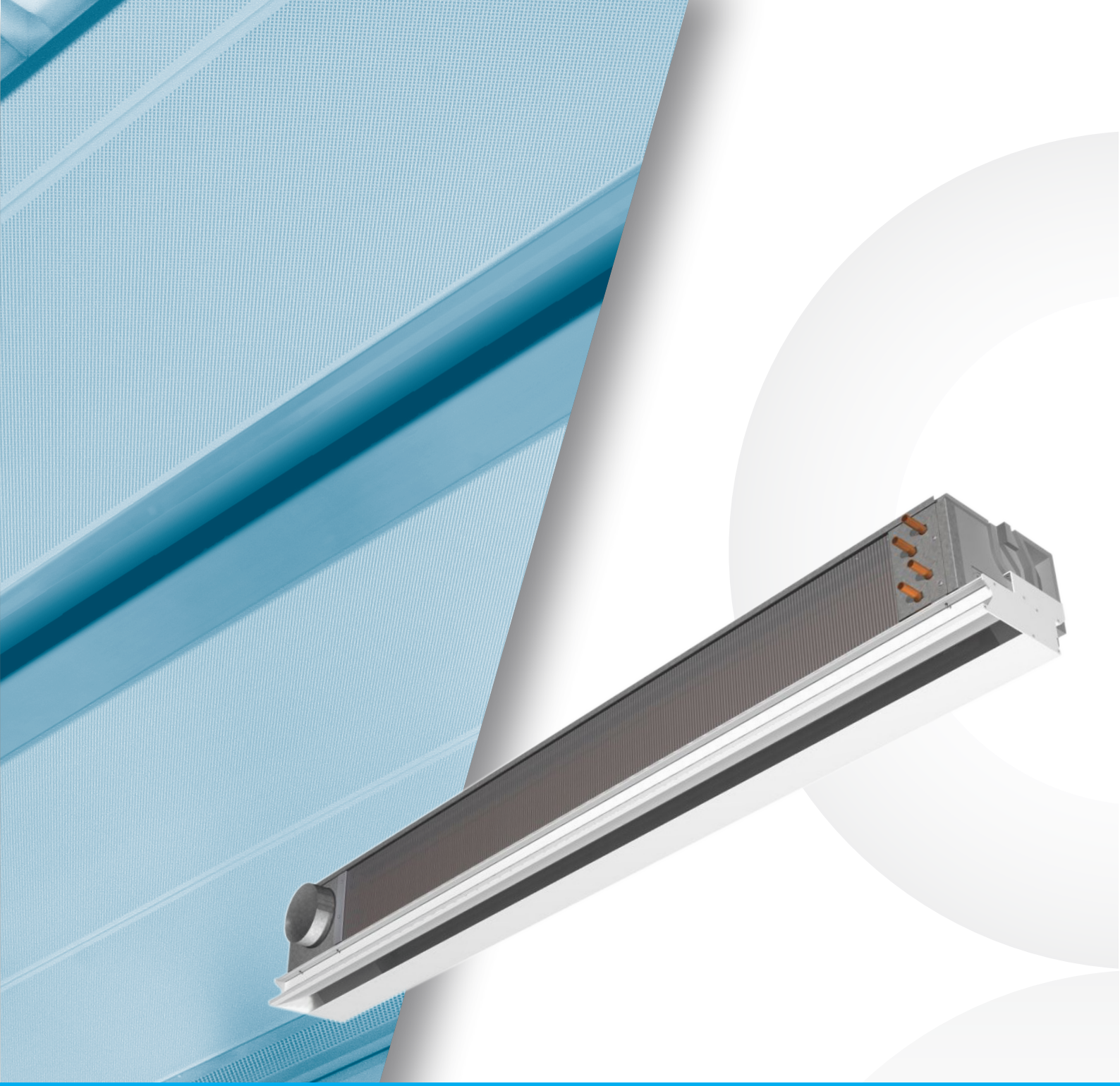


AIR-TWIST® - ACTIVE CHILLED BEAM

SUSTAINABLE AND AESTHETIC

SUSTAINABLE / INNOVATION

HC GROEP

HC BARCOL-AIR | AIR DISTRIBUTION

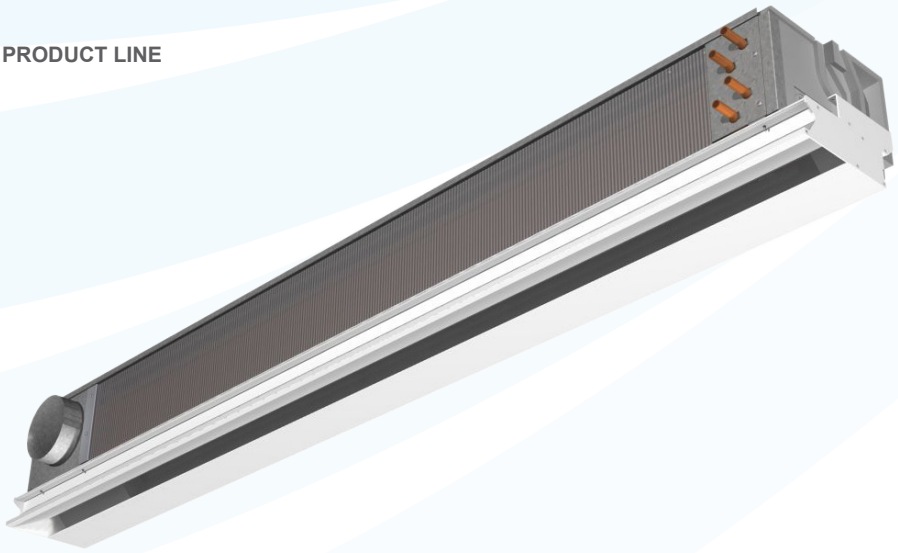
HC VERDE® product line

The HC Groep is adding to the sustainable product line the AIR-TWIST®: the technology for an active chilled beam and the aesthetics of a linear diffuser in one.

In a world in which sustainability and environmental awareness are considered to be of paramount importance, the HC Groep is pleased to help you to come up with effective solutions for 'green construction issues' as a strategic partner.
In this context the HC VERDE® product line was introduced in 2010; a line of environmentally aware, low energy, sustainable products and concepts originating from all of the company divisions of the HC Groep.

HC VERDE

PRODUCT LINE



Contents

General description

Introduction to AIR-TWIST®

The unique design of the AIR-TWIST® guarantees a comfortable indoor climate with minimum power consumption and building volume whilst retaining sufficient ventilation.

The AIR-TWIST® was designed for mixed systems in which the air conditioning system supplies the necessary ventilation air, while the cooling and heating energy is conveyed mainly by means of water. The low installation height makes the unit highly suitable for projects with limited space above the false ceiling and for renovation projects.

The high induction ratio and efficient coil configuration combined with the primary air quantity provide for sufficient cooling and/or heating capacity.

Scope of application

The AIR-TWIST® is ideally suitable for rooms that are permanently occupied, such as offices.

The continuous volume flow introduces sufficient fresh air to meet the ventilation requirement. Sufficient room air is additionally induced and cooled to compensate for a normal cooling load.
The heating demand for offices in the winter season is also perfectly controlled with this active chilled beam.

For rooms with variable occupation, the AIR-TWIST® can be provided with a VAV plenum for the supply of extra fresh air; the room can be controlled based on occupancy or CO_2 sensor.

Operation

The operational principle is based on the induction of room air caused by the venturi effect of the specially shaped nozzles.

The conditioned ventilation air from the central air conditioning system is supplied in the plenum by means of a (mechanical) continuous volume control. This air is injected into the unit mixing chamber by nozzles. Room air is induced from above the false ceiling passing a heat exchanger. The mixture of conditioned primary air and heated or cooled induced room air is supplied to the room via a linear diffuser integrated in the unit along the ceiling.

Return air

The AIR-TWIST® induces return air from above the false ceiling.

An adequate return air opening is needed for optimum performance. There are various ways of doing this. Structural facilities, lighting armatures or (ceiling) ventilation diffusers are among the options (see page 9).

Air distribution in the room

The efficient flushing of the room creates effective ventilation, cooling and/or heating.

The specific shape of the linear diffuser enables the AIR-TWIST® to supply a very level air stream along the ceiling. This stream ensures that the supply air is effectively distributed in the room.
The velocity of the air blown along the ceiling and the underpressure between the stream and the ceiling creates the Coanda effect, which causes the cooled air to continue to stream along the ceiling rather than prematurely entering the occupied zone.

For a blowing pattern such as this it is important that the ceiling is within reach of the stream surface and is free of obstacles. This is especially important in the direct vicinity of the blower openings.

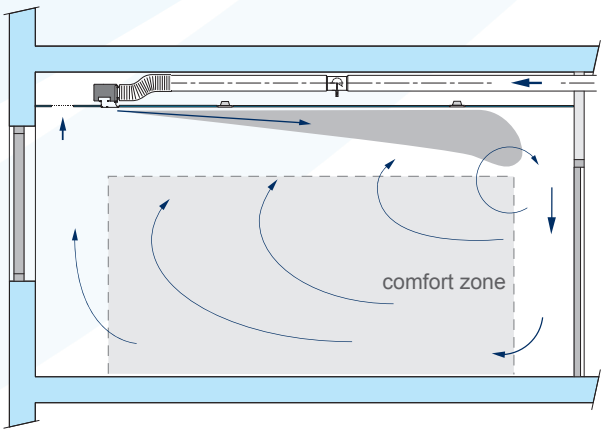


Figure 1: The AIR-TWIST® principle

HC Barcol-Air - 04.12
Patent no. 2005294
Changes w/o notice or obligation

Benefits

Sustainable

- ✓ Low energy recyclable (cradle to cradle)
- ✓ CO_2-friendly
- ✓ Low environmental impact
- ✓ Contributes to a higher BREEAM / LEED score
- ✓ Partially made out of recycled raw materials

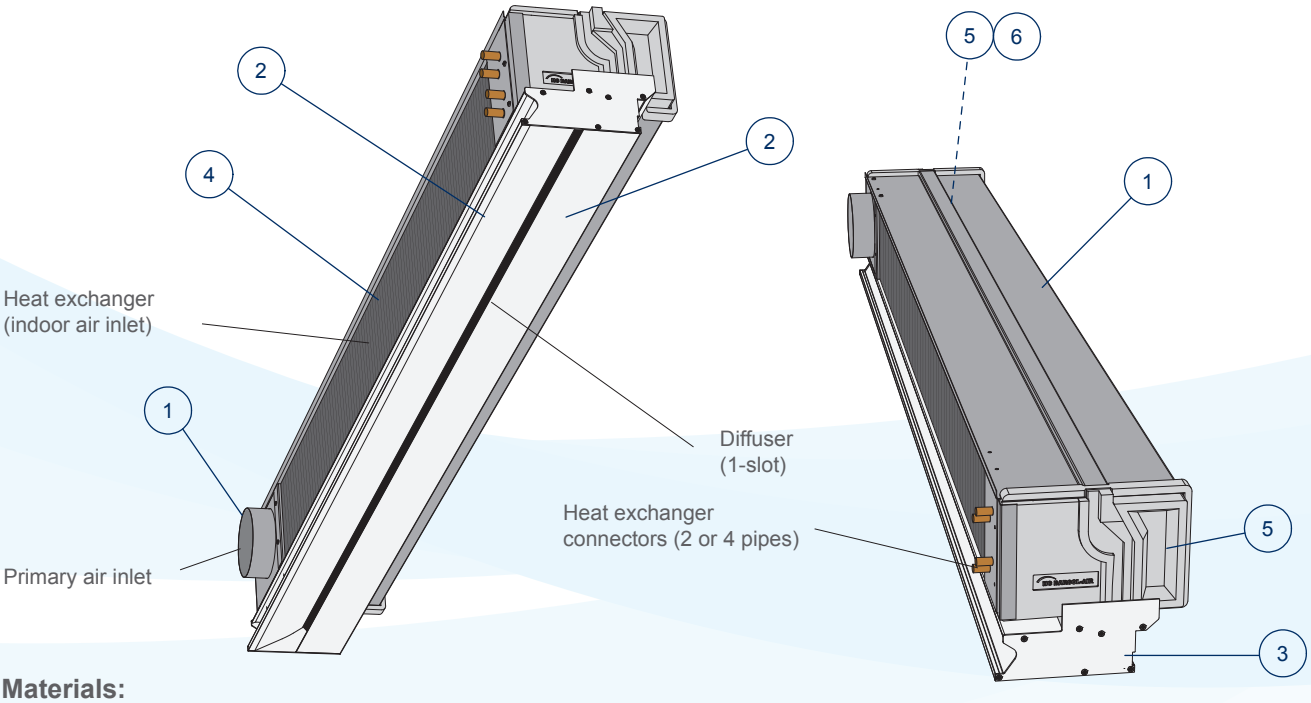
Flexible

- ✓ Suitable for renovation projects
- ✓ Less installation and storage space required
- ✓ Freedom of ceiling layout
- ✓ Can be combined with lighting armature
- ✓ Freedom of choice in finishing
- ✓ Compact and light design

Innovative

- ✓ Streamlined, linear design
- ✓ Minimum visibility
- ✓ Freedom of choice for return air
- ✓ Maintenance-free

Product and material presentation



Materials:

1. Plenum, inlets and cover plates: galvanised sheet steel, 0.6 - 0.75 mm.
2. Diffuser flanges: extruded aluminium*, standard finishing RAL 9010, gloss level 70%.
3. Side plates: aluminium* finishing RAL 9010, gloss level 70%.
4. Heat exchanger: aluminium* fins, copper pipe, galvanised steel assembly plates.
5. Side caps CAV-plenum + internal air conveyance elements: NEOPOR® (EPS-SE).
6. Internal jet nozzle elements: fire-inhibiting ABS.

* *The aluminium material used for the production of the AIR-TWIST® is mainly recycled material and therefore environmental friendly. The recycling process uses 95% less energy and less new raw materials are required.*

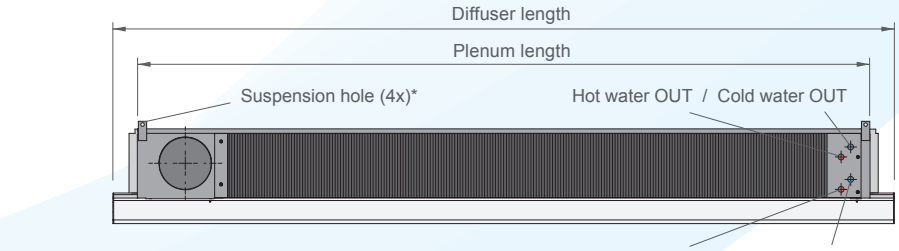
Properties of NEOPOR®:

- Lightweight.
- Noise insulating.
- Inhibits heat conduction.
- Recyclable.
- Resistant to ageing.
- Extremely sustainable and dimensionally stable.
- Highly water resistant.
- Free of halogen and chlorofluorocarbons (CFCs, HCFCs and HFCs).
- Fire protection: NEOPOR® insulation materials are produced in conformity with the requirements of European standard DIN EN 13163 and are placed in eurocategory E in conformity with DIN EN 13501-1 and B1 in conformity with DIN 4102 for fire behaviour.

Properties of fire-inhibiting ABS:

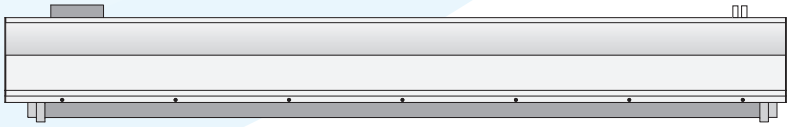
- Bromine-free fire inhibiting (free of PBDE).
- Lightweight.
- Dimensionally stable and wearproof.
- Sustainable.
- Flammability test method UL 94 V-0.

Dimensions

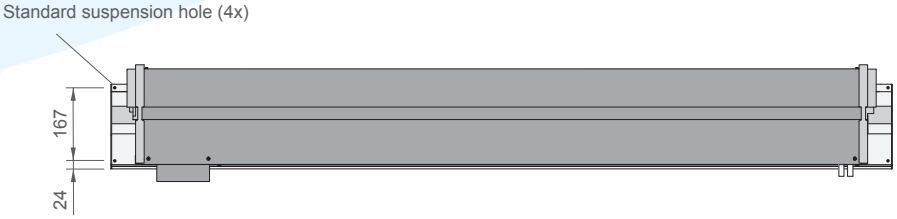


* These suspension holes are supplied when:
Diffuser length < (Plenum length + 80)

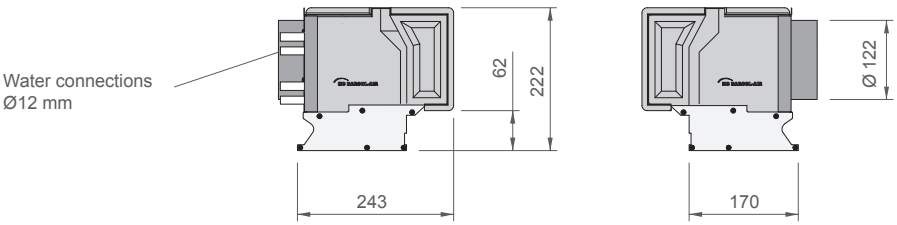
Front view



Bottom view



Top view



Side view

Table: Dimensions

Description		Model			
		1	2	3	Other details
Plenum length	mm	1160	1710	2330	On request
Inlet spigot (diameter)	mm	1x125	1x125	2x125	
Minimum diffuser length	mm	1148	1698	2318	
Weight of unit (minimum diffuser length)	kg	11	15	20	
Weight of extra diffuser length	kg/m	3.4			

Remarks:

1. The maximum diffuser length of each unit is 3600 mm.

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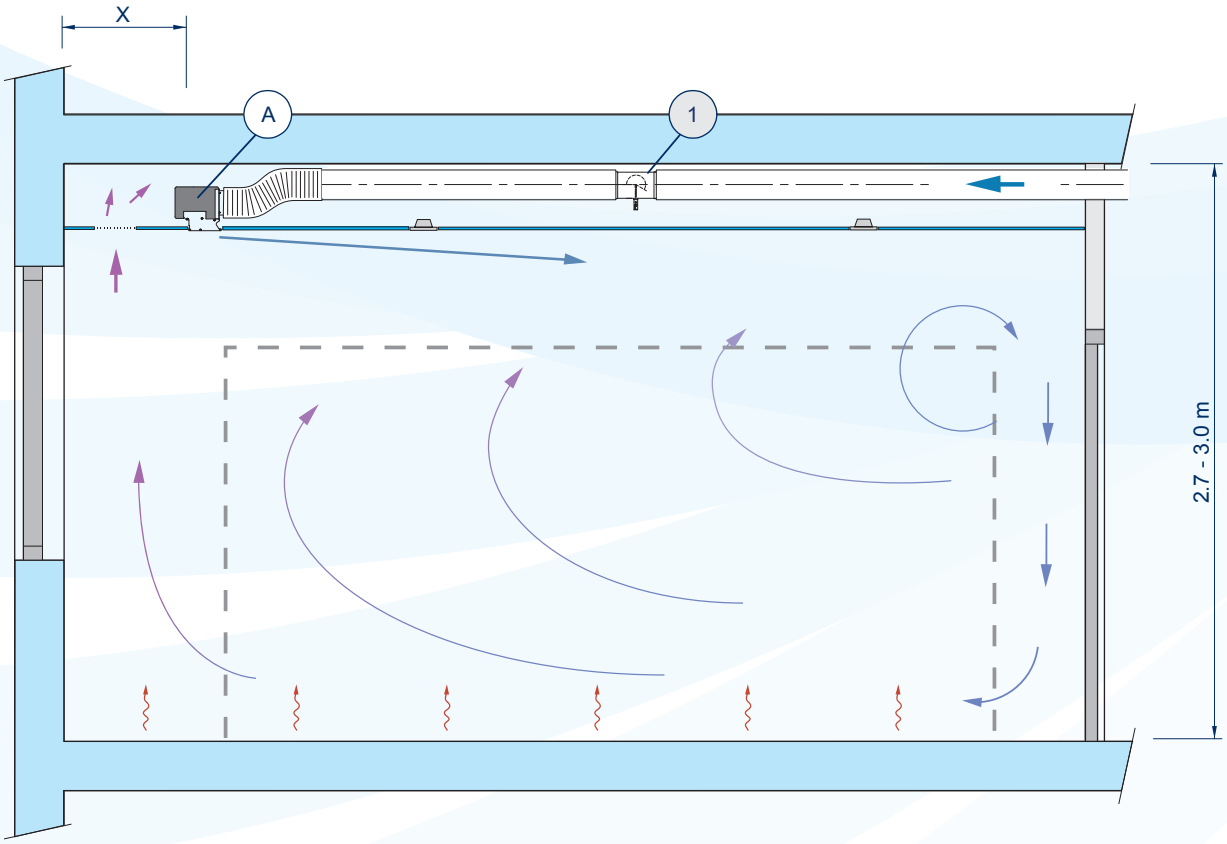
Application

The modular structured AIR-TWIST® is a single-way unit with a fresh air inlet and 4-pipe water-side connections for cooling and/or heating.

The unit can be fitted with a special VAV plenum (see page 20) for rooms with high variation in occupation levels (e.g. meeting rooms or classrooms). The variable quantity of fresh air also makes it possible to control the unit based on CO_2 levels without difficulty.

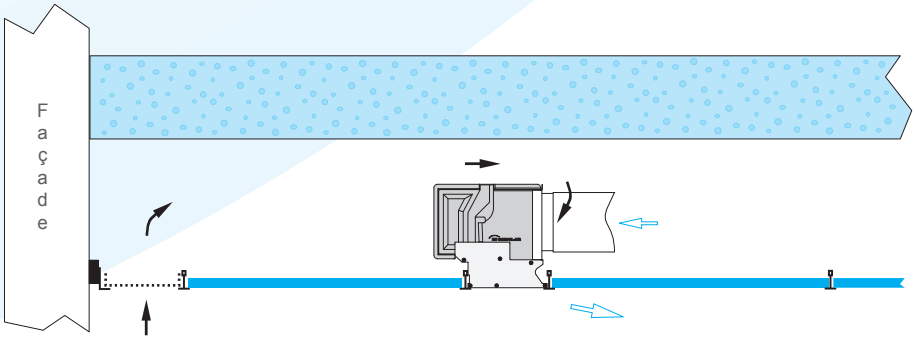


X	Recommended installation 60 – 90 cm from the facade
A	Unit with 1-way discharge pattern
1	Constant volume unit (CAV)
	Comfort zone

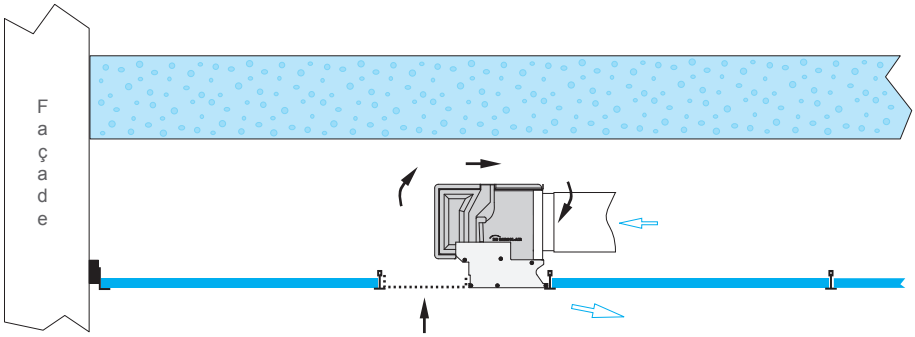
Return air

The AIR-TWIST® offers complete freedom of choice both for return air and for ceiling layout. If a false ceiling has been fitted, an adequate airduct opening will be needed for optimum performance. There are various ways of doing this. Some options are set out below.

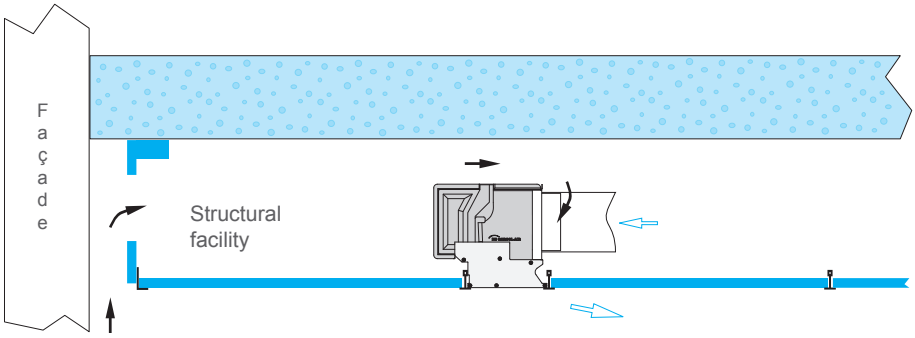
Duct diffuser* between wall and AIR-TWIST®.



Duct diffuser* combined with AIR-TWIST®.



Structural facility in false ceiling



* HC Barcol-Air has various diffuser models in its range of products. Ask about the options.

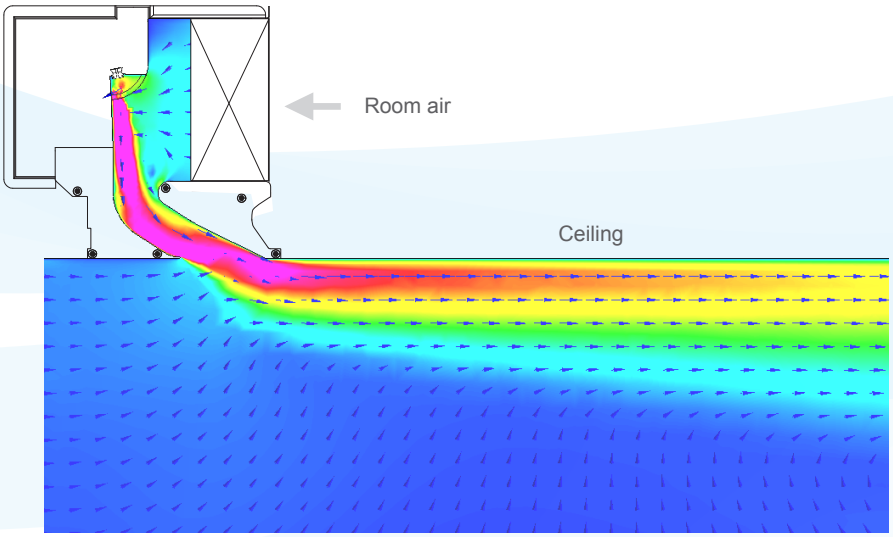
Table: Free passage

Model	1	2	3
Free space required (in cm²)	1100	1800	2200

Remarks:
1. A reduced free passage will reduce the capacity.

Computational Fluid Dynamics (CFD)

For the design of the AIR-TWIST® use was made of modern design tools.
Use has made of CFD software for technical airflow aspects. CFD stands for computational fluid dynamics, in which flows (such as air flows) can be analysed using numerical methods and algorithms.
The figure below presents a clear image of the active flows through the air distribution unit.



CFD illustration AIR-TWIST®

Simulation process

For the simulation the geometry is structured three-dimensionally and the medium is determined by its properties; the medium for the development of diffusers is air. The room conditions are then formulated and properties are allocated to the physical limits, such as the inlet and outlet of an air distribution system. The volume is divided into sufficient small cells (meshing) and the simulation is started. The necessary comparisons are iteratively resolved until a configured level of accuracy is achieved. The result can then be visualised, analysed and, if necessary, validated in a climate room.

Visualisation

There are various ways of providing an insight into the values of the desired variables. This can be done using colour and/or arrows, but it is also possible to generate graphs or tables. A cross section of the model is shown above, indicating the air velocity with various colours.

Analysis

The results can be analysed in order to gain an insight into the supply pattern. This is also a quick way of ascertaining the effect of certain design modifications. This method can be used to optimise a design relatively quickly.

Validation

Even with simple processes the result of a calculation may not be sufficiently accurate, so it remains important to validate predictions. For this reason, this technique was used as a tool for the development of HC Barcol-Air products and the final results were validated using models in our own climate room.

Climate room test in conformity with ISO-7726

Climate room

The climate room of HC Barcol-Air makes it possible to simulate full-scale offices. Measurements are carried out in various setups under summer and winter conditions to determine the room temperatures and the final velocities in the occupation zone. More than 500 full-scale climate tests have been carried out in the past 25 years.

Data Acquisition System

The necessary measurement values are collected and processed using an automatic "LabVIEW®" supported automatic “Data Acquisition System”. “LabVIEW®” is a software package of National Instruments for virtual instrumentation.

Measurement robot

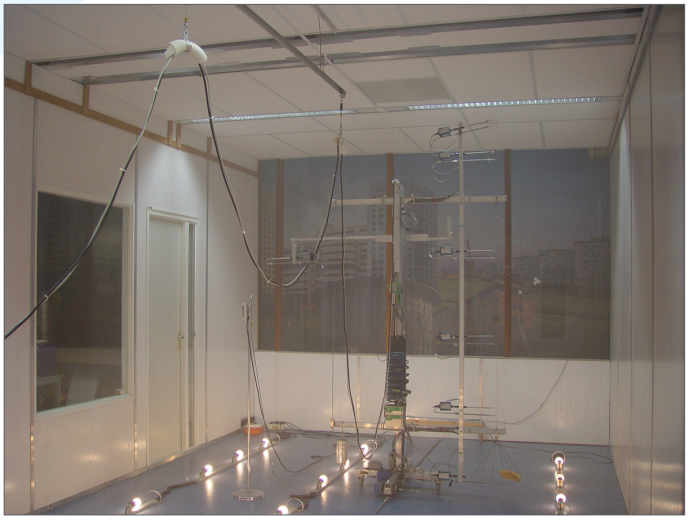
An important component of the measurement system in the full-scale simulated room is the mobile measurement robot with temperature and velocity sensors. The measurement heights are in conformity with the NEN - ISO standards: 0.1 - 0.6 - 1.1 and 1.7 metres above floor level. These heights are in keeping with the ankles, elbows and the head of standing or sitting people. The robot is used to measure the temperatures and velocities in one or - if necessary - several vertical surfaces perpendicular to the wall. More than 100 measurement points are located in each measurement surface, which extends from the floor to the ceiling and from the wall to the passage. An extra sensor is placed outside of the occupation zone in the main measurement area 5 cm under the ceiling to determine the air pattern of the supply diffusers.

Measurement results

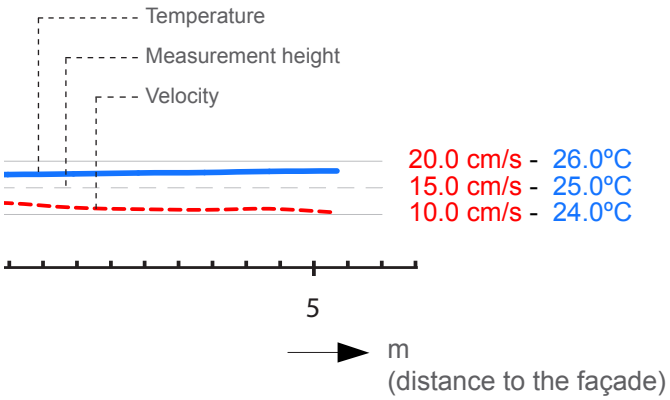
The results of a “LABVIEW®” measurement are presented as follows:

1. Graphic representation of the room temperature and the air velocity profiles in a cross section of the room, the "temperature/velocity traverse”.
2. The same details in table form.

In the temperature/velocity traverses on the vertical axis the temperature is shown in °C and the air velocities in cm/s. Horizontal dotted lines are used to show the measurement height. These lines also serve as a reference for the values measured at that height.



Mock-up climate room



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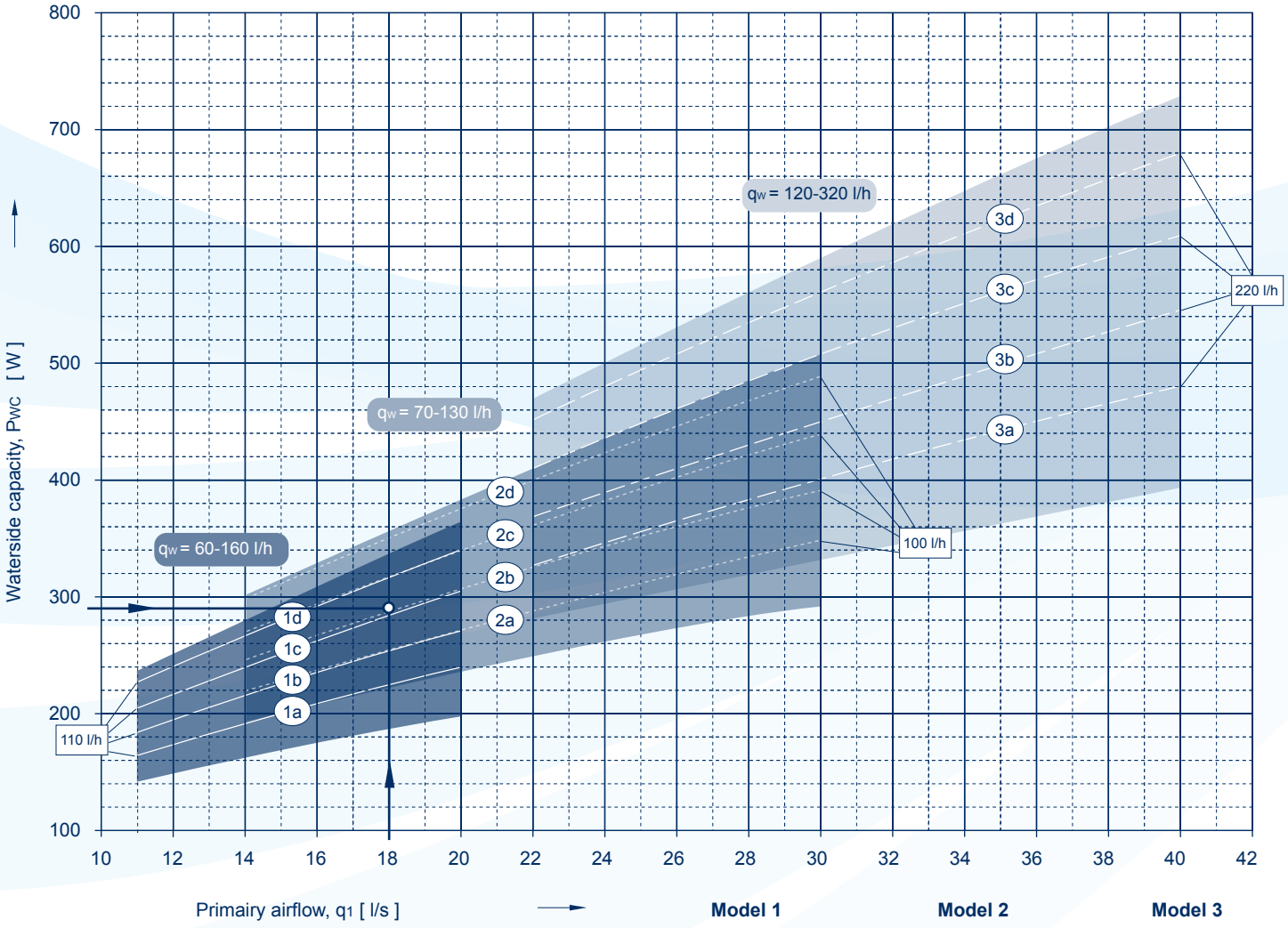
Quick selection

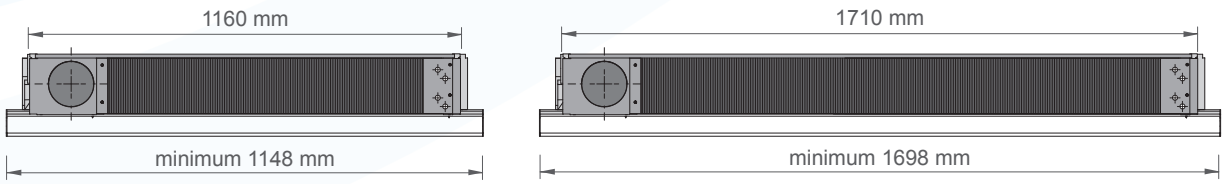
The quick selection is intended to make it easy to choose the right model, after which the length of the diffuser can be determined. Each model has a minimum and a maximum diffuser length.
The choice of model and the exact length of the diffuser (in mm) should be indicated when placing an order.



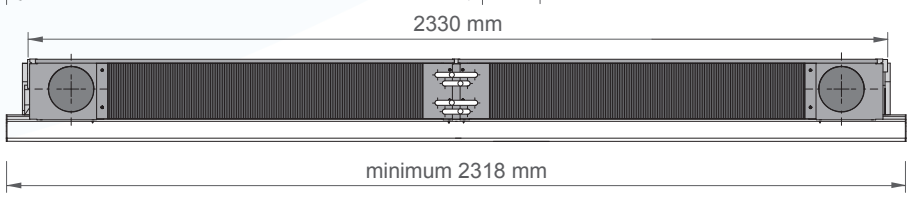
The graph is based on the primary airflow, q_1 in m³/h.
The temperature difference between the inlet water and the room temperature (ΔT_{WC}) and the water quantity (q_w) are variables.

Model 1		Model 2		Model 3	
1d	ΔTwc = 10K	2d	ΔTwc = 10K	3d	ΔTwc = 10K
1c	ΔTwc = 9K	2c	ΔTwc = 9K	3c	ΔTwc = 9K
1b	ΔTwc = 8K	2b	ΔTwc = 8K	3b	ΔTwc = 8K
1a	ΔTwc = 7K	2a	ΔTwc = 7K	3a	ΔTwc = 7K

Model 1 & 2



Model 3



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Selection example

Details:

Office (L x W x H)		=	5.4 x 3.6 x 2.7 m
Fresh air supply (2.5 x ventilation)	q_1	=	36 l/s
Desired diffuser length		=	1795 mm
Desired number of units in the room		=	2
Total cooling capacity at 25°C room temperature (T_{room}), 55% RH	P_{TC}	=	970 W (50 W/m²)
Total heating capacity at 20°C (T_{room}) room temperature	P_{TH}	=	1050 W
Inlet water temperature cooling	$T_{WC,in}$	=	16°C
Inlet water temperature heating	$T_{WH,in}$	=	45°C
Primary air temperature summer	$T_{1,S}$	=	17°C
Primary air temperature winter	$T_{1,W}$	=	18°C

Solution:

Diffuser length:
The quick selection on page 12 shows that both model 1 and model 2 are suitable for the desired diffuser length.

Cooling:
The temperature differences of the primary air and cooling water inlet compared to the room temperature are:

ΔT_{AC}	= 25°C - 17°C (T_{room} - $T_{1,S}$)	= 8K
ΔT_{WC}	= 25°C - 16°C (T_{room} - $T_{WC,in}$)	= 9K
Air side cooling capacity, P_{AC}		= 1.2 * ΔT_{AC} * q_1 ~ 346 W
Water side cooling capacity per unit, P_{WC}		= (P_{TC} - P_{AC}) / 2 = 312 W/unit

Quick selection
The graph on page 12 shows both models 1 and 2 as an option with ΔT_{WC} = 9K and q_1 = 18 l/s

Selection table
The tables (page 14) show for q_1 = 18 l/s and ΔT_{WC} = 9K:
Model 1: P_{WC} = 306 W with q_w = 160 l/h, p_{st} = 181 Pa, L_{pA} = NC 25
Model 2: P_{WC} = 319 W with q_w = 100 l/h, p_{st} = 73 Pa, L_{pA} < NC 20

Heating:
The temperature differences of the primary air and the heating water inlet compared to the room temperature are:

ΔT_{AH}	= 18°C - 20°C ($T_{1,W}$ - T_{room})	= -2K
ΔT_{WH}	= 45°C - 20°C ($T_{WH,in}$ - T_{room})	= 25K
Air side heating capacity, P_{AH}		= 1.2 * ΔT_{AH} * q_1 ~ -86 W
Water side heating capacity per unit, P_{WH}		= (P_{TH} - P_{AH}) / 2 = 568 W/unit

Selection table
The tables (page 16) show for q_1 = 18 l/s and ΔT_{WV} = 25K:
Model 1: P_{WH} = 597 W with q_w = 60 l/h
Model 2: P_{WH} = 660 W with q_w = 60 l/h

Conclusion:
Both model 1 and model 2 meet the requirements in this selection example.
The static pressure (p_{st}), the water side pressure drop (Δp_w) and the noise level (L_{pA}) of model 2 are more favourable.
This could be a reason to opt for model 2.

q_l	p_{st}	Cooling capacity air P_A (W)				Δp_w	q_w	Cooling capacity water P_W (W)								L_{pA}
		$\Delta T_{AC} = T_{room} - T_1$ (K)						$\Delta T_{WC} = T_{room} - T_{water,in}$ (K), $T_{water,in}$ > dew point air								
								7		8		9		10		
(l/s)	(Pa)	7	8	9	10	(kPa)	(l/h)	P_{WC},7K	ΔT_W,7K	P_{WC},8K	ΔT_W,8K	P_{WC},9K	ΔT_W,9K	P_{WC},10K	ΔT_W,10K	(NC)

AIR-TWIST® chilled beam model 1 (plenum length 1160 mm)

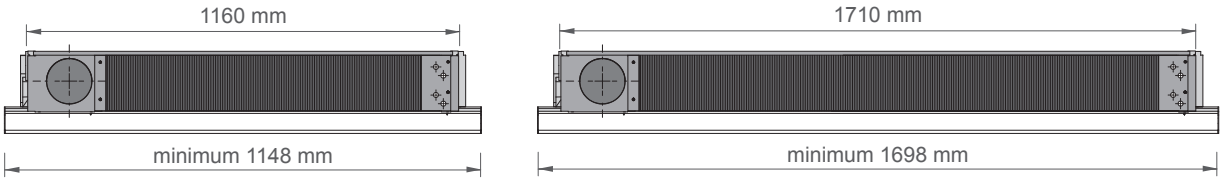
l/s	P_{st}	7	8	9	10	kPa	l/h	P_{WC},7K	ΔT_W,7K	P_{WC},8K	ΔT_W,8K	P_{WC},9K	ΔT_W,9K	P_{WC},10K	ΔT_W,10K	L_{pA}
11	68	93	106	119	133	2.0	60	141	2.0	158	1.9	177	2.1	196	2.3	--
						5.3	110	164	1.3	184	1.2	205	1.3	227	1.4	
						10.0	160	174	0.9	194	0.8	215	0.9	237	1.0	
12	80	101	116	130	145	2.0	60	148	2.1	167	2.1	186	2.3	207	2.6	--
						5.3	110	173	1.3	195	1.3	217	1.5	241	1.6	
						10.0	160	185	1.0	207	0.9	229	1.0	252	1.1	
13	94	110	125	141	157	2.0	60	155	2.2	175	2.2	195	2.5	217	2.8	--
						5.3	110	183	1.4	206	1.4	229	1.6	254	1.8	
						10.0	160	195	1.0	219	1.0	243	1.1	267	1.3	
14	110	118	135	152	169	2.0	60	161	2.3	182	2.4	204	2.7	227	3.0	--
						5.3	110	191	1.5	216	1.5	241	1.7	267	1.9	
						10.0	160	206	1.1	230	1.1	256	1.2	282	1.4	
15	126	127	145	163	181	2.0	60	168	2.4	190	2.6	213	2.9	237	3.2	--
						5.3	110	200	1.5	226	1.6	252	1.8	280	2.0	
						10.0	160	216	1.1	242	1.2	269	1.3	296	1.5	
16	143	135	154	174	193	2.0	60	174	2.4	197	2.7	221	3.0	246	3.4	21
						5.3	110	208	1.6	235	1.8	263	2.0	292	2.2	
						10.0	160	226	1.2	253	1.3	281	1.4	310	1.6	
17	161	144	164	185	205	2.0	60	180	2.5	204	2.8	229	3.2	256	3.6	23
						5.3	110	217	1.7	245	1.9	274	2.1	305	2.3	
						10.0	160	235	1.2	264	1.4	294	1.5	324	1.7	
18	181	152	174	195	217	2.0	60	186	2.6	211	3.0	237	3.3	265	3.7	25
						5.3	110	225	1.7	254	2.0	285	2.2	317	2.4	
						10.0	160	245	1.3	275	1.5	306	1.6	338	1.8	
19	202	160	183	206	229	2.0	60	191	2.7	218	3.1	245	3.5	274	3.9	26
						5.3	110	232	1.8	263	2.1	295	2.3	328	2.6	
						10.0	160	254	1.3	285	1.5	318	1.7	351	1.9	
20	224	169	193	217	241	2.0	60	197	2.8	224	3.2	253	3.6	282	4.1	28
						5.3	110	240	1.8	272	2.1	305	2.4	340	2.7	
						10.0	160	263	1.4	296	1.6	330	1.8	364	2.0	

AIR-TWIST® chilled beam model 2 (plenum length 1710 mm)

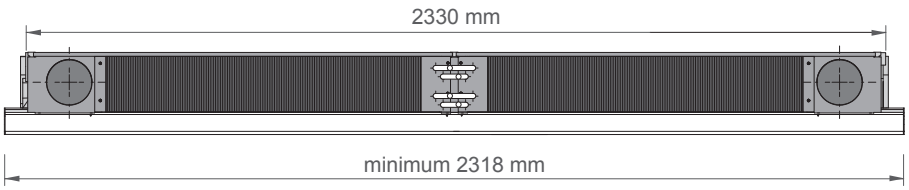
l/s	P_{st}	7	8	9	10	kPa	l/h	P_{WC},7K	ΔT_W,7K	P_{WC},8K	ΔT_W,8K	P_{WC},9K	ΔT_W,9K	P_{WC},10K	ΔT_W,10K	L_{pA}
14	44	118	135	152	169	3.5	70	196	2.4	219	2.6	243	2.9	267	3.2	--
						6.4	100	220	1.9	246	2.1	272	2.3	299	2.5	
						10.1	130	224	1.5	249	1.6	275	1.8	302	2.0	
16	58	135	154	174	193	3.5	70	211	2.5	236	2.8	261	3.2	288	3.5	--
						6.4	100	239	2.0	267	2.3	296	2.5	326	2.8	
						10.1	130	244	1.6	272	1.8	301	2.0	330	2.1	
18	73	152	174	195	217	3.5	70	224	2.7	251	3.0	279	3.4	308	3.7	--
						6.4	100	256	2.2	287	2.4	319	2.7	351	3.0	
						10.1	130	264	1.7	294	1.9	326	2.1	358	2.3	
20	91	169	193	217	241	3.5	70	237	2.9	266	3.2	296	3.6	328	4.0	--
						6.4	100	273	2.3	306	2.6	340	2.9	376	3.2	
						10.1	130	282	1.8	315	2.1	350	2.3	385	2.5	
22	110	186	212	239	265	3.5	70	249	3.0	280	3.4	312	3.8	346	4.2	21
						6.4	100	288	2.4	324	2.7	361	3.1	400	3.4	
						10.1	130	300	2.0	336	2.2	373	2.4	411	2.7	
24	130	203	232	260	289	3.5	70	260	3.1	294	3.5	328	4.0	364	4.4	24
						6.4	100	304	2.6	342	2.9	381	3.2	422	3.6	
						10.1	130	317	2.1	356	2.3	395	2.6	436	2.8	
26	153	219	251	282	314	3.5	70	272	3.3	307	3.7	343	4.1	381	4.6	26
						6.4	100	319	2.7	359	3.0	401	3.4	445	3.8	
						10.1	130	334	2.2	375	2.4	417	2.7	460	3.0	
28	177	236	270	304	338	3.5	70	282	3.4	319	3.9	358	4.3	398	4.8	28
						6.4	100	333	2.8	376	3.2	420	3.5	466	3.9	
						10.1	130	351	2.3	394	2.6	438	2.8	484	3.1	
30	204	253	289	326	362	3.5	70	293	3.5	331	4.0	372	4.5	414	5.0	30
						6.4	100	347	2.9	392	3.3	439	3.7	487	4.1	
						10.1	130	367	2.4	412	2.7	459	3.0	507	3.3	

q_t	p_{st}	Cooling capacity air P_A (W)				Δp_w	q_w	Cooling capacity water P_W (W)								L_{pA}
		$\Delta T_{AC} = T_{room} - T_1$ (K)						$\Delta T_{WC} = T_{room} - T_{water,in}$ (K), $T_{water,in}$ > dew point air								
								7		8		9		10		
(l/s)	(Pa)	7	8	9	10	(kPa)	(l/h)	P_{WC},7K	ΔT_W,7K	P_{WC},8K	ΔT_W,8K	P_{WC},9K	ΔT_W,9K	P_{WC},10K	ΔT_W,10K	(NC)
AIR-TWIST® chilled beam model 3 (plenum length 2330 mm)																
l/s	P_{st}	7	8	9	10	kPa	l/h	P_{WC},7K	ΔT_W,7K	P_{WC},8K	ΔT_W,8K	P_{WC},9K	ΔT_W,9K	P_{WC},10K	ΔT_W,10K	L_{pA}
22	68	186	212	239	265	2.5	120	281	2.0	317	2.2	354	2.5	392	2.8	
						6.3	220	328	1.3	369	1.4	410	1.6	454	1.7	--
						11.6	320	348	0.9	389	1.0	431	1.1	473	1.3	
24	80	203	232	260	289	2.5	120	296	2.1	333	2.3	373	2.6	413	2.9	
						6.3	220	347	1.3	390	1.5	435	1.7	481	1.8	--
						11.6	320	370	1.0	413	1.1	458	1.2	504	1.3	
26	94	219	251	282	314	2.5	120	309	2.2	349	2.5	391	2.8	434	3.1	
						6.3	220	365	1.4	411	1.6	459	1.8	508	2.0	--
						11.6	320	391	1.0	437	1.2	485	1.3	534	1.4	
28	110	236	270	304	338	2.5	120	322	2.3	365	2.6	408	2.9	454	3.2	
						6.3	220	383	1.5	431	1.7	482	1.9	534	2.1	--
						11.6	320	411	1.1	461	1.2	511	1.4	563	1.5	
30	126	253	289	326	362	2.5	120	335	2.4	379	2.7	426	3.0	474	3.3	
						6.3	220	400	1.5	451	1.7	505	1.9	560	2.1	22
						11.6	320	431	1.1	484	1.3	537	1.4	592	1.6	
32	143	270	309	347	386	2.5	120	348	2.4	394	2.8	442	3.1	493	3.5	
						6.3	220	417	1.6	471	1.8	527	2.0	585	2.2	24
						11.6	320	451	1.2	506	1.3	562	1.5	620	1.6	
34	161	287	328	369	410	2.5	120	360	2.5	408	2.9	459	3.2	511	3.6	
						6.3	220	433	1.7	490	1.9	548	2.1	609	2.3	26
						11.6	320	470	1.2	528	1.4	587	1.6	648	1.7	
36	181	304	347	391	434	2.5	120	371	2.6	422	3.0	474	3.3	529	3.7	
						6.3	220	449	1.7	508	2.0	570	2.2	633	2.4	28
						11.6	320	489	1.3	550	1.5	612	1.6	675	1.8	
38	202	321	367	412	458	2.5	120	383	2.7	435	3.1	490	3.5	547	3.9	
						6.3	220	465	1.8	527	2.0	590	2.3	657	2.5	29
						11.6	320	508	1.3	571	1.5	636	1.7	702	1.9	
40	224	338	386	434	482	2.5	120	394	2.8	448	3.2	505	3.6	564	4.0	
						6.3	220	480	1.8	544	2.1	611	2.3	680	2.6	31
						11.6	320	526	1.4	592	1.6	659	1.7	728	1.9	

Model 1 & 2



Model 3



Remarks:

1. *The above selection details apply to a room height of 2.7 - 3.0 m and installation in a level ceiling.*
2. *Recommended installation 60 - 90 cm from the façade.*
3. *Air volumes up to 17 l/s (model 1), 22 l/s (model 2) and 30 l/s (model 3) recommended for areas 5.4 m length.*
4. *Larger air volumes than mentioned in note 3 are recommended to be used for areas 7.2 m length.*
5. *The stated L_{pA}-values are based on a room absorption of 10 dB, noise pressure level lower than NC 20 is stated as --.*
6. *For non-standard selections we advise you to contact our technicians.*
7. *See the definitions on page 23 for an explanation of the symbols used.*

q_t	p_{st}	Heating capacity air P_A (W)				Δp_w	q_w	Heating capacity water P_W (W)								L_{pA}
		$\Delta T_{AH} = T_1 - T_{room}$ (K)						$\Delta T_{WH} = T_{water,in} - T_{room}$(K)								
								15		20		25		30		
(l/s)	(Pa)	-2	-1	0	-2	(kPa)	(l/h)	$P_{WH},15K$	$\Delta T_W,15K$	$P_{WH},20K$	$\Delta T_W,20K$	$P_{WH},25K$	$\Delta T_W,25K$	$P_{WH},30K$	$\Delta T_W,30K$	(NC)

AIR-TWIST® chilled beam model 1 (plenum length 1160 mm)

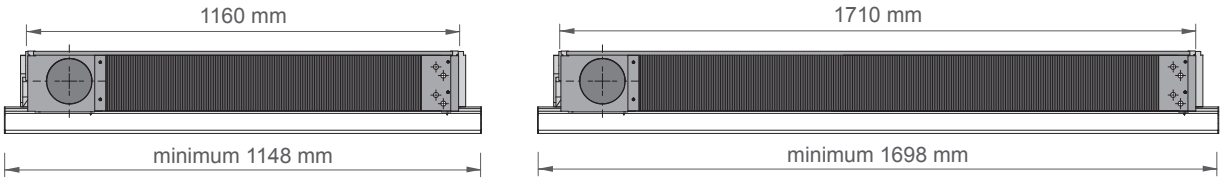
l/s	P_{st}	-2	-1	0	1	kPa	l/h	$P_{WH},15K$	$\Delta T_W,15K$	$P_{WH},20K$	$\Delta T_W,20K$	$P_{WH},25K$	$\Delta T_W,25K$	$P_{WH},30K$	$\Delta T_W,30K$	L_{pA}
11	68	-27	-13	0	13	0.6	60	267	3.8	364	5.2	462	6.6	559	8.0	--
						1.3	90	292	2.8	399	3.8	505	4.8	612	5.9	
						2.3	120	314	2.3	428	3.1	541	3.9	655	4.7	
12	80	-29	-14	0	14	0.6	60	279	4.0	381	5.5	483	6.9	585	8.4	--
						1.3	90	307	2.9	419	4.0	531	5.1	643	6.2	
						2.3	120	332	2.4	452	3.2	572	4.1	693	5.0	
13	94	-31	-16	0	16	0.6	60	291	4.2	397	5.7	504	7.2	610	8.8	--
						1.3	90	322	3.1	439	4.2	556	5.3	674	6.5	
						2.3	120	349	2.5	476	3.4	602	4.3	729	5.2	
14	110	-34	-17	0	17	0.6	60	303	4.3	413	5.9	524	7.5	634	9.1	--
						1.3	90	336	3.2	459	4.4	581	5.6	703	6.7	
						2.3	120	366	2.6	499	3.6	632	4.5	764	5.5	
15	126	-36	-18	0	18	0.6	60	314	4.5	428	6.2	543	7.8	657	9.4	--
						1.3	90	350	3.4	477	4.6	605	5.8	732	7.0	
						2.3	120	383	2.7	522	3.7	660	4.7	799	5.7	
16	143	-39	-19	0	19	0.6	60	324	4.7	443	6.4	561	8.1	680	9.8	21
						1.3	90	363	3.5	495	4.7	628	6.0	760	7.3	
						2.3	120	399	2.9	543	3.9	688	4.9	833	6.0	
17	161	-41	-21	0	21	0.6	60	335	4.8	457	6.6	579	8.3	702	10.1	23
						1.3	90	376	3.6	513	4.9	650	6.2	787	7.5	
						2.3	120	415	3.0	565	4.1	715	5.1	866	6.2	
18	181	-43	-22	0	22	0.6	60	345	5.0	471	6.8	597	8.6	723	10.4	25
						1.3	90	389	3.7	530	5.1	672	6.4	814	7.8	
						2.3	120	430	3.1	586	4.2	742	5.3	898	6.4	
19	202	-46	-23	0	23	0.6	60	355	5.1	484	7.0	614	8.8	743	10.7	26
						1.3	90	401	3.8	547	5.2	693	6.6	840	8.0	
						2.3	120	445	3.2	607	4.4	768	5.5	929	6.7	
20	224	-48	-24	0	24	0.6	60	364	5.2	497	7.1	630	9.1	763	11.0	28
						1.3	90	413	4.0	564	5.4	714	6.8	865	8.3	
						2.3	120	460	3.3	627	4.5	794	5.7	960	6.9	

AIR-TWIST® chilled beam model 2 (plenum length 1710 mm)

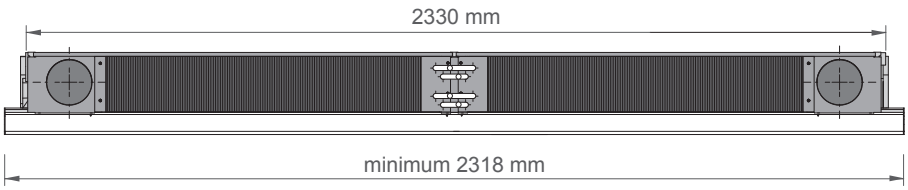
l/s	P_{st}	-2	-1	0	1	kPa	l/h	$P_{WH},15K$	$\Delta T_W,15K$	$P_{WH},20K$	$\Delta T_W,20K$	$P_{WH},25K$	$\Delta T_W,25K$	$P_{WH},30K$	$\Delta T_W,30K$	L_{pA}
14	44	-34	-17	0	17	0.9	60	335	4.8	457	6.6	579	8.3	702	10.1	--
						1.6	80	363	3.9	496	5.3	629	6.8	762	8.2	
						2.4	100	391	3.4	536	4.6	681	5.9	825	7.1	
16	58	-39	-19	0	19	0.9	60	359	5.2	490	7.0	621	8.9	752	10.8	--
						1.6	80	391	4.2	534	5.8	678	7.3	821	8.9	
						2.4	100	424	3.7	581	5.0	737	6.4	894	7.7	
18	73	-43	-22	0	22	0.9	60	382	5.5	521	7.5	660	9.5	800	11.5	--
						1.6	80	418	4.5	571	6.2	724	7.8	877	9.5	
						2.4	100	455	3.9	623	5.4	791	6.8	959	8.3	
20	91	-48	-24	0	24	0.9	60	403	5.8	550	7.9	697	10.0	845	12.1	--
						1.6	80	443	4.8	606	6.5	768	8.3	931	10.0	
						2.4	100	484	4.2	664	5.7	843	7.3	1022	8.8	
22	110	-53	-27	0	27	0.9	60	424	6.1	578	8.3	733	10.5	887	12.8	21
						1.6	80	467	5.0	639	6.9	810	8.7	982	10.6	
						2.4	100	513	4.4	703	6.1	893	7.7	1082	9.3	
24	130	-58	-29	0	29	0.9	60	443	6.4	605	8.7	767	11.0	929	13.3	24
						1.6	80	491	5.3	671	7.2	851	9.2	1031	11.1	
						2.4	100	541	4.7	740	6.4	940	8.1	1140	9.8	
26	153	-63	-31	0	31	0.9	60	462	6.6	631	9.1	799	11.5	968	13.9	26
						1.6	80	513	5.5	701	7.6	890	9.6	1078	11.6	
						2.4	100	567	4.9	777	6.7	987	8.5	1196	10.3	
28	177	-68	-34	0	34	0.9	60	480	6.9	656	9.4	831	11.9	1006	14.5	28
						1.6	80	535	5.8	731	7.9	927	10.0	1124	12.1	
						2.4	100	593	5.1	812	7.0	1031	8.9	1251	10.8	
30	204	-72	-36	0	36	0.9	60	498	7.2	680	9.8	861	12.4	1043	15.0	30
						1.6	80	556	6.0	760	8.2	964	10.4	1168	12.6	
						2.4	100	618	5.3	846	7.3	1075	9.3	1304	11.2	

q_l	p_{st}	Heating capacity air P_A (W)				Δp_w	q_w	Heating capacity water P_W (W)								L_{pA}
		$\Delta T_{AH} = T_1 - T_{room}$ (K)						$\Delta T_{WH} = T_{water,in} - T_{room}$(K)								
								15		20		25		30		
(l/s)	(Pa)	-2	-1	0	-2	(kPa)	(l/h)	$P_{WH},15K$	$\Delta T_W,15K$	$P_{WH},20K$	$\Delta T_W,20K$	$P_{WH},25K$	$\Delta T_W,25K$	$P_{WH},30K$	$\Delta T_W,30K$	(NC)
AIR-TWIST© chilled beam model 3 (plenum length 2330 mm)																
l/s	P_{st}	-2	-1	0	1	kPa	l/h	$P_{WH},15K$	$\Delta T_W,15K$	$P_{WH},20K$	$\Delta T_W,20K$	$P_{WH},25K$	$\Delta T_W,25K$	$P_{WH},30K$	$\Delta T_W,30K$	L_{pA}
22	68	-53	-27	0	27	1.1	120	534	3.8	729	5.2	924	6.6	1119	8.0	
						2.0	180	584	2.8	797	3.8	1010	4.8	1223	5.9	--
						3.2	240	628	2.3	855	3.1	1083	3.9	1310	4.7	
24	80	-58	-29	0	29	1.1	120	558	4.0	763	5.5	967	6.9	1171	8.4	
						2.0	180	615	2.9	839	4.0	1062	5.1	1286	6.2	--
						3.2	240	664	2.4	904	3.2	1145	4.1	1385	5.0	
26	94	-63	-31	0	31	1.1	120	582	4.2	795	5.7	1008	7.2	1221	8.8	
						2.0	180	644	3.1	878	4.2	1113	5.3	1347	6.5	--
						3.2	240	699	2.5	952	3.4	1205	4.3	1458	5.2	
28	110	-68	-34	0	34	1.1	120	605	4.3	826	5.9	1047	7.5	1268	9.1	
						2.0	180	672	3.2	917	4.4	1162	5.6	1407	6.7	--
						3.2	240	732	2.6	998	3.6	1263	4.5	1529	5.5	
30	126	-72	-36	0	36	1.1	120	627	4.5	856	6.2	1086	7.8	1315	9.4	
						2.0	180	700	3.4	954	4.6	1209	5.8	1464	7.0	22
						3.2	240	766	2.7	1043	3.7	1320	4.7	1598	5.7	
32	143	-77	-39	0	39	1.1	120	649	4.7	886	6.4	1123	8.1	1360	9.8	
						2.0	180	726	3.5	991	4.7	1255	6.0	1520	7.3	24
						3.2	240	798	2.9	1087	3.9	1376	4.9	1665	6.0	
34	161	-82	-41	0	41	1.1	120	669	4.8	914	6.6	1159	8.3	1403	10.1	
						2.0	180	752	3.6	1026	4.9	1300	6.2	1574	7.5	26
						3.2	240	829	3.0	1130	4.1	1431	5.1	1731	6.2	
36	181	-87	-43	0	43	1.1	120	690	5.0	942	6.8	1194	8.6	1446	10.4	
						2.0	180	778	3.7	1061	5.1	1344	6.4	1627	7.8	28
						3.2	240	860	3.1	1172	4.2	1484	5.3	1796	6.4	
38	202	-92	-46	0	46	1.1	120	709	5.1	968	7.0	1228	8.8	1487	10.7	
						2.0	180	802	3.8	1095	5.2	1387	6.6	1679	8.0	29
						3.2	240	891	3.2	1213	4.4	1536	5.5	1859	6.7	
40	224	-96	-48	0	48	1.1	120	728	5.2	995	7.1	1261	9.1	1527	11.0	
						2.0	180	827	4.0	1128	5.4	1429	6.8	1730	8.3	31
						3.2	240	920	3.3	1254	4.5	1587	5.7	1921	6.9	

Model 1 & 2



Model 3



Remarks:

1. *The above selection details apply to a room height of 2.7 - 3.0 m and installation in a level ceiling.*
2. *Recommended installation 60 - 90 cm from the façade.*
3. *Air volumes up to 17 l/s (model 1), 22 l/s (model 2) and 30 l/s (model 3) recommended for areas 5.4 m length.*
4. *Larger air volumes than mentioned in note 3 are recommended to be used for areas 7.2 m length.*
5. *The stated L_{pA}-values are based on a room absorption of 10 dB, noise pressure level lower than NC 20 is stated as --.*
6. *For non-standard selections we advise you to contact our technicians.*
7. *See the definitions on page 23 for an explanation of the symbols used.*

Installation examples

AIR-TWIST® combined with CAV unit

The constant primary air volume is controlled by a circular mechanical constant air volume unit.

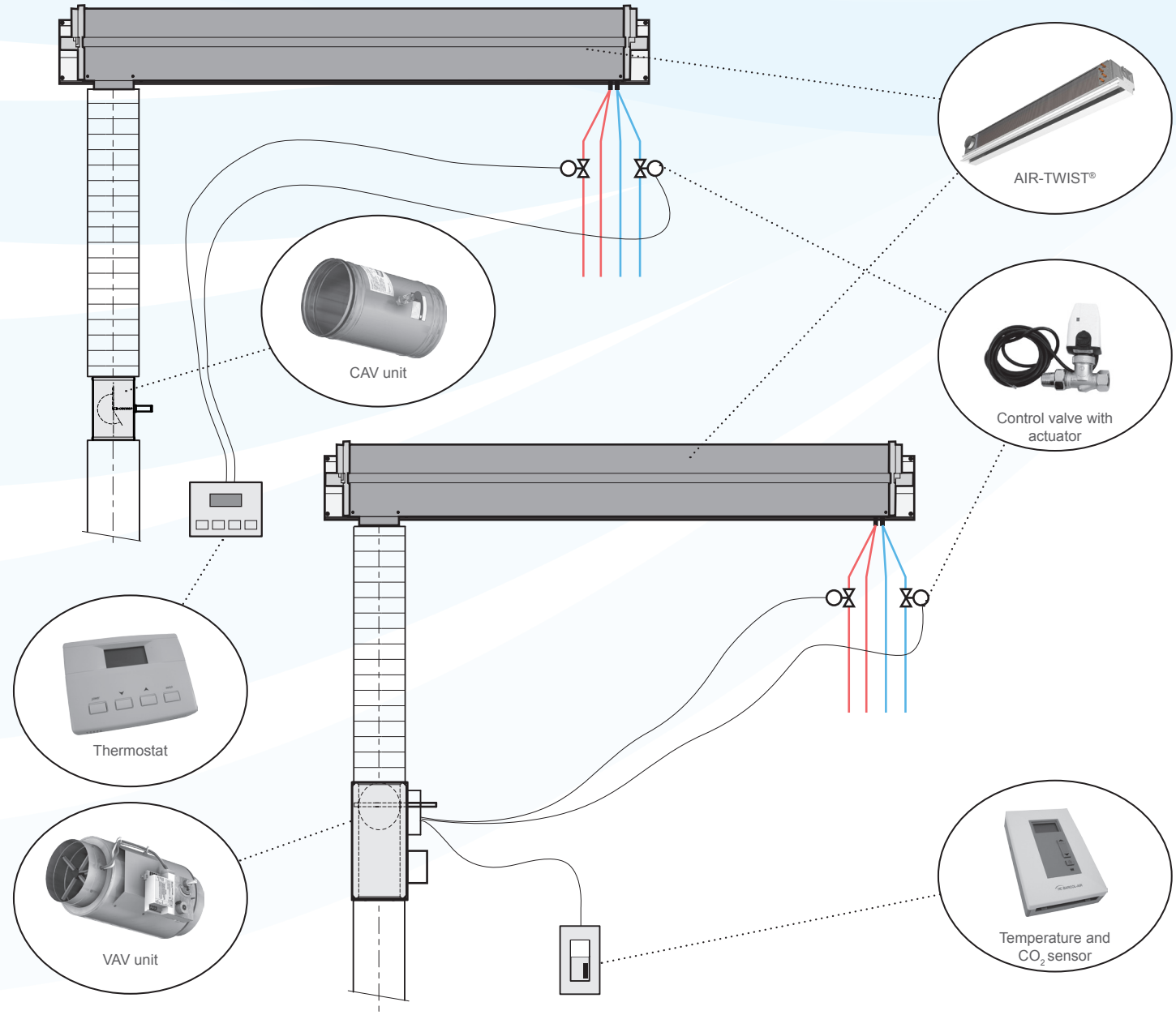
The amount of water passing through the heat exchanger is maintained by control valves with electrothermal actuators, controlled by the wall-mounted thermostat

AIR-TWIST® combined with VAV unit

The variable primary air volume is controlled by a circular pressure independent variable air volume unit.

The amount of water passing through the heat exchanger is maintained by control valves with electrothermal actuators. The valve actuators and the VAV damper are controlled by a LON® or BACnet® I/A Series® DDC controller.

The wall-mounted room thermostat is equiped with a CO_2 , air temperature and relative humidity sensor and can be used in combination with the LON® or BACnet® DDC controller.



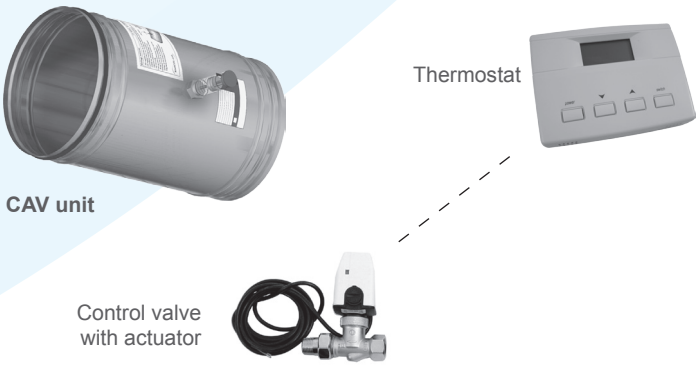
HC Barcol-Air - 04.12
Patent no. 2005294
Changes w/o notice or obligation

Accessories

✓ CAV unit, type NR

The circular mechanical constant volume unit type NR is designed to maintain a constant airflow, independently of the static pressure and without using electronic controls.
Available for air volumes from 11 l/s.

The stand-alone thermostat controls the valve actuator(s).



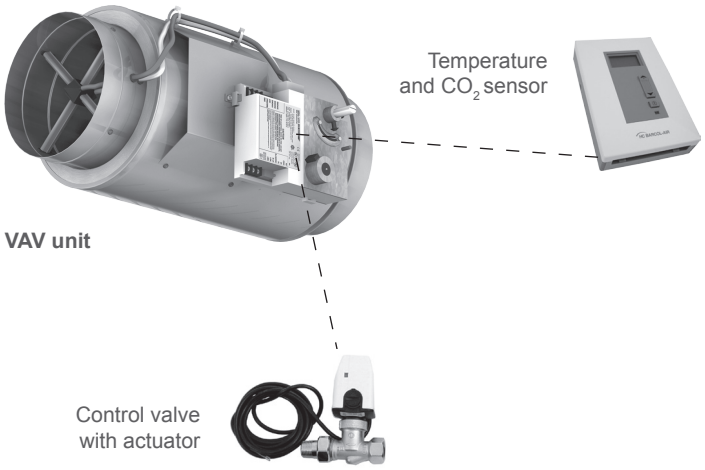
✓ VAV unit, type NA / NB (can be variably regulated)

VAV unit type NA (single wall) or NB (double wall) is a circular pressure independent VAV terminal, suitable for the measurement and regulation of air quantities.

When used as CAV unit the unit constantly maintains the configured air quantity, independently of the pressure. When applied as VAV unit the unit regulators the air quantity supplied to the room, depending on the demand.

Optionally, the VAV unit can be used as CO_2- control. Depending on the air quality, sufficient fresh air is always supplied.

The thermostat communicates to the DDC controller which controls the valve actuator(s)

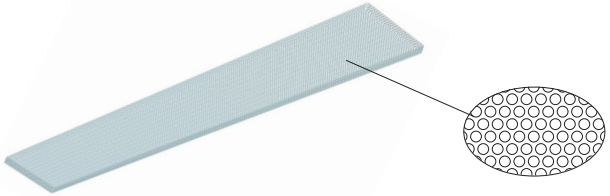


✓ Control technology

By applying the ECO-CONTROL® system of HC RT, the lighting and climate control are fully integrated and the entire room is regulated on a occupancy base. In this situation the amount of supplied energy (lighting and climate) is optimal tuned according to the indivual demand of each individual space and provides up to 40% energy savings.

✓ Return diffuser

Facility used to return sufficient room air above the false ceiling.

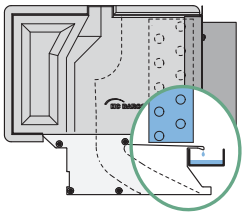


Return diffuser
50% perforated (see detail)

Options

✓ **Drip Tray**

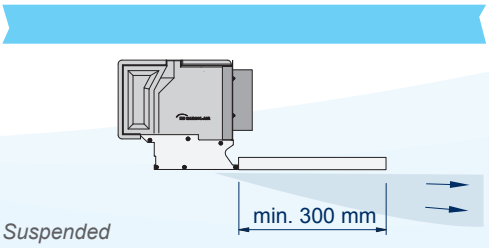
Optionally the AIR-TWIST® can be supplied with a drip tray. This drip tray has been designed as a safety precaution to prevent water leaking damage in the ceiling in area's with high humidity levels and/or for projects where only low water temperatures are available.



Drip tray

✓ **Suspended**

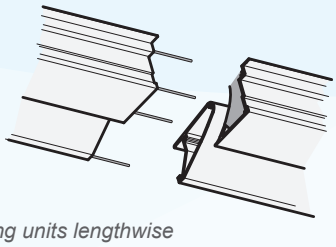
The AIR-TWIST® can be suspended if a panel of at least 300 mm is mounted against the unit so that sufficient 'Coanda effect' can occur and the air will not enter the occupation zone too quickly.



Suspended

✓ **Connecting units lengthwise**

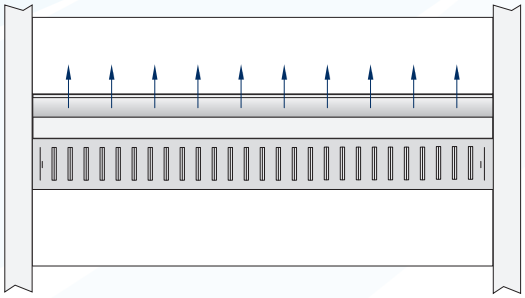
Several AIR-TWIST®'s can be connected lengthwise using alignment pins.



Connecting units lengthwise

✓ **Lighting**

The AIR-TWIST® can be placed with the back directly against a lighting line.



Lighting

✓ **Tapping facility for heat exchanger**

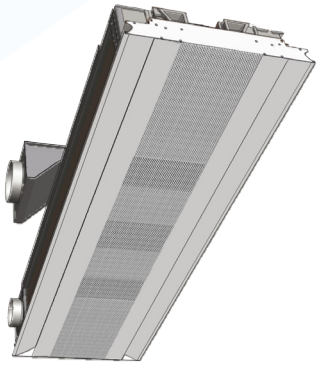
The heat exchanger can be fitted with a tap nipple and/or an air vent nipple.

✓ **Colour finishing**

The standard colour is RAL 9010, 70% gloss grade. Another colour or print finishing can be selected as an option.

✓ **AIR-TWIST® Special**

The unit can be fitted with a special VAV plenum for rooms with an alternating occupation level (e.g. meeting rooms or classrooms).
The combination of CAV, VAV and induced indoor air is mixed and suppllied through the existing lineair diffuser.



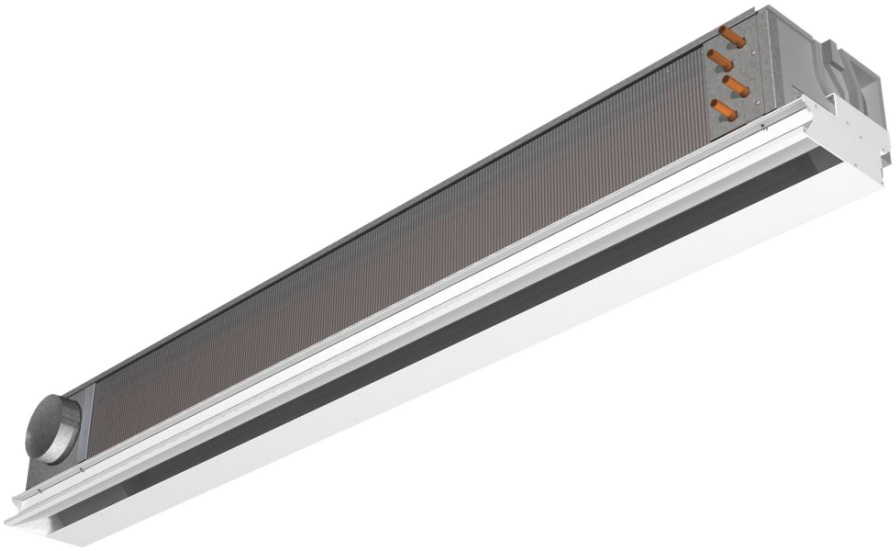
AIR-TWIST® Special: with 2-way discharge pattern and fitted with VAV plenum with special discharge pattern

Specification description

AIR-TWIST® active chilled beam with standard plenum box, fitted with round side spigot and induction above the ceiling. The unit must be suitable for primary air quantities between 11 - 40 l/s. The maximum height of the active chilled beam is 222 mm. The active chilled beam is fitted with a 4-pipe heat exchanger suitable for heating and cooling.

Colour finish: RAL 9010, 70% gloss grade.
HC Barcol-Air type: AT241800-170ROSB.

Standard:
1. The water connection is positioned to the other side than the air connection.
2. The standard colour is RAL 9010, 70% gloss grade.



Standard version AIR-TWIST® - model 2

Product code

A	T	2	4	1	7	9	5	-	1	7	0	R	O	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Position	Code	Description
1 + 2		**Product**
	AT	AIR-TWIST®
3		**Type**
	1	Model 1
	2	Model 2
	3	Model 3
4		**Finishing**
	4	RAL9010, 70% gloss grade (standard)
	1	Different RAL colour finish to be specified
5 + 6 + 7 + 8		**Length**
	BBBB	Actual front length in mm
9		*Division line between length and width*
10 + 11 + 12		**Width**
	170	Standard width (in mm)
13		**Connection**
	L/R	Water side connection, 12Ø mm (left / right) Water right side = air left side
	O	Not applicable for model 3
14		**Options**
	O	To be specified in consultation with our technicians
15		**Plenum box**
	S	Standard plenum box
	1	Special model
16		**Coil configuration**
	A	2-Pipe model (cooling)
	B	4-Pipe model (cooling / heating)
	1	Special model

Remark:
1. *The installation of overlay types requires special profiles, which are available and must be ordered as extra's.*

Symbol index

L_{pA} = Noise pressure level of the unit (NC)
P_{AC} = Air side cooling capacity (W)
P_{AH} = Air side heating capacity (W)
P_{WC} = Water side cooling capacity (W)
P_{WH} = Water side heating capacity (W)
P_{TC} = Total delivered cooling capacity of the heat exchanger + the primary air (W)
P_{TH} = Total delivered heating capacity of the heat exchanger + the primary air (W)
Δp_W = Water side pressure drop over the heat exchanger (kPa)
p_{st} = Static pre-pressure (Pa)
q_1 = Primary air flow (l/s)
q_W = Water flow over the heat exchanger (l/h)
$T_{1,S}$ = Primary air temperature, summer (°C)
$T_{1,W}$ = Primary air temperature, winter (°C)
T_{room} = Room temperature (°C)
$T_{WC,in}$ = Temperature of the inlet water flow over the heat exchanger during cooling (ºC)
$T_{WH,in}$ = Temperature of the inlet water flow over the heat exchanger during heating (ºC)
ΔT_W = Difference between inlet and outlet water temperature over the heat exchanger (K)
ΔT_{WC} = Difference between the room temperature and the temperature of the inlet water flow during cooling (K)
ΔT_{WH} = Difference between the room temperature and the temperature of the inlet water flow during heating (K)
ΔT_{AC} = Difference between the room temperature and the primary air temperature during cooling (K)
ΔT_{AH} = Difference between the room temperature and the primary air temperature during heating (K)

Remarks:

1. *All details given in this catalogue are based on installations used at sea level.*
2. *The primary air conditions (temperature and humidity) should be controlled in such a way that no condensation will occur.*

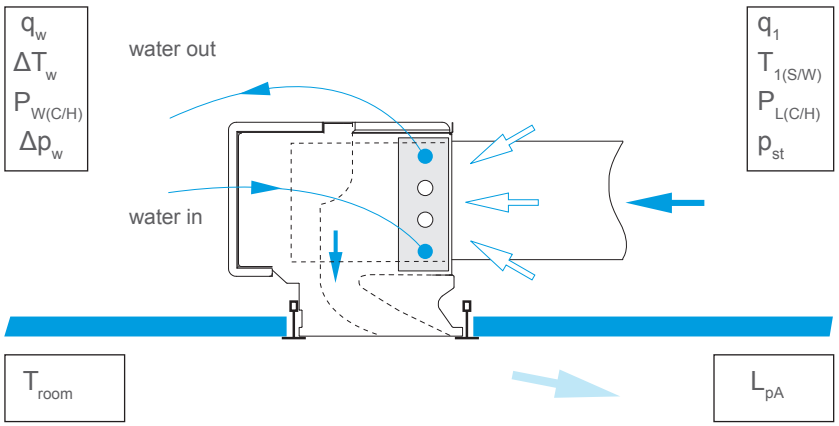


Figure: explanation of the list of definitions (cross-cut)

HC GROEP

HC BARCOL-AIR | AIR DISTRIBUTION

Benefits of AIR-TWIST®:

Sustainable

- ✓ Low energy recyclable (cradle to cradle)
- ✓ CO_2-friendly
- ✓ Low environmental impact
- ✓ Contributes to a higher BREEAM / LEED score
- ✓ Partially made out of recycled raw materials

Flexible

- ✓ Also suitable for renovation projects
- ✓ Less installation and storage space required
- ✓ Freedom of ceiling layout
- ✓ Can be combined with a lighting armature
- ✓ Freedom of choice in finishing
- ✓ Compact and light design

Innovative

- ✓ Streamlined, linear design
- ✓ Minimum visibility
- ✓ Freedom of choice for return air
- ✓ Maintenance-free

Let's Twist!

HC Barcol-Air

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PRODUCT LINE