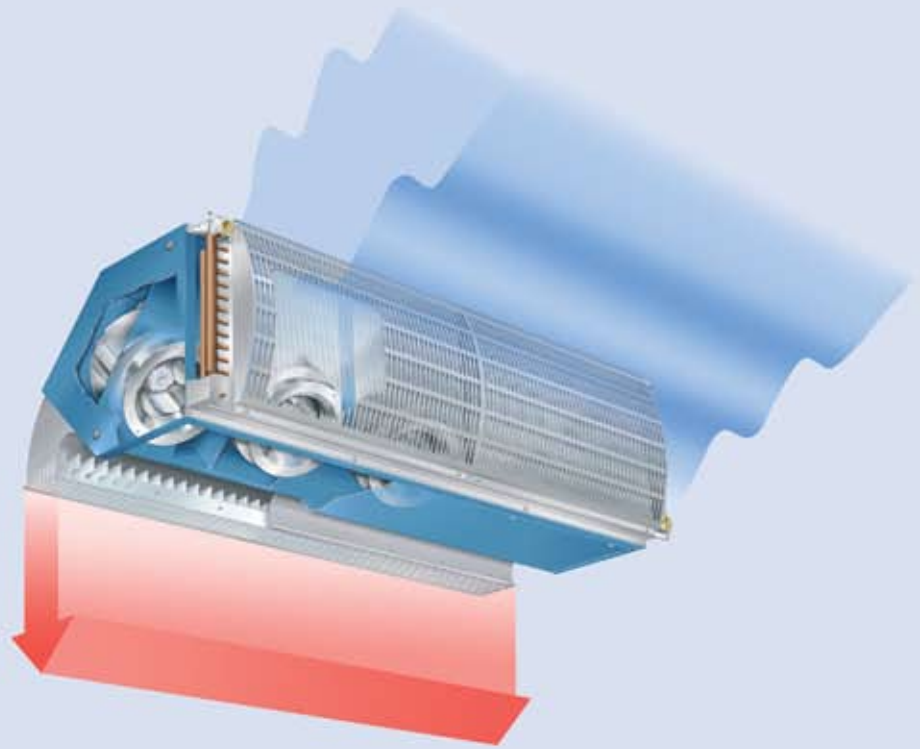




biddle

CLIMATE SOLUTIONS



invisidor[®]
IndAC
INDUSTRIAL AIR CURTAINS

invisidor
IndAC
INDUSTRIAL AIR CURTAINS



Industrial Air Curtains - Invisidor IndAC

Benefits of IndAC

- Free access
- Comfortable working climate
- Suitable for doors with high ventilation problems
- Combines well with overhead door systems
- Distinctive industrial appearance
- Numerous options
- Flexible suspension system
- Easy to control
- Easy to maintain (no filter)

Industrial building doors are often open for long periods of time to facilitate transport in and out of the building. However, open doors result in a loss of heat to the outside and the ingress of cold air. This disturbs the climate within the building, leads to draughts and creates uncomfortable working conditions for staff.

The new Invisidor IndAC air curtains, incorporating patented rectifier technology, special fan design and available in a wide choice of mounting configurations, are an ideal energy efficient solution to these problems.

Available with LPHW or electric heating, IndAC is suitable for doors up to 6m in height or width, and whilst positioning in the horizontal plane above the door is the ideal, it is also possible to install it vertically up one or both sides of the door.

Energy saving solution

Doorways of industrial buildings are usually faced with direct wind attack, or suffer from under-pressure, resulting in large air volumes being introduced into the working area. In order to provide optimum screening, a unit with large air volumes is required in most situations.

By incorporating a patented 'Double Rectifier' the Invisidor IndAC ensures that the turbulent air from the fans is bundled into a laminar air stream, discharging in a straight vertical line to the floor, without any expensive energy being lost to outside. Additionally, the homogenous discharge pattern across the door provides optimum heating of the cold air.

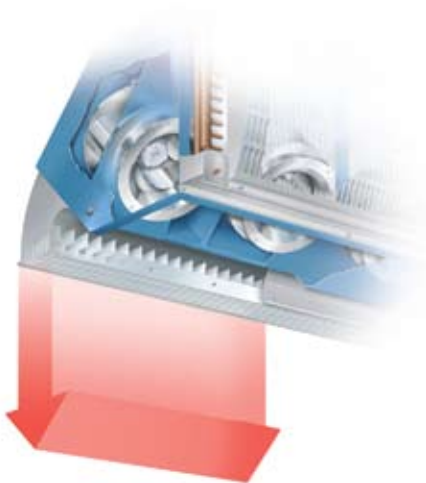
The distinctive, curved design of the discharge section also means that it is easily installed close to the door, preventing cold air bypassing at the side of the doorway.

Control of the units can be as simple or as sophisticated as the user requires, with options for fully automatic control, regulating the heat output to suit the internal and external conditions as they occur.



During loading and unloading the door remains open, without the indoor climate being disturbed.





Patented Double Rectifier

Airflow Technology

When a door is open, the difference between the outside and inside temperature leads to an exchange of air, resulting in cold air entering and warm heated air flowing out. An air curtain above or next to the open door provides separation of the two climates. Whilst developing the Invisidor IndAC, Biddle has researched the outlet discharge pattern. The result is the Double Rectifier.

Patented Double Rectifier

With industrial doorways the air volumes required to deal with climate separation are high. The Double Rectifier, which minimises turbulence in the discharge air stream and surrounding air, ensures that the air movement generated by the fans is directed downward in a deeply penetrating laminar air stream, reducing energy consumption and increasing comfort levels all year round (see figure 1 & 2).

The pressure chamber behind the rectifier evenly distributes the air stream across the whole width of the unit, ensuring air does not bypass at the ends of the unit.

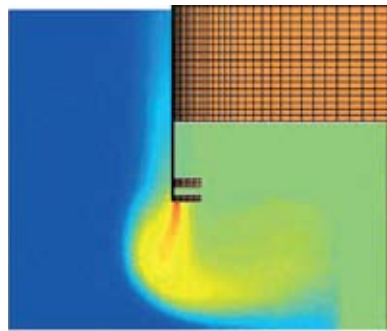


Fig. 1
Industrial air curtain without rectifier

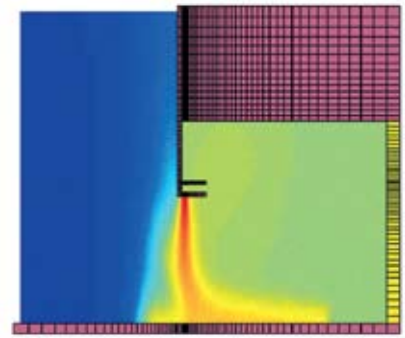


Fig. 2
IndAC with Double Rectifier

Fan Technology – Improved Fan Design

Radial backward curved fans are used in conjunction with the Double Rectifier to provide an evenly distributed air stream pattern across the whole unit width, without dead spots associated with more commonly used individual axial, or centrifugal fans.

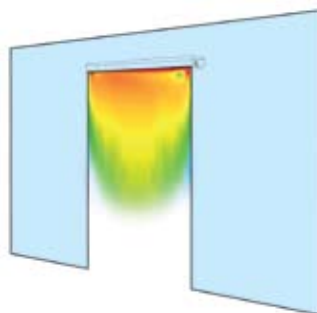


Fig. 3
Industrial air curtain without rectifier

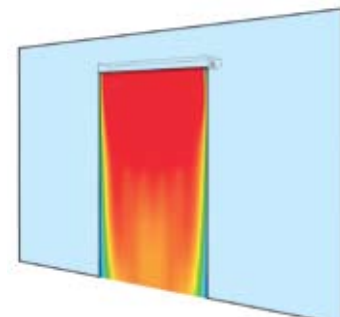
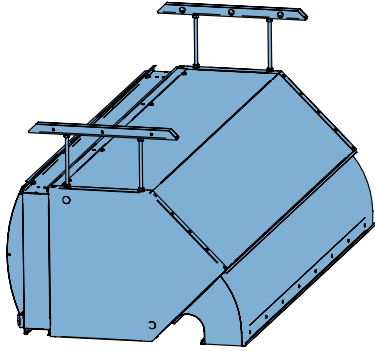


Fig. 4
IndAC with Double Rectifier and backward curved fans



Horizontal installation (position 0)

Modular Design

The modular design of the Invisidor IndAC facilitates the installation of multiple units next to or above each other, in order to cover any door height or width. From standard unit widths of 1.5 & 2.0m, any combination from 3.0m upwards is possible, in 0.5m increments. When joined, multiple units provide a continuous appearance.

Choice of Mounting Positions

The air curtains can be installed directly above or to the side of the doorway – See page 7 for options.

Simple Mounting System

With horizontal installations, the unit is suspended above the door by using four threaded rods (M12) and the suspension brackets supplied.

For vertical installations, the air curtains should be fitted on to the supplied base plate/plinth. Coupling plates and securing brackets hold the units in vertical alignment.

Cleaning & Maintenance

All parts of the Invisidor IndAC have been carefully designed so that there is unhindered access for installation and maintenance. Internal panel work is painted allowing the units to be easily cleaned.

Styling

The styling is robust with round forms, with the colours geared to the latest developments in the industry. Thus the casing is supplied in Blue (RAL 5023), with the grilles finished in a metallic Silver. Other colours are available upon request.



Combines well with overhead door systems.

Air Curtain Selection



The selected air curtain should have sufficient capacity to heat up the cold entering air to a comfortable temperature. Additionally, the unit should be able to screen off the entire doorway.

The selection of an appropriate air curtain depends on:

1. The door height

Door height, or unit mounting height, is measured from the floor to the bottom of the unit.

2. The door width

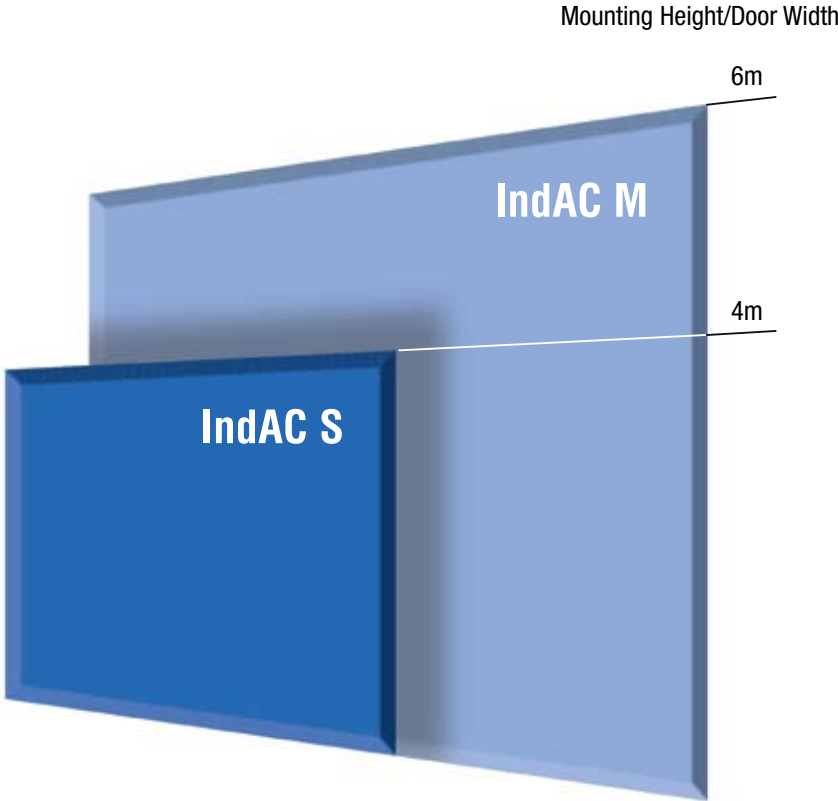
Selected units should be at least as wide or as high as the door opening.

3. The situation

The conditions at a door vary continuously, leading to difficulty in determining the volume and temperature of the outside air, entering the open door. Other aspects such as multiple open doors in a single room, or the orientation of the building may also have a large influence on the capacity needed.

The 'at a glance' selector below will enable a simple selection of the most appropriate product for your entrance. If you are unsure which unit suits your application, please contact the Biddle sales office.

Product Selector





Invisidor IndAC can be installed both horizontally and vertically.

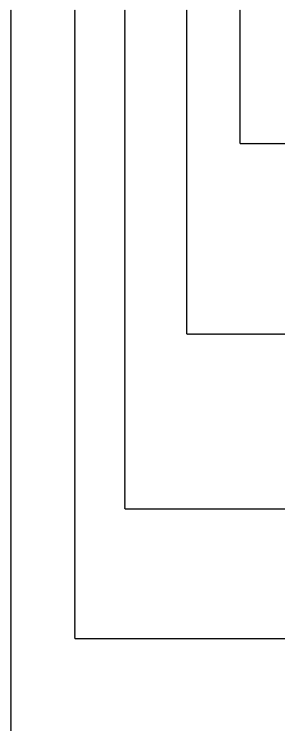
Various Options

The industrial air curtain is available in two capacities: S(mall) and M(edium). There are two lengths to choose from, 1.5 and 2.0 metres, and by combining these two lengths any desired discharge width / or height, from 3.0m, can be achieved. Both types are supplied with either a water heating coil, an electric heating coil, or without any heating coil (Ambient model). The Invisidor IndAC can be positioned horizontally or vertically (see page 7 for options).

Specification Codes

Please use the specification code, explained below:

IndAC - S - 150 - W2 - 2R



Installation Position - See Page 7

- 0 = Horizontal, above door
- 1R = Vertical, right side, square to wall
- 1L = Vertical, left side, square to wall
- 2R = Vertical, right side, parallel to wall
- 2L = Vertical, left side, parallel to wall

Coil Type - See Pages 8 & 9

- W1/W2 = Water Heating
- W3 = Water Heating - low water temperatures
- E = Electrical Heating
- A = Ambient, no heating coil

Unit Length

- 150 = 1500mm
- 200 = 2000mm

Unit Type

- S = S(mall)
- M = M(edium)

Air Curtain Range

- IndAC = Industrial Air Curtain range

Standard Components, Controls & Accessories

Invisidor IndAC is delivered with:

- two suspension brackets - for horizontal installation
- base plate / plinth - for vertical installation
- two coupling plates - for vertical installation
- top securing bracket - for vertical installation
- cables to connect adjoining modules

Additionally one of the three types of controller is supplied (See page 11 for details):

- Basic controller (type RTRD)
- Plus controller (type RDP)
- Automatic controller

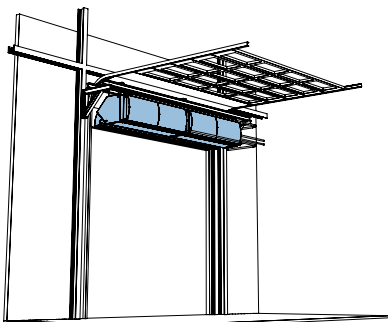
Optional items:

- door contact switch
- room thermostat

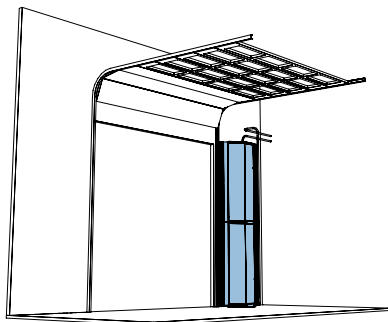
Flexible Installation Positions

The room layout around a door determines where and how an air curtain can be best installed. Thanks to a diverse range of installation positions, the IndAC air curtain can be matched to the possibilities offered by the local situation.

Invisidor IndAC should be positioned above or next to the door, covering the full length or width of the doorway. Depending on the situation, the air curtain is either installed horizontally above or vertically next to the door (to the left or right or on both sides). There are a total of five installation positions, which are shown below.



Horizontal installation (position 0): excellent to combine with overhead door systems.



Example of vertical installation (position 2R): to the right and parallel to wall.

Installation position	Situation	Explanation
0		Horizontal - above door opening
1R		Vertical - right side of door opening - square to wall
1L		Vertical - left side of door opening - square to wall
2R		Vertical - right side of door opening - parallel to wall
2L		Vertical - left side of door opening - parallel to wall

← Air direction ▲ Inspection side ▨ Wall ◻ Door ▬ Ceiling

Note: The installation position is not interchangeable once manufactured. Please ensure the correct model is specified at time of order.

Technical Data

Water Heating

General data		S-150	S-200	M-150	M-200
unit length	m	1.5	2.0	1.5	2.0
door width / height ¹	m	3.0 - 4.0		4.0 - 6.0	
air inlet temperature	°C	15			
electrical supply	V/ph/Hz	400 / 3 / 50			
max. current motors	A	0.96	1.28	1.56	2.08
max. power motors	kW	0.33	0.44	0.81	1.08

IndAC S-150	Speed	W1 LPHW 82/71°C					W2 LPHW 80/60°C					W3 LPHW 60/40°C				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.51	0.79	1.01	1.19	1.43	0.51	0.79	1.01	1.19	1.43	0.51	0.79	1.01	1.19	1.43
air outlet temperature	°C	45	40	38	36	34	50	45	42	40	38	41	37	35	33	32
heating capacity	kW	18.8	24.5	28.3	31.3	34.2	22.2	29.3	33.9	37.4	41.2	16.0	21.3	24.7	27.3	30.1
water flow rate	l/s	0.42	0.55	0.63	0.69	0.76	0.27	0.36	0.41	0.46	0.50	0.19	0.26	0.30	0.33	0.36
water pressure loss	kPa	2.3	3.8	5.0	5.9	7.0	1.0	1.7	2.2	2.7	3.2	0.6	1.0	1.3	1.5	1.8
sound pressure level at 5m	dB(A)	34	44	50	54	59	34	44	50	54	59	34	44	50	54	59
weight	kg	92					95					97				

IndAC S-200	Speed	W1 LPHW 82/71°C					W2 LPHW 80/60°C					W3 LPHW 60/40°C				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.68	1.05	1.35	1.60	1.91	0.68	1.05	1.35	1.60	1.91	0.68	1.05	1.35	1.60	1.91
air outlet temperature	°C	46	41	39	37	35	52	47	44	42	40	43	39	37	35	34
heating capacity	kW	26.1	34.2	39.5	43.5	47.9	30.9	41.1	47.7	52.7	58.2	23.0	30.8	35.9	39.8	44.0
water flow rate	l/s	0.58	0.76	0.88	0.97	1.06	0.38	0.50	0.58	0.64	0.71	0.28	0.37	0.43	0.48	0.53
water pressure loss	kPa	4.9	8.2	10.7	12.9	15.4	2.1	3.6	4.8	5.8	7.0	1.3	2.2	2.9	3.5	4.3
sound pressure level at 5m	dB(A)	35	45	52	56	61	35	45	52	56	61	35	45	52	56	61
weight	kg	119					124					126				

IndAC M-150	Speed	W1 LPHW 82/71°C					W2 LPHW 80/60°C					W3 LPHW 60/40°C				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.76	1.16	1.45	1.61	2.10	0.76	1.16	1.45	1.61	2.10	0.76	1.16	1.45	1.61	2.10
air outlet temperature	°C	41	36	34	33	31	46	41	38	37	35	37	34	32	31	29
heating capacity	kW	24.1	30.5	34.4	36.3	41.1	28.7	36.6	41.6	43.9	49.9	20.9	26.7	30.3	32.0	36.3
water flow rate	l/s	0.54	0.68	0.77	0.81	0.91	0.35	0.45	0.51	0.53	0.61	0.25	0.32	0.37	0.39	0.44
water pressure loss	kPa	3.7	5.7	7.2	8.0	10.0	1.6	2.6	3.2	3.6	4.6	0.9	1.5	1.8	2.0	2.6
sound pressure level at 5m	dB(A)	40	48	53	57	62	40	48	53	57	62	40	48	53	57	62
weight	kg	99					102					104				

IndAC M-200	Speed	W1 LPHW 82/71°C					W2 LPHW 80/60°C					W3 LPHW 60/40°C				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	1.02	1.54	1.94	2.14	2.74	1.02	1.54	1.94	2.14	2.74	1.02	1.54	1.94	2.14	2.74
air outlet temperature	°C	42	37	35	34	32	47	42	40	39	36	39	36	34	33	31
heating capacity	kW	33.6	42.6	48.3	50.9	57.7	40.3	51.6	58.7	62.0	70.7	30.2	38.9	44.3	46.9	53.5
water flow rate	l/s	0.75	0.95	1.07	1.13	1.28	0.50	0.63	0.71	0.76	0.86	0.36	0.47	0.53	0.57	0.64
water pressure loss	kPa	7.9	12.4	15.6	17.3	21.9	3.5	5.6	7.1	7.9	10.0	2.1	3.4	4.3	4.8	6.1
sound pressure level at 5m	dB(A)	41	49	55	58	63	41	49	55	58	63	41	49	55	58	63
weight	kg	128					133					136				

¹ Based on normal circumstances. For selection see page 5.

Technical Data

Ambient units

General data		S-150	S-200	M-150	M-200
unit length	m	1.5	2.0	1.5	2.0
door width / -height	m	3.0 - 4.0		4.0 - 6.0	
electrical supply	V/ph/Hz	400 / 3 / 50			
max. current motors	A	0.96	1.28	1.56	2.08
max. power motors	kW	0.33	0.44	0.81	1.08

IndAC S	Speed	150					200				
		1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.51	0.79	1.01	1.19	1.43	0.68	1.05	1.35	1.60	1.91
sound pressure level at 5m	dB(A)	34	44	50	54	59	35	45	52	56	61
weight	kg	78					101				

IndAC M	Speed	150					200				
		1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.76	1.16	1.45	1.61	2.10	1.02	1.54	1.94	2.14	2.74
sound pressure level at 5m	dB(A)	40	48	53	57	62	41	49	55	58	63
weight	kg	85					111				

Electrical Heating

General Data		S-150	S-200	M-150	M-200
unit length	m	1.5	2.0	1.5	2.0
door width / -height ¹	m	3.0 - 4.0		4.0 - 6.0	
air inlet temperature	°C	15			
electrical supply	V/ph/Hz	400 / 3 / 50			
max. current motors	A	0.96	1.28	1.56	2.08
max. cur. cons. (per phase)	A	45.2	60.9	67.8	91.3
max. power motors	kW	0.33	0.44	0.81	1.08
max. power consumption	kW	31.2	42.0	46.8	63.0

IndAC S	Speed	150					200				
		1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.51	0.79	1.01	1.19	1.43	0.68	1.05	1.35	1.60	1.91
air outlet temperature	°C	27	28	29	30	32	27	28	29	30	32
heating capacity	kW	7.4	12.4	17.3	22.2	29.6	10	16.6	23.3	29.9	39.9
sound pressure level at 5m	dB(A)	34	44	50	54	59	35	45	52	56	61
weight	kg	119					155				

IndAC M	Speed	150					200				
		1	2	3	4	5	1	2	3	4	5
air displacement	m ³ /s	0.76	1.16	1.45	1.61	2.10	1.02	1.54	1.94	2.14	2.74
air outlet temperature	°C	31	31	32	34	33	31	31	32	34	33
heating capacity	kW	14.8	22.2	29.6	37.1	44.5	20.0	29.9	39.9	49.9	59.9
sound pressure level at 5m	dB(A)	40	48	53	57	62	41	49	55	58	63
weight	kg	126					165				

¹ Based on normal circumstances. For selection see page 5.

Explanation Of Technical Data

Heating Capacity Correction Coefficients

The heating capacity of the battery type W1 represented in the tables on page 8 and 9 is based on a water range of 82/71°C. The heating capacity of battery type W2 is based on a water range of 80/60°C and of W3 on 60/40°C. An air inlet temperature of + 15°C has been assumed. When other water temperatures and/or air inlet temperatures are used, the heating capacity is to be multiplied by the appropriate correction factor given below.

Heating capacity correction factors for battery types W1, W2 and W3

Water-temperature	Air inlet temperature														
	+ 5°C			+ 10°C			+ 15°C			+ 18°C			+ 20°C		
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
120/100°C	1.74	2.10	3.72	1.64	1.98	3.51	1.54	1.85	3.30	1.48	1.78	3.17	1.44	1.74	3.08
110/90°C	1.56	1.88	3.35	1.46	1.76	3.12	1.37	1.65	2.93	1.31	1.58	2.80	1.27	1.53	2.72
100/80°C	1.38	1.67	2.97	1.28	1.55	2.76	1.19	1.44	2.55	1.13	1.37	2.43	1.09	1.32	2.35
90/70°C	1.19	1.45	2.58	1.10	1.33	2.38	1.00	1.22	2.17	0.95	1.15	2.05	0.91	1.11	1.97
82/71°C	1.20	n/a	n/a	1.10	n/a	n/a	1.00	n/a	n/a	0.94	n/a	n/a	0.90	n/a	n/a
80/60°C	1.00	1.22	2.18	0.91	1.11	1.98	0.81	1.00	1.78	0.76	0.93	1.66	0.72	0.89	1.68
70/50°C	0.81	1.00	1.78	0.72	0.89	1.59	0.63	0.78	1.39	0.57	0.71	1.28	0.54	0.67	1.20
60/40°C	0.62	0.78	1.39	0.53	0.67	1.19	0.44	0.56	1.00	0.39	0.50	0.89	0.36	0.45	0.81
50/40°C	0.62	0.75	1.33	0.52	0.64	1.14	0.43	0.53	0.94	0.38	0.47	0.83	0.34	0.43	0.76

To increase the service life of the fans as well as for safety reasons, the maximum discharge air temperature allowed is 65°C.

Water Flow Rate

- m_w = water flow rate [l/s]
- Q = capacity [kW]
- ρ_w = density of water (=1) [kg/l]
- C_{pw} = specific heat of water (=4.18) [kJ/kg°C]
- ΔT_w = temperature difference, water [°C]

When water and room temperatures other than the values represented in the tables are used, the water flow rate can be roughly calculated using the formula below. Before doing so, the heating capacity must first be recalculated based on the table above.

$$m_w = \frac{Q}{\rho_w C_{pw} \Delta T_w}$$

Waterside Pressure Loss

- Δp_{w_2} = waterside pressure loss [kPa]
- Δp_{w_1} = waterside pressure loss according to table values [kPa]
- m_{w_1} = water flow rate table values [l/s]
- m_{w_2} = water flow rate calculated using formula [l/s]

When water temperatures other than the values represented in the tables are used, the waterside pressure loss can be calculated using the formula below. To do so, the water volume must first be calculated.

$$\Delta p_{w_2} = \Delta p_{w_1} \left(\frac{m_{w_2}}{m_{w_1}} \right)^2 \text{ [kPa]}$$

Sound

- T = reverberation value, deviating room [s]
- T_0 = reverberation value ref. room [s] (see table)
- V = volume, deviating room [m³]
- V_0 = volume, reference room [m³] (see table)
- n = number of units

The sound data represented on pages 8 and 9 were measured at a distance of 5m from the device, in a room with a reverberation time of 0.8 seconds and with a volume of 2500m³. If a unit is used in a deviating room, or if multiple devices are used in a single room, the sound pressure level must be recalculated. This can be done using the formula below. The relevant table value can be found in the tables on pages 8 and 9.

$$\text{table value} + \left(10 \cdot \log \left(\frac{T}{T_0} \right) - 10 \cdot \log \left(\frac{V}{V_0} \right) + 10 \cdot \log (n) \right) \text{ [dB(A)]}$$

Control Options

Three types of controller are available: Basic, Plus or Automatic. The control panel allows you to control the climate separation between the inside and outside air, in a simple and comfortable way.



Basic controller (RTRD) with neon indicator.

1. Basic Controller (RTRD)

The five-speed switch allows you to match the volume of air to different conditions. The RTRD controller has a rotary control switch for five speeds, a neon indicator and an input for a door contact switch or thermostat.

2. Plus Controller (RDP)

The Plus controller has two five-speed switches:

Position 1: with open door

The rotary speed switch is set to the desired operating position for when the doorway is in use - door open. This speed/or setting is activated by a door switch wired to the controller.

Position 2: with door closed

When the door is closed, the unit returns to a lower speed setting, again selected with the rotary speed switch, and adjusted to the desired operating position. This setting is generally lower than the position 1 setting so that the air curtains act as a background heating device. A room mounted thermostat is connected to the controller to switch off the units when the desired indoor temperature is achieved.



The control panel has the following dimensions: 600 x 330 x 205 mm (l x w x d).

3. Automatic Controller

In situations where doors must be open frequently and for longer periods of time, it is difficult to ensure a constant indoor temperature as the external conditions can change continuously throughout the day. The automatic controller is developed to economically create a comfortable indoor climate in these changing situations.

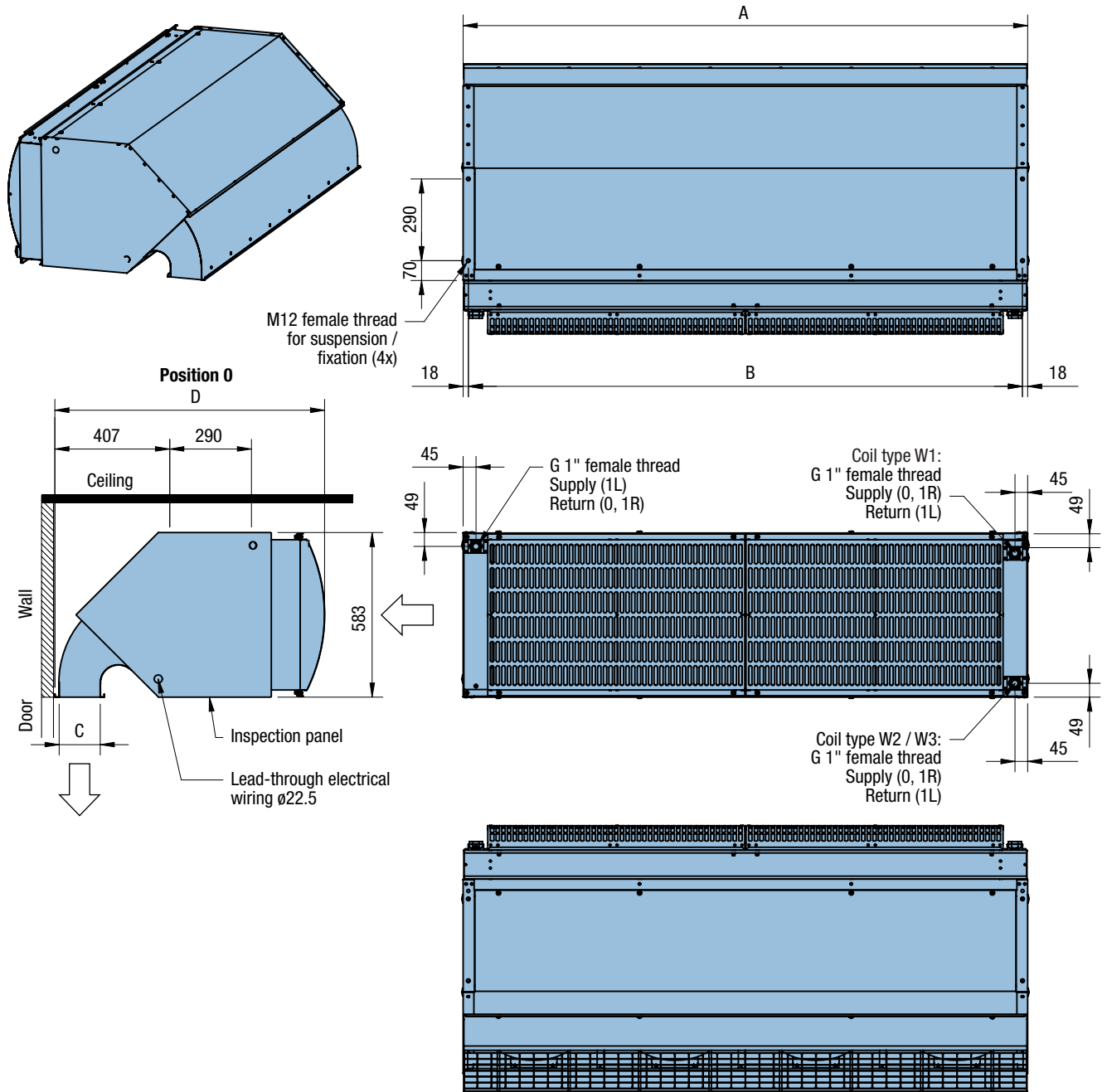
The controller operates by controlling both the water/or electric heating capacity and the fan speed to provide an automatically adjusted air flow and heat output, matched to the particular climate requirements. This controller ensures that only the heat energy required is used.

The controller has an automatic five speed operation, plus sensor inputs from:

- Integrated floor sensor
- Internal temperature sensor
- External temperature sensor

Dimensional Sketches

Installation position¹ horizontal (0) and vertical, square to wall (1R and 1L)



Type	A	B	C
IndAC S-150	1500	1464	104
IndAC S-200	2000	1964	104
IndAC M-150	1500	1464	146
IndAC M-200	2000	1964	146

Coil type	D
Water	956
Ambient	853
Electric	976

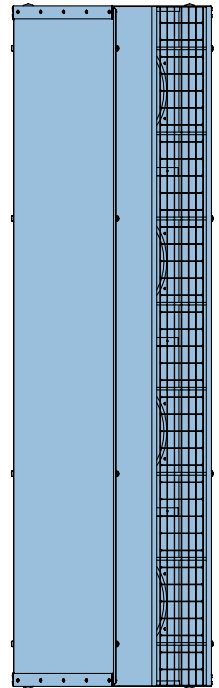
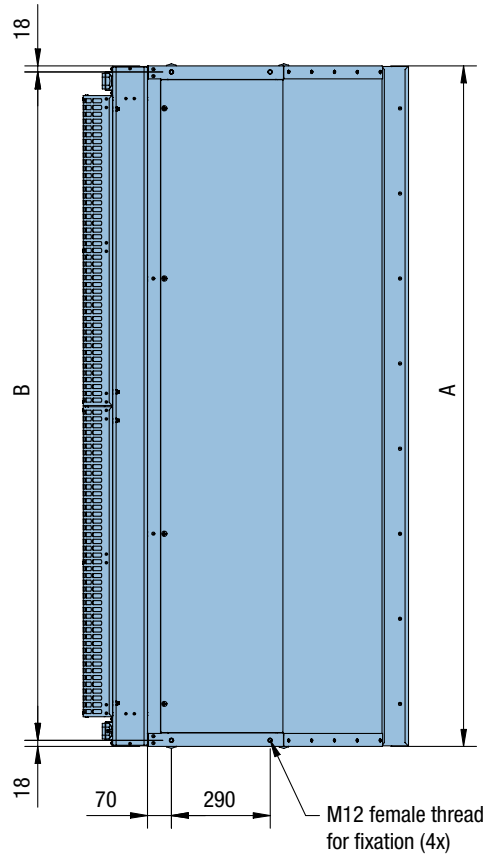
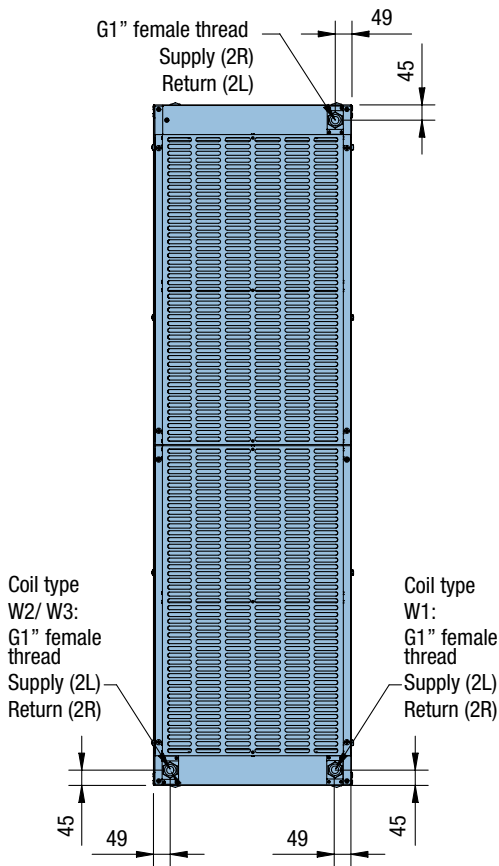
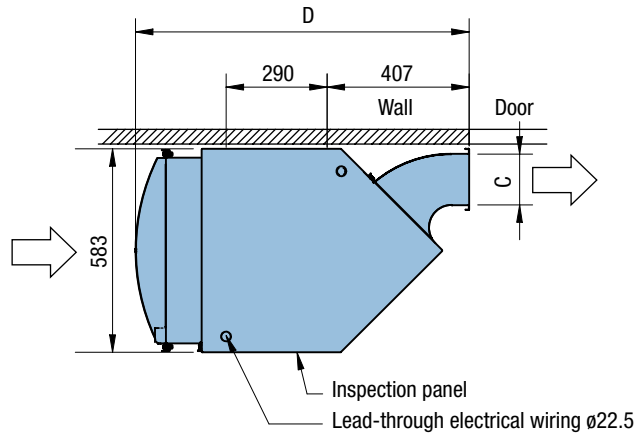
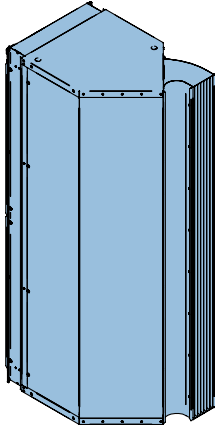
Notes:

• The type without heating element (= ambient) does not have water connections.

¹ For explanation of installation positions see page 7.

Dimensional Sketches

Installation position¹ vertical, parallel to wall (2R and 2L)



Type	A	B	C
IndAC S-150	1500	1464	104
IndAC S-200	2000	1964	104
IndAC M-150	1500	1464	146
IndAC M-200	2000	1964	146

Coil type	D
Water	956
Ambient	853
Electric	976

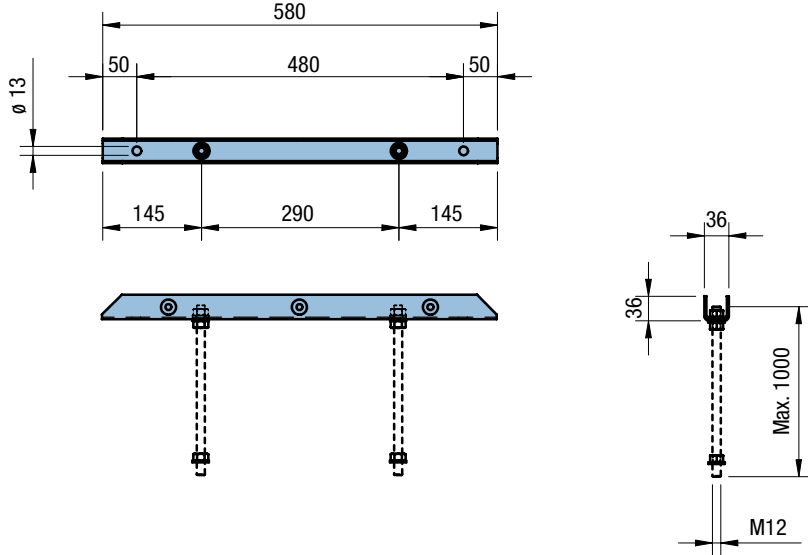
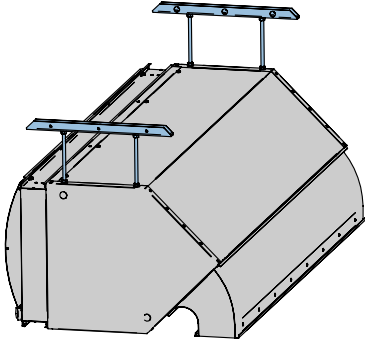
Notes:

• The type without heating element (= ambient) does not have water connections.

¹ For explanation of installation positions see page 7.

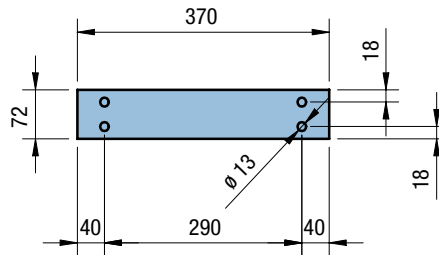
Dimensional Sketches

Horizontal Installation: Suspension Brackets

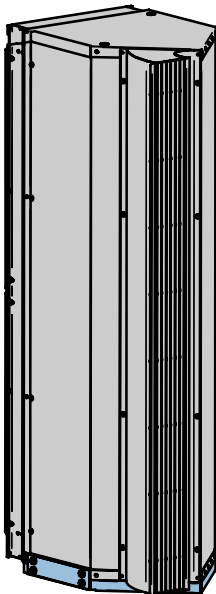
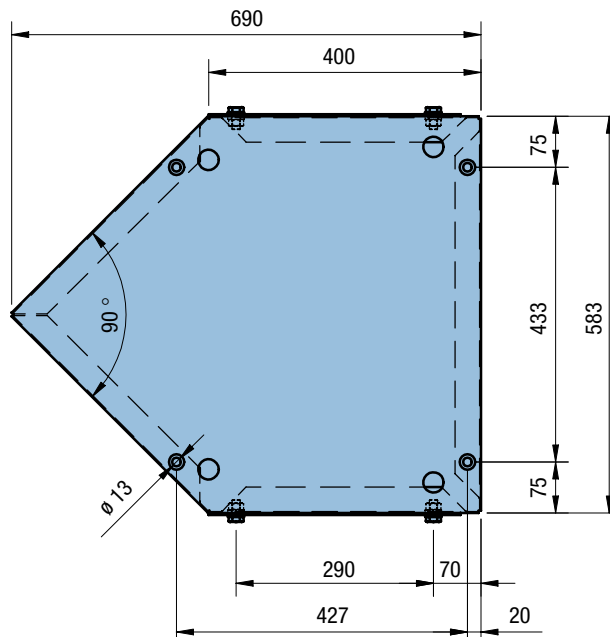


Vertical Installation

Coupling plate



Base plate / plinth



Notes:

- With horizontal installation, two suspension brackets are supplied as standard.
- With vertical installation, two coupling plates, a securing bracket (not drawn) and a base plate/plinth are supplied as standard.
- Threaded rods are not supplied as standard.

Specification

Casing

The casing and the inlet grille are manufactured from zinc coated steel, extra strengthened to minimise deformations and vibrations. The main casing is supplied in Blue (RAL 5023) and the grilles are finished in Silver. Other colours are available upon request.

Fan/Motor Assembly

The radial backward curved fans are mounted in the casing such that they cause no vibration. Fans are direct driven and fitted with sealed for life bearings. The fan casing and impellers are manufactured from Aluminium. Motors are rated to protection class IP44.

LPHW Heating Coil

Heating coils are manufactured with 1/2" Copper tubes and Aluminium fins. The water connections are G1" female thread. Coils are suitable for a maximum operating pressure of 8 bars at 125°C. Higher temperatures and pressures are available upon request.

Electric Heating Coil

The electric heating coil is manufactured with Aluminium fins and is controlled electronically. As a safety feature, when the unit is switched off, the fans will continue to rotate until the fins have cooled sufficiently. The elements are fitted with high temperature cut-out thermostats to prevent overheating.

Grilles

All units are supplied with a patented 'Double Rectifier' for the discharge air stream. Units have inlet grilles without filters and are easily removable for cleaning and maintenance of the air curtain. The outlet rectifier has an Aluminium finish.

Electrical Connections

The Invisidor IndAC is supplied fully wired. The wiring included makes it easy to interlink multiple units. Apart from the interconnecting wiring, only the mains supply cables needs to be connected.



IndAC with electrical heating.



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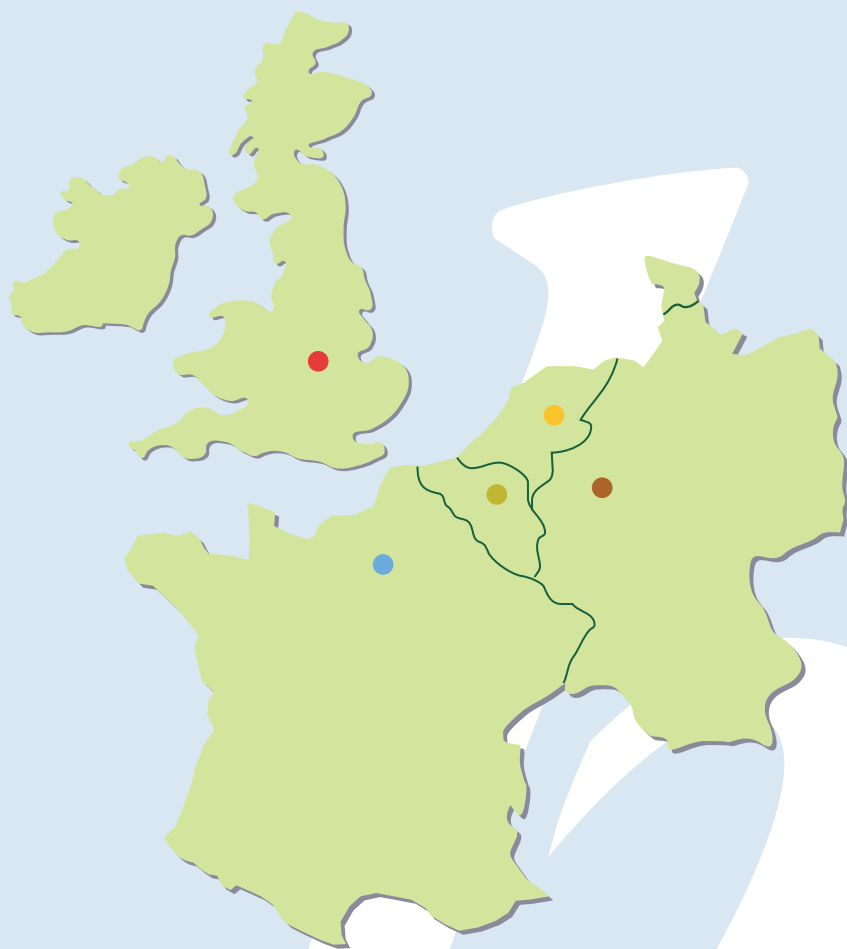
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