

Lindab **Carat**

Passive radiant chilled beam

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Passive radiant chilled beam Carat

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Passive radiant chilled beam Carat



Use

Lindab's passive radiant chilled beam Carat has a high radiation quotient of approx. 35% (compared to approx. 5% for traditional finned products).
This gives great freedom in placing, when installing Carat, yet keeps air velocities low.

Carat can be used for cooling (and for limited requirements for heating also).
It can be equipped with the Regula Connect condensation guard feature. It offers many possibilities and great flexibility. For example, it is possible to paint Carat any colour you want.

Installation

Carat is installed suspended or above a perforated suspended ceiling.

Carat can be supplied with different connection options, and supplies cooling, with a low air velocity, to the room below, depending on whether the passive radiant chilled beam is to be installed individually or in series.

Worth noting

The radiation quotient of Carat is as high as 35%, which results in low air velocities when the beam is placed above a perforated suspended ceiling. A low air velocity ensures a good indoor climate and eliminates the risk of draft problems.

Basically, the high radiation part of Carat is the key when used for heating.

Lindabs passive radiant chilled beams are Eurovent-certified and tested according to EN-14518.

Key figures

Length:	1200 - 6000 mm (steps of 100 mm)
Width:	310, 440, 580, 710, 840 mm
Height:	147 mm
Capacity:	1850 W

Calculation setup
Room temp: 25°C, Water temp: 14-17°C.

Passive radiant chilled beam Carat

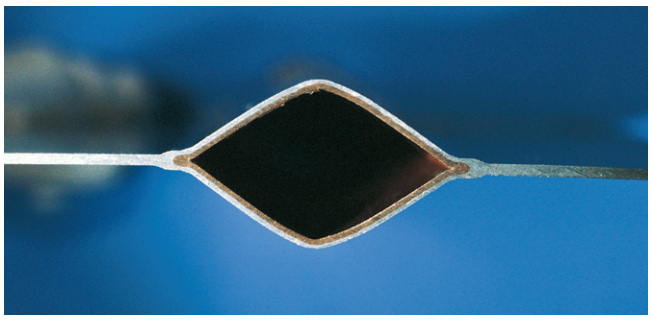
Radiation exchange in passive radiant chilled beams creates no air movement

Function

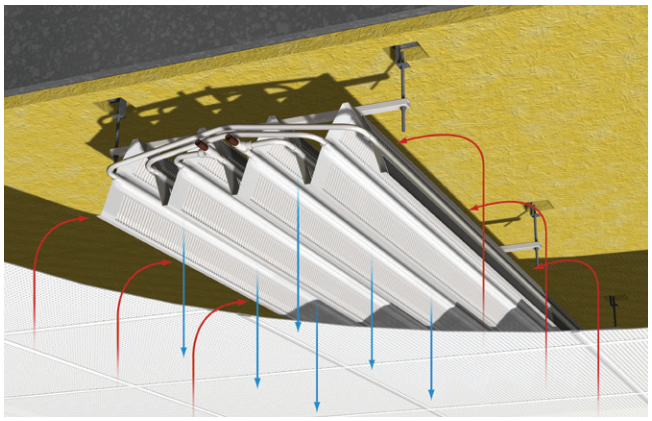
As cold water passes through the passive radiant chilled beam, the warm air from the room is cooled on the cold surface of the beam.
The cooled air (which has a higher density) then streams through the passive radiant chilled beam and down into the room (see Picture 2). This leads to air circulation in the room, where warm air from the room is continually replaced by cooled air. The cold surfaces of the beam also absorb heat radiation from warmer surrounding surfaces.

The high radiation quotient leads to direct heat exchange between the cold surfaces of the beam and the warm surfaces in the room.
The radiation quotient for Carat is approx. 35% of the total emitted cooling effect. This is a high quotient, compared to conventional finned battery beams, which have a radiation quotient of approx. 5%.

Direct heat exchange, through a high quotient of radiation to the room surfaces, and a high cooling effect, even at lower room temperatures, allows a large amount of cold to be stored efficiently in the building structure during low-load periods.
The overall result is that Carat gives off more cooling energy during a 24-hour period than a finned battery beam. This means that a lower room temperature can be achieved.



Picture 1. Cross-section of Lindab's unique strips. The rhomboid shape provides an efficient heat-transfer surface.



Picture 2. How Carat works.

Optimal design

Construction

Carat is a passive radiant chilled beam that absorbs heat by both radiation and convection. By optimising the beam's radiation quotient, output has been increased by 50% compared to finned battery beams, without increasing the risk for drafts.

Carat is based on a method that is unique in the world: in a cold-rolling process, the copper pipe is connected by metallurgical bonding to a gilled aluminium sheet.

The energy transfer between the cooling surface and the water circuit is made more efficient, which results in a high cooling effect per surface unit.
The technology for the metallurgical bonding of copper and aluminium renders galvanic corrosion impossible.

Carat is available in widths from 31 cm to 84 cm. The length can vary from 1.2 m to 6.0 m.

Carat provides a high cooling effect per surface unit, which leads to resource-efficiency and a low weight for the product. Carat is made of 100% recyclable materials.

The water pipes are made of copper. Nevertheless, the water should be oxygen-free to prevent corrosion.

Easy to clean

Hygiene

Carat's surface area is four times smaller than that of a corresponding finned battery beam with the same performance.

All parts of the product are accessible for cleaning and inspection.

These qualities, together with the relatively strong aluminium plate, make Carat easy to wipe and clean.

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Passive radiant chilled beam Carat

Data, Standard version

Carat is a passive radiant chilled beam that absorbs heat by both radiation and convection and is installed above a perforated suspended ceiling or exposed.

Lengths:
Carat is available in lengths from 1,2 m to 6.0 m, in steps of 0.1 m.

Width:
Carat is available in five widths: 31, 44, 58, 71 and 84 cm (see Pictures 8 to 12, on page 7).

Height:
All models are 147 mm high.

Water connection:
Carat is available with a variety of connection dimensions, 10, 12, 15, 22 and 28 mm, depending on the product's width and connection options.

Surface treatment:
Carat is powder-coated.

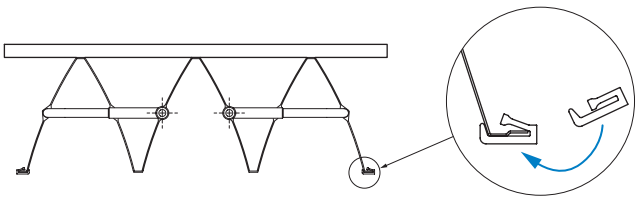
Installation:
Carat is mounted horizontally.

Colour:
The product is available as standard, in signal white RAL 9003, in pure white RAL 9010 or jet black RAL 9005, gloss value 30. Other RAL colours on request.

Plus features

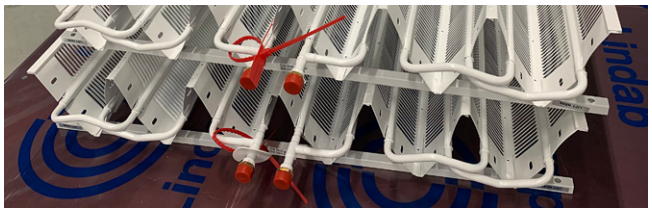
Factory preinstalled.

Edge list:
For a nicer design or overall visual upgrate an aluminium edge can be pressed on two sides of the panel and powder coated in same colour.

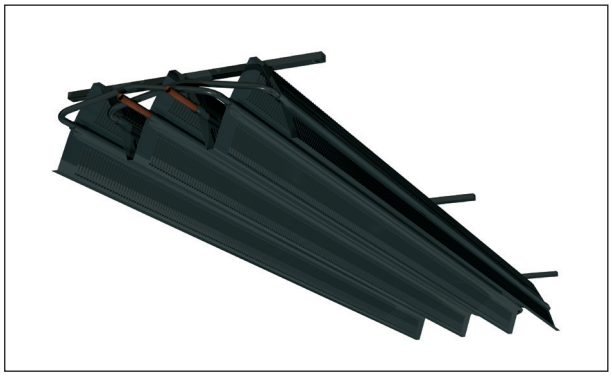


Picture 3. Carat with Edge list.

Water connection:
BSP straight or bended connection fittings with thread (12 mm, 15 mm or 22 mm) can be soldered to the pipes.



Picture 4. Carats with BSP fittings and protection caps.

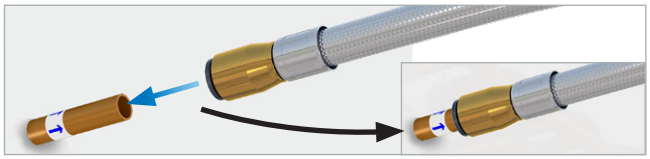


Picture 5. Carat with black coating.

Accessories

Delivered separately.

Flexible water connection:
For flexible connection, an oxygen diffusion impermeable, flexible hose with JG push-on couplings or other coupling types (on demand) are available. See "Accessories" document.



Picture 6. Example of water connection cooling outlet with push-on flexible hose.

Lindab offers water connection sets - LinCon including everything needed to connect your Lindab water product to the central piping system. See also the "Accessories" document.

Control:
Refer to the chapter Regula.

Hangers:
For recommended installation principles (see: "Carat Installation Instruction").

All these different hangers are available at Lindab:

-pendulum hangers (in different sizes)
-threaded rods M8

For additional accessories please refer to the "Accessories" document on www.lindQST.com.

Passive radiant chilled beam Carat

Dimensioning

The specific dimensioning of the passive radiant chilled beam can be easily done with our waterborne calculator in our online quick selection tool LindQST.
Calculate the Carat here



Picture 7. LindQST - Indoor Climate Designer

LindQST® helps you select the right waterborne products, e. g. active chilled beams, passive radiant chilled beams, radiant cooling- and heating panels and facade units and quickly finds the corresponding documentation.

In *Waterborne Documentation* you can easily find all available product documentation. Always in the latest version.

In *Waterborne Calculator* you can do a professional calculation based on your specific input data to finetune your choice or calculate different variants of the product. Smart warnings piont out if a set-up will not work.

In *Waterborne Selector* you can compare the proposed products according to your specific reguirements and select the one which fits best to your needs .

Not enough? With *Indoor Climate Designer* you can insert your selected waterborne product into your room and simulate the actual air distribution, optimise the placing in the ceiling taking into account the calculated air velocities and sound levels.

You can at anytime display your selection and calculations graphically. In addition, you can print or save all results and related documents for your documentation (incl. data sheets, dxf-files and room books).

With lindQST® you will easily find the most suitable product for your project.

It provides easy and quick access to the latest product information, technical specifications and assembly instructions on the internet, making it the ideal tool for installers, consultants and architects alike.
www.LindQST.com

- Easy access to all current documentation.
- Fast design of waterborne products.
- Indoor Climate Designer: Graphical representation of the spatial situation in 2D / 3D and floor plans from AutoCAD®.
- Calculation of capacities, sound power levels, pressure losses and flow conditions.
- 3D particles or smoke show the air distribution in the room.
- Diagram showing the time course of the CO_2 concentration in the room.
- Room book generation and data sheet for individual rooms and outlets or entire projects.
- Project can be saved and exchanged in its own project area.
- Fast product selection waterborne products in accordance to Eurovent (chilled beams and facade units).

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Passive radiant chilled beam Carat

Versions



Picture 8. Carat -31



Picture 9. Carat -44



Picture 10. Carat -58



Picture 11. Carat -71



Picture 12. Carat -84

Passive radiant chilled beam Carat

Air velocities in the living area, depending on the cooling capacity

Extensive measurements show that if Carat is placed above a metal perforated suspended ceiling, air velocities in the occupied zone are reduced, compared to a suspended product.

The extent of the reduction depends on the suspended ceiling's degree of perforation.
Diagram 1 shows the air velocities for Carat with different cooling capacitys for four different perforations, as well as for suspended installation of Carat and for finned battery beams.

The output is also reduced compared to a suspended installation. For cooling capacity, refer to diagram 2, page 11.

Air velocities are reduced when Carat is placed above a metal perforated suspended ceiling, the reason for this is that the perforated sheet is cooled by the increased radiation exchange between

Carat and the perforated metal. Moreover, the cold air spreads under the beam and increases the area of the cold surface.

At the same time, the volume of air that passes through the perforated ceiling decreases; i.e. there is a change from convection to radiation.
Radiation exchange in passive radiant chilled beams does not create any air movement.

Minimum flow

Please note that flows below the recommended minimum water flow q_{wmin}, can result in unwanted air in the water pipes.

Exceeding the nominal flows is not recommended as the capacity gains will only be minimal.

For minimal (q_{wmin}) and nominal water flows (q_{wnom}) please refer to page 9, table 1.

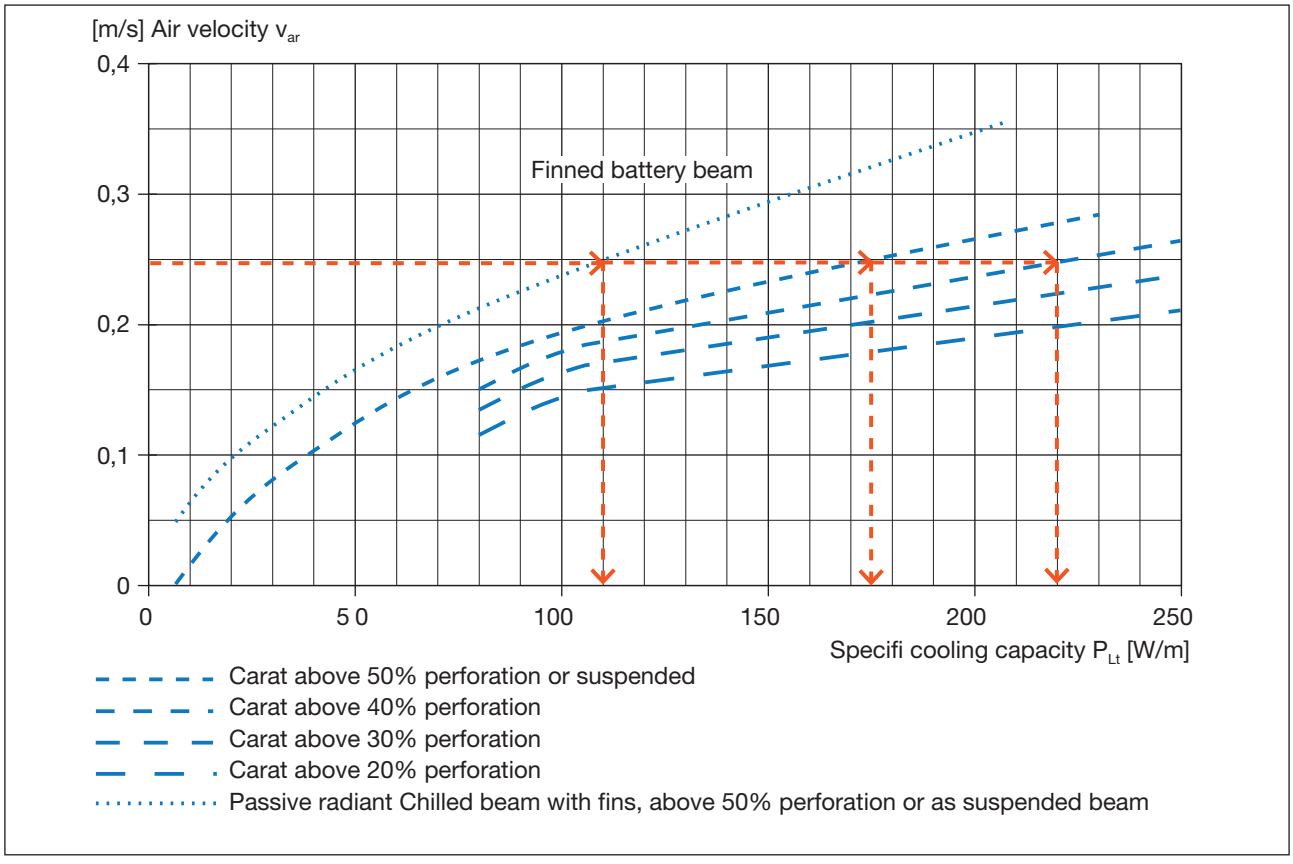
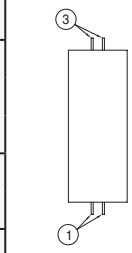
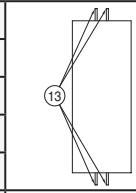
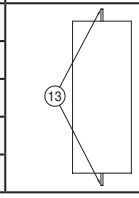


Diagram 1. Air velocity v_{ar} as a function of specific cooling capacity P_{Lt} for passive radiant chilled beams.

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Passive radiant chilled beam Carat

Couplings & connections

Model	Coupling options	Pipe diameter [mm]	q_{wmin} [l/s]	q_{wnom} [l/s]	Number of parallel flows
Carat-31		10	0.015	0.025	1
		12	0.030	0.050	2
Carat-44		10	0.015	0.025	1
		15	0.045	0.075	3
Carat-58		10	0.015	0.025	1
		12	0.030	0.050	2
		15	0.060	0.100	4
Carat-71		10	0.015	0.025	1
		15	0.075	0.125	5
Carat-84		10	0.015	0.025	1
		12	0.030	0.050	2
		15	0.045	0.075	3
		22	0.090	0.150	6
Carat-31		12	0.030	0.050	2
Carat-44		15	0.045	0.075	3
Carat-58		15	0.060	0.100	4
Carat-71		15	0.075	0.125	5
Carat-84		22	0.090	0.150	6
Carat-31		15	0.060	0.100	4
Carat-44		22	0.090	0.150	6
Carat-58		22	0.120	0.200	8
Carat-71		22	0.150	0.250	10
Carat-84		28	0.180	0.300	12

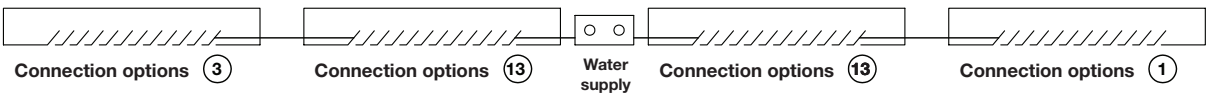


Table 1. Carat's couplings & connections.

Due to of the beam's "gills", its surface structure looks different, depending on the direction from which it is viewed.

If products connected in series are to have the same appearance, the connection point should be oriented in the same direction throughout the room.

Note! Connection option 13 can be turned in both directions.

Weight, water content and material data

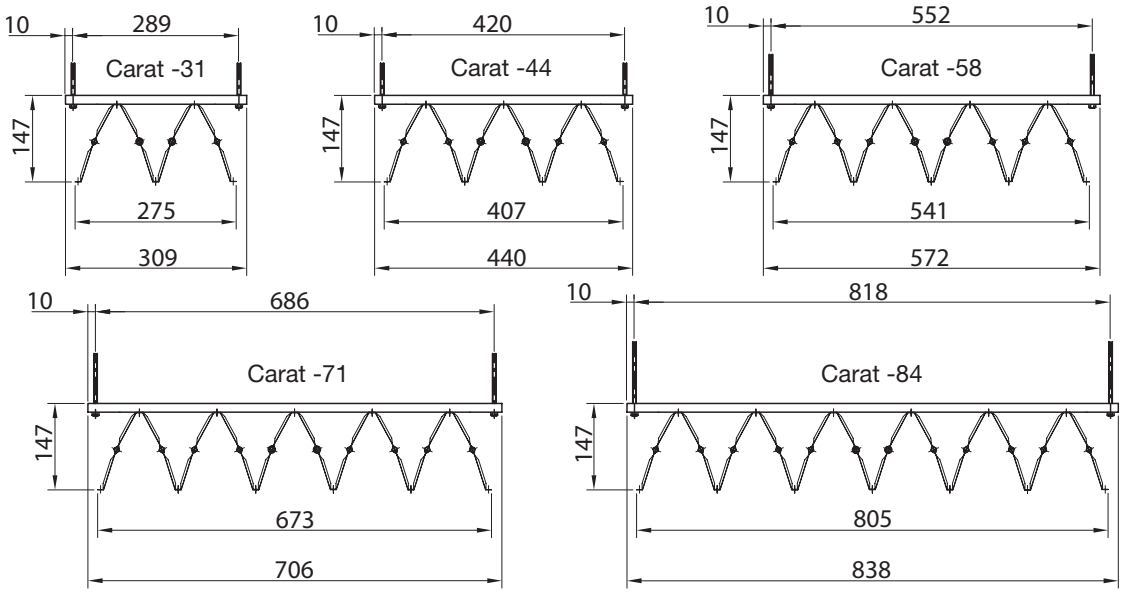
	Carat-31	Carat-44	Carat-58	Carat-71	Carat-84
Dry weight, [kg/m]	1.7	2.5	3.3	4.2	5.0
Water content, [l/m]	0.4	0.5	0.7	0.9	1.06
Copper pipes, quality	EN12735-2 CU-DHP				
Pressure class	PN10				

Table 2. Carat's weight, water content and material data.

Passive radiant chilled beam Carat

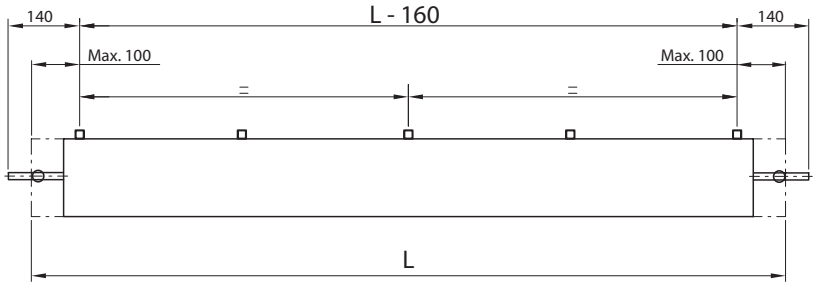
Dimensions

Width & height, mm



Length, mm

As standard, Carat is available in lengths from 1.2 m to 6.0 m, in steps of 0.1 m.



3 × 2 suspension points for lengths > 3 m.

Connection dimensions, mm

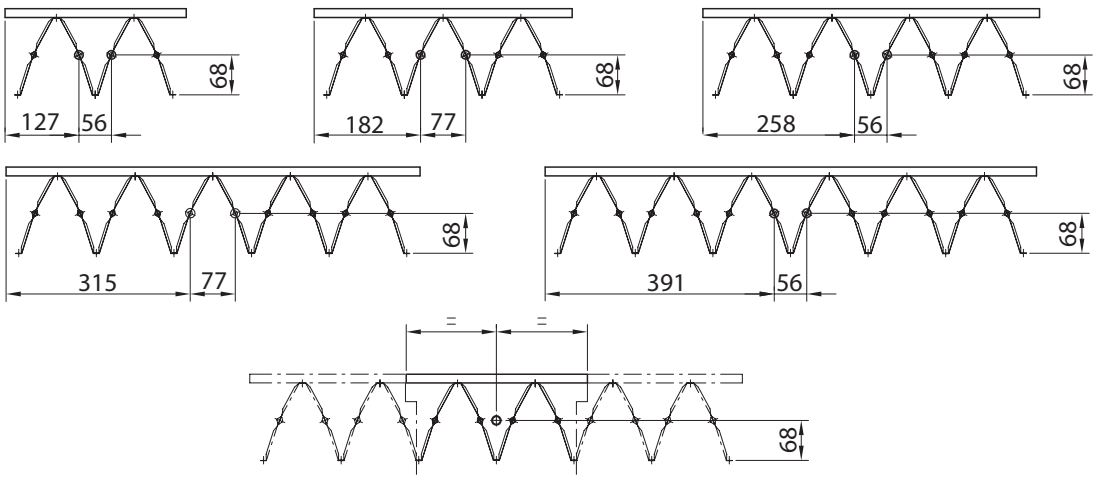


Figure 1. Carat, width, height, length and connection dimensions.

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Passive radiant chilled beam Carat

Installation examples

Carat has a wide range of applications and can be installed in offices, exhibition halls and industrial premises or warehouses.

Carat is suitable for both visible and hidden installation. Hidden installation above a perforated suspended ceiling is the most common in office environments.

During installation, it is important that the separation between the product and the ceiling be large enough. Otherwise, the output can be reduced because of insufficient air intake.
The minimum acceptable distance varies depending on the width of the product.

Table 3 and figures 2 to 4 list the minimum installation dimensions that are required for each model, so as to avoid a reduction in Carat's capacity.
If the minimum installation dimensions are not met, the cooling capacity of Carat must be reduced in accordance with diagram 2.

Carat is light, and this makes the product easy to handle during installation.

There are 3 suspension options for Carat: Pendulum, threaded rods (M8) or suspended wires (FH-system) are easy to adjust, so as to achieve the necessary measurement between the product and the ceiling.

Model	A (mm)	B (mm)	C (mm)
Carat -31	45	192	232
Carat -44	55	202	252
Carat -58	70	217	267
Carat -71	85	232	302
Carat -84	105	252	322

Table 3. Minimum installation dimensions, required by the respective models, to avoid a reduction in Carat's capacity.

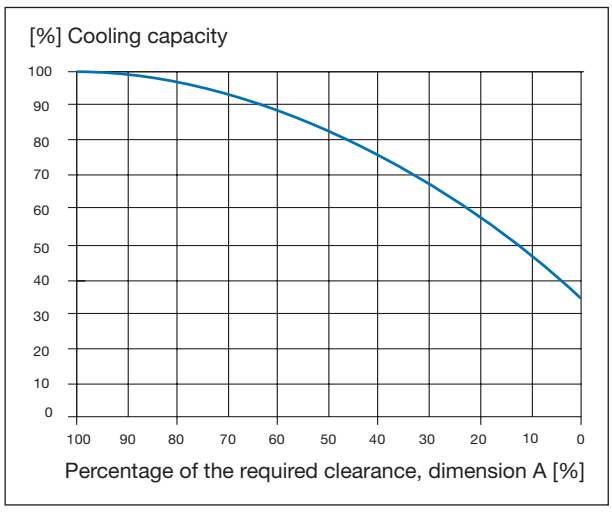
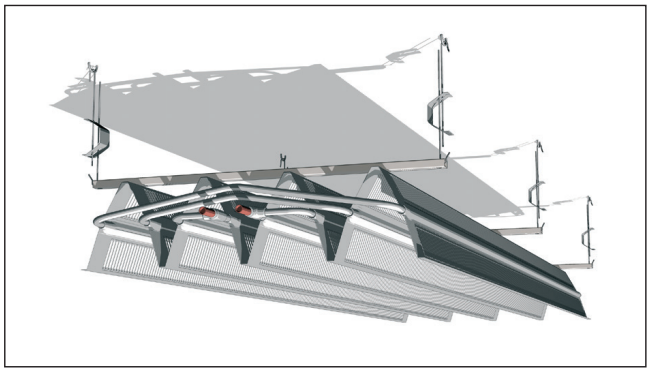
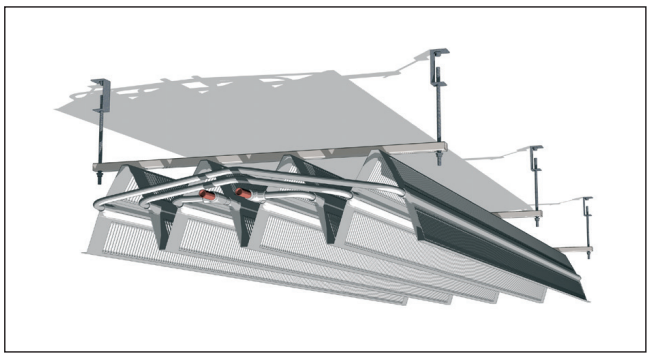


Diagram 2. Reduction of the cooling capacity when dimension A is reduced.



Picture 13. Installation of Carat with pendulum hangers suspended.



Picture 14. Installation of Carat with threaded rods.

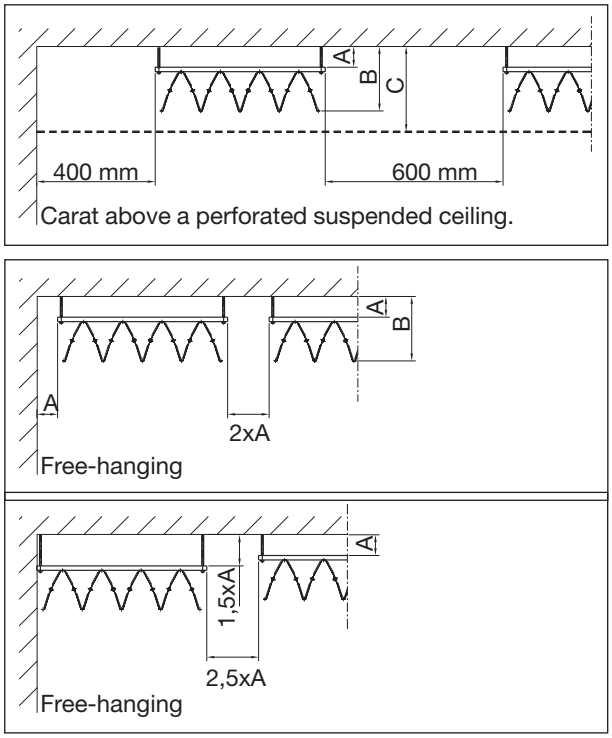


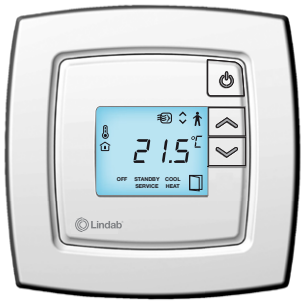
Figure 2-4. Installation dimensions for Carat.

NB! To achieve low air velocities as per diagram 1, the distance between the beams should be at least 600 mm.

Passive radiant chilled beam Carat

Control

Lindab offers control equipment that is very simple to use. To avoid the heating and cooling being activated at the same time, the system is controlled sequentially (Regula Combi). For the technical data, refer to the chapter Regula.



Designations

Product:	Carat
Width:	31, 44, 58, 71, 84 cm
Connection dimensions, water:	10, 12, 15, 22, 28 mm
Coupling options:	1, 3, 13
Length:	Length in m
Plus features:	See page 5

Programme text

Passive radiant chilled beams from Lindab **Qty**

Product:
Carat -58-15-1-3 m 10

Plus features:
Edge list
BSP connection

Accessories:
No.

Product:
Carat -71-15-13-2.4 m 25

Plus features:
Edge list

Accessories:
Regula Combi 25
Regula Secura 25
Cooling control valve 25
Cooling actuator 25

Product:
Carat -71-15-1-2.4 m 10

Plus features:
Edge list

Accessories:
Regula Combi 10
Regula Secura 10
Cooling control valve 10
Cooling actuator 10

Order code

Product: **Carat - 71 - 15 - 1 - 2.4 - 9003**

Carat

Width [cm]:
31, 44, 58, 71, 84

Water connection [mm]:
10, 12, 15, 22, 28

Connection type :
1, 3, 13

Product length [m]:
1.2 - 6.0 (In steps of 0.1)

*RAL colours *:*
9005, 9003, 9010 gloss 30, other colours on request.

Standard colours*

RAL 9003	Signal white	gloss 30
RAL 9005	Jet black	gloss 30
RAL 9010	Pure white	gloss 30

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Most of us spend the majority of our time indoors. Indoor climate is crucial to how we feel, how productive we are and if we stay healthy.

We at Lindab have therefore made it our most important objective to contribute to an indoor climate that improves people's lives. We do this by developing energy-efficient ventilation solutions and durable building products. We also aim to contribute to a better climate for our planet by working in a way that is sustainable for both people and the environment.

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