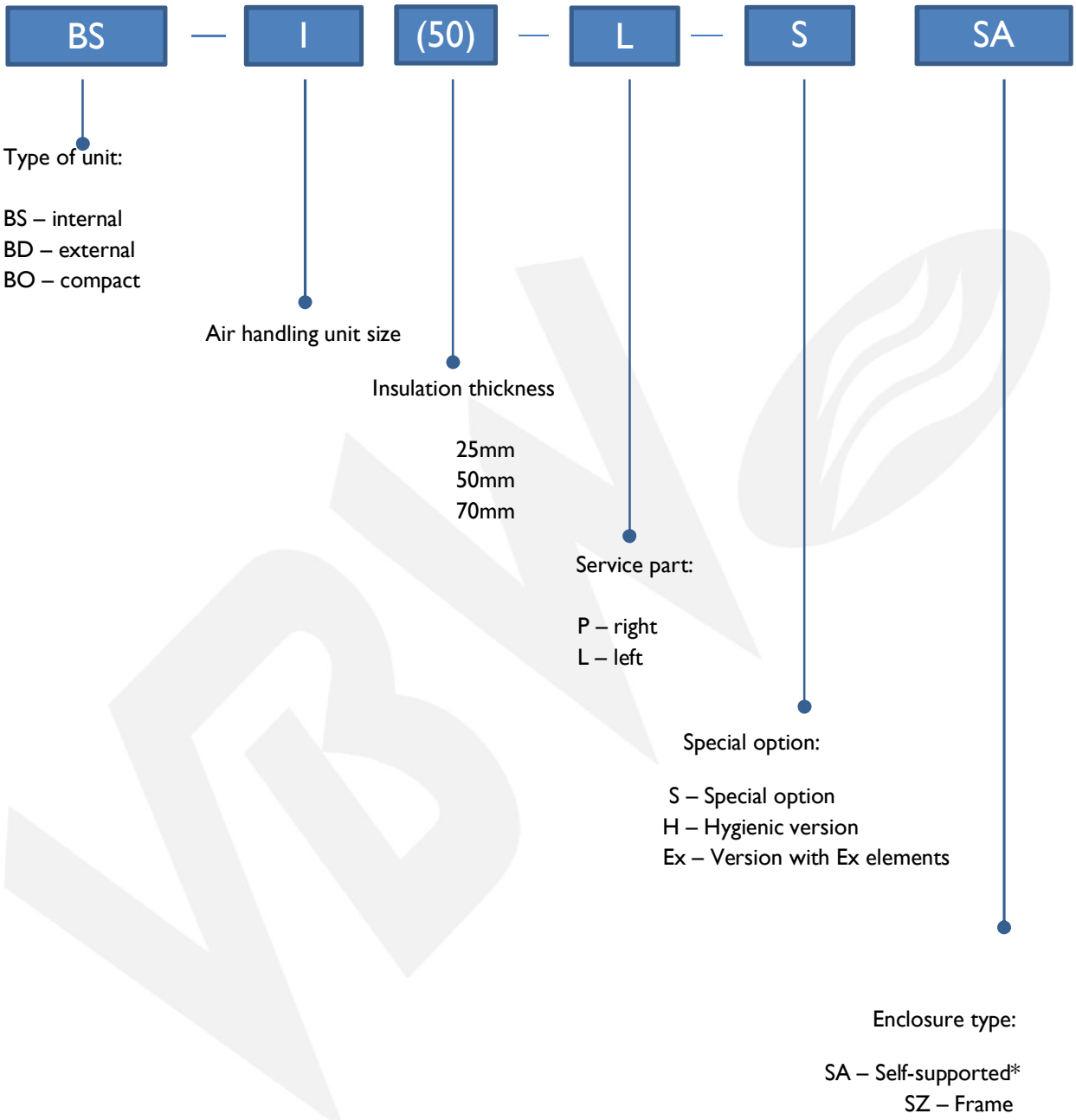
- reading and entering a ready application program via the Internet or directly from the network, e.g. from a BAS monitoring workunit. It reduces time, facilitates servicing and reduces its costs. Program modifications are possible with active air handling units. It is especially important at the premises with high inertia, needing long time for withdrawal and repeated start, as well as at the buildings, where production technology imposes limits on the frequency of switching off air conditioning systems;

- extension with electric power controlling sections (allowing the management and concentration of signals from power meters [standard M-Bus] and with analysing systems of other electric power parameters [standard Modbus RTU] to assure future optimisation in the management of the building available energy resources)

- storage of telemetric data (Datalogger) for recording and archiving of all measurement data to be then used or referred to for the changes in the settings of parameters required to optimise the operation of units and installations.

9. In the case of historical buildings or in the areas with limited access, it possible to install sensors and controllers communicating with other controllers by radio.

Labelling of BS/BD/BO air handling units



* Self-supported structure is applied in BS/BD MINI air handling units and 1, 2, 3, 4 size with 50 mm insulation and in BO-VESTA air handling units.

Detailed information on the ordered product is included in the overall dimensions and technical data provided individually for each unit, following the design requirements.

Labelling of automatic components

BS-7 — A — 2 — 12 — 1 (Fb)

Type of unit

Automatic

Type of operation:

0 – exhaust air
1 – supply air
2 – supply and exhaust air

Type of heat recovery:

0 – without heat recovery
1 – recirculation
2 – cross-flow heat exchanger
3 – heat pipe
4 – glycol system
5 – rotating heat exchanger – constant speed
6 – rotating heat exchanger – variable speed
7 – heat pump
8 – reversing heat pump
9 – cooling system integrated in the air conditioning system

Type of heat processing:

0 – none
1 – water heater
2S- electric heater with step-wise control
2P- electric heater with infinitely variable control
3 – steam heater
4 – water cooler
5 – freon refrigerator
6 – PEGAZ

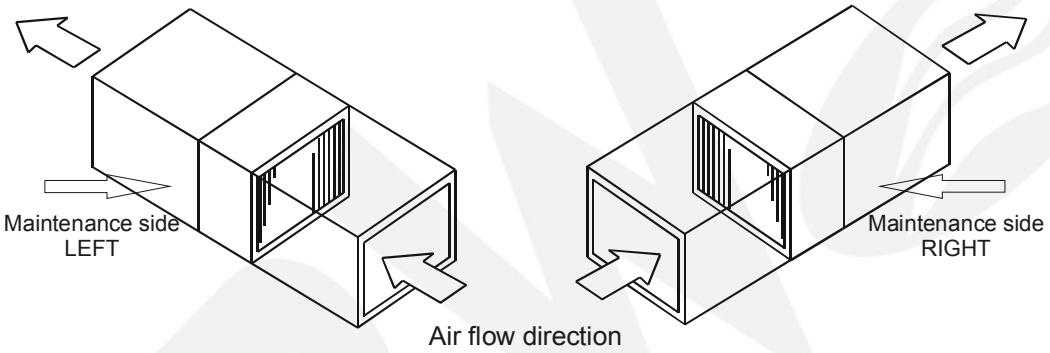
Additional accessories:

Fb – additional filter
Mo – humidifier with on/off control
Mc – humidifier with infinitely variable control
Ks – remote control cassett

Access to equipment

Taking into consideration access to the equipment, BS/BD/BO-5x air handling units are made in one of two possible versions:

RIGHT - looking in the direction of the air flow, on the right side of the air handling unit are removable covers and connectors of exchanger collectors.
LEFT - looking in the direction of the air flow, on the left side of the air handling unit are removable covers and connectors of exchanger collectors.
In addition, heat collector connections can be available opposite to the maintenance side.



Transport, installation, service

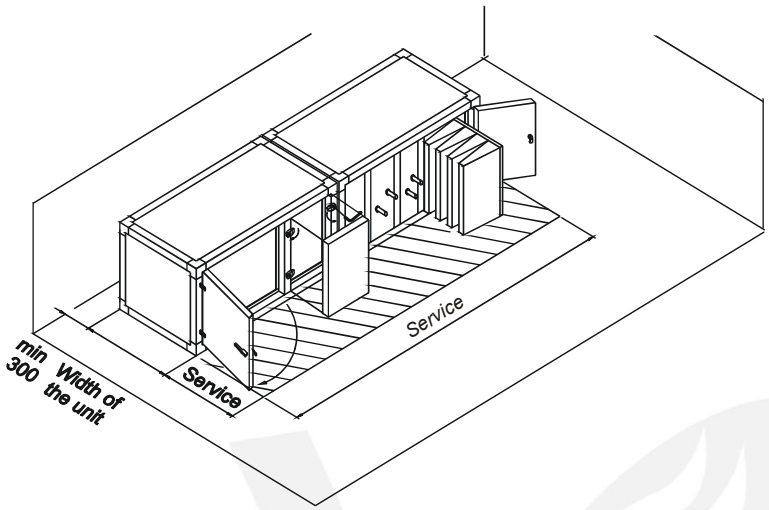
Transport

The air handling units should be transported only in a position in which they will work. Loading and unloading is to be carried out with a forklift truck or a crane.

Engine room

Leave free space (at least 1000 mm) from the service side of the air handling unit for current service and repairs. This space will allow opening of doors and revision covers. Other installation around the unit (pipelines, cable routes) should not compromise access to the unit. Within the repair space, other installations, pipelines or supports are allowed, provided they can easily be removed for the time of repairs of the air handling unit. If it is possible, for assembly purposes, on the back side of the unit there is to be clear space of width of 300 mm left.

Service space to operate the air handling unit



Foundation

The unit should be placed on a foundation, on a foundation steel frame concreted in the floor, or on a specially prepared steel structure (a stand). The foundation, frame or stand must be absolutely levelled. The fan unit is mounted on its own shock absorbers. Installation of the air handling unit does not require any additional shock absorbers. It is recommended to use an additional plate or rubber strips under the unit frame. Air handling units having the heat pipe or cross-flow exchanger sections should be placed on a foundation or framework of height allowing for installation of a syphon bottle on the condensate drain. The total height of the framework or concrete underpayment for a typical syphon bottle equals at least 150mm.

Service

Customer's contact with VBW Engineering is not limited to delivery of the ready-made. We provide comprehensive high quality service care:

- self-assembly of equipment or supervision of installation carried out by another company,
- carrying out start-up of the device and performing basic measurements of amount of air and fan air pressure,
- installation and starting up automatic control systems, which are within the scope delivery by VBW Engineering,
- carrying out regular maintenance,
- carrying warranty and post-warranty service works,
- staff training.

Operation and maintenance

The purpose of the equipment installed in the building is to ensure supply of air of adequate parameters. The product itself also requires compliance with relevant regulations. The equipment is to be inspected periodically; this refers especially to those components that can become dirty (e.g., heat exchangers, filters) or worn-out (e.g. bearings).The Operation and Maintenance Manual that every user is provided with includes a detailed description of operational activities and functional components of the device.