Heating and cooling panels Atrium/Loggia

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Use

Lindab's heating and cooling panels are mounted in the ceiling and primarily provide heating/cooling by radiation. The radiation share for the panels exceeds 50% to 60%, compared to approx. 5% for conventional finned products. Since the air velocities can be kept low, this results in a draught-free environment.

Radiant heating can also be used with high ceiling heights since the radiant heating, despite the high placement, heats the underlying surfaces directly without any losses to the air.

The lower temperature gradient and the increased radiation temperature also results in energy-efficient heating alternatives compared to other heating systems.

Installation

The heating/cooling panels are installed either suspended or recessed into a suspended ceiling. The panels can be supplied with different connection alternatives, depending on whether they are to be mounted individually or in series.

Worth noting

A high radiation quotient results in low air velocities and provides very good functioning, even with high installation heights. The low weight ensures quick installation. The weight for a panel, which is 6 m long and 87 cm wide, does not exceed 18 kg. These are by far the lightest heating and cooling panels available on the market. The cooling panels can also be supplied perforated, to ensure high sound absorption in office environments.

Lindabs radiant panels are tested according to EN-14037/ EN-14240 and are CE-marked.

Key figures

Length:	1200 - 6000 mm (steps of 100 mm)
Width:	330, 600, 870 mm
Height:	60 mm
Capacity:	1610 W

Calculation setup
Room temp: 21°C, Water temp: 55-45°C

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Function

Heating (Atrium-H, Loggia)

When warm water passes through the copper pipe, heat is transferred to the aluminium plate, with very little temperature loss. The panel is warmed and it then radiates the heat into the room. The thermal radiation travels tens of metres through the air without any loss of output on its way to the floor and walls. In this way, you avoid heating a large air mass that, when warm, sticks to the ceiling. Instead, the heat goes where it is needed the most.

It is mainly the floor, walls, furniture and fittings in the room that are heated. The temperature of the room surfaces becomes higher than that of the room air and thus transfers its heat to the air. By heating primarily the room surfaces instead of the air, you can save a lot of energy.

A more detailed description of how ceiling heating works is available in Lindab's Ceiling Heating Guide.

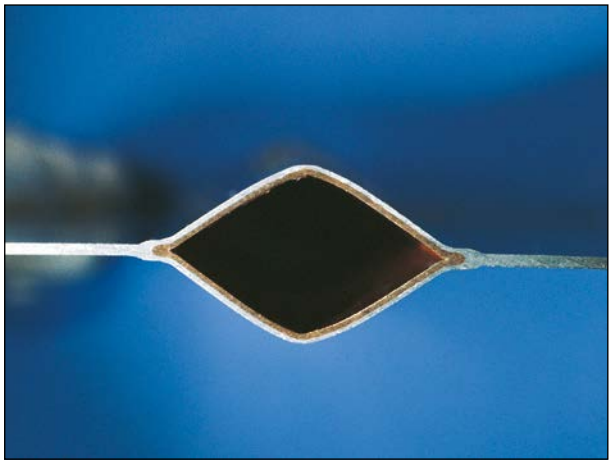
Cooling feature (Atrium-C)

When cold water passes through the panel, the heat of the aluminium plate is transferred to the cold water, with very little temperature loss. The panel partly chills the warm room air on its cold surfaces and, partly absorbs heat from the room via low-temperature radiation. In this way, the room is chilled via both radiation (approx. 50 %) and convection. The absorption of low-temperature radiation means that the surfaces of the room, and above all the floor, walls, furniture and fittings have a lower temperature than if then cooling was only convective. This means that storage of "cooling energy" is greater.

Design

The design of the panels is based on a world-patented method of joining a copper pipe to an aluminium plate. The aluminium plate is metallurgically bonded with the copper pipe (the materials are partially fused together under very high pressure). Due to this, the energy transport between the pipe and the plate is very efficient. The copper pipe has a rhomboid shape (see Picture 1), which ensures that turbulent flows are obtained quicker than with a round pipe and guarantees very good heat transfer even at low flow rates.

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



Picture 1. Cross-section of the metallurgically bonded copper and aluminium plates and the rhomboid water duct.

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Atrium H & C

Atrium-H is a heating panel. It is equipped with end-pieces and can be installed recessed into a suspended ceiling (see picture 2). The top of the panel is insulated with extruded polystyrene foam. The foamed plastic is manufactured without the addition of CFC or HCFC gas, i.e. Freons.

Atrium-C is a cooling panel. It is equipped with end-pieces and can be installed recessed into a suspended ceiling. The top of the Atrium-C is not insulated.
Atrium-H and C are available in a hygienic design with the top covered. The hygienic design is suitable for washing bays or suchlike.

Atrium-H should be used if the panel is to provide both cooling and heating with a so-called “Change-Over” system.

Picture 2. Atrium is equipped with end-pieces and can be installed recessed into a suspended ceiling.

Loggia

Loggia is the brand name of Lindab's heating strips. What distinguishes Loggia from Atrium-H is that it does not have end-pieces on its short sides. Loggia is therefore not designed for installation in the supporting structure of a suspended ceiling (see picture 3). Loggia is suited for industrial premises, for example, warehouses, showrooms, etc. The top of the panel is insulated with extruded polystyrene foam. The foamed plastic is manufactured without the addition of CFC or HCFC gas, i.e. Freons.

Picture 3. Loggia is suitable for suspended installation in industrial premises.

Heating and cooling panels Atrium/Loggia

Data

Variants

The panels are available in three different versions: Loggia, Atrium-H and Atrium-C

Loggia are heating strips without end-pieces for industrial use.

Atrium-H is equipped with end-pieces. Width 60 (600 mm) is adapted in size, -8 mm, so as to facilitate installation in a suspended ceiling using a standard T-profile with 600-mm module.

Atrium-C is a cooling panel and is supplied without insulation. Width 60 (600 mm) is adapted in size, -8 mm, so as to facilitate installation in a suspended ceiling using a standard T-profile with 600-mm module.

The panels are available in three different widths: 330 (width 33), 600 (width 60) and 870 mm (width 87). The height is always 60 mm.

Lengths: Available in lengths from 1.2 m to 6.0 m in steps of 0.1m.

Water connection: Available with four different connections, depending on the width of the product – 10, 12, 15 and 22 mm. This allows the pressure drop to be adjusted for different dimensioning cases.

Surface treatment: The panels are powder-coated.

Colour

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

Accessories

Delivered separately.

Control: Refer to the chapter Regula.

Connection cover: Conceals visible piping to a wall or in between panels (see figure 1). Indicate the length when you place your order.

Suspension options: Mounting equipment for suspended or direct-to-ceiling mounting are available as accessories.

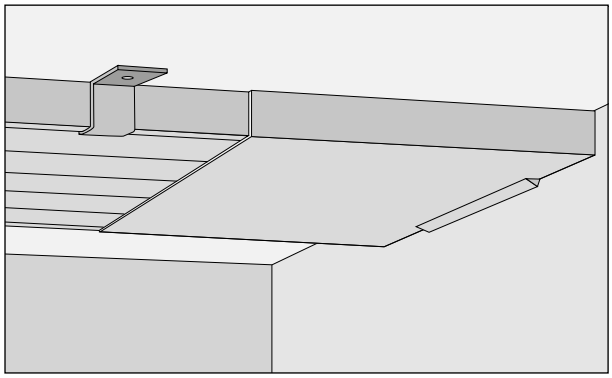

Figure 1. Atrium with connection cover.

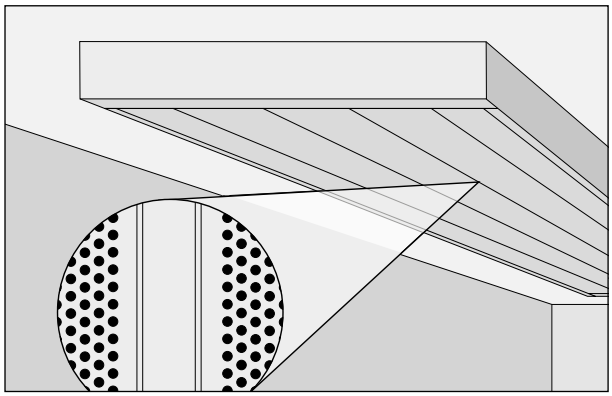

Figure 2. Atrium in perforated design.

Plus features

Factory preinstalled.

Perforation: A perforated cooling and heating panel provides increased sound attenuation in the room. With this option, the standard insulation of the panels is replaced with sound-absorbing mineral wool insulation. (see fig. 2). The available perforation is Dot 3 mm with a perforation degree of 25%.

Hygienic design: For premises with very high hygiene requirements, Atrium and Atrium-C are available with the top covered in aluminium and with the joints sealed with a white sealing compound. The panel can then be disinfected or rinsed.

Heating and cooling panels Atrium/Loggia

Dimensioning of heating panels Atrium-H and Loggia heating strips.

There are a number of things to think of when dimensioning heating panels. To achieve the best energy efficiency and as small a temperature gradient as possible and to utilise the high radiation quotient, you should take the following points into consideration:

The length and width of the ceiling surface should be greater than the height of the room and the room's furnishings should not consist of high walls or storage shelves. If this is the case, there is a risk that the thermal radiation is absorbed before it reaches the floor.

The capacity requirement in the lower part of the room should not be less than 60% of the total capacity requirement. Otherwise, the convective heat will not be utilised and the temperature gradient will rise.

There should not be any large uncoated horizontal metal surfaces under the heating strips, as these will reflect the thermal radiation. The floor should be insulated or positioned above the ground without running groundwater. (Otherwise, there is a risk that the floor will not be warmed sufficiently.) If some of these dimensioning recommendations are not fulfilled, the heating panels should be supplemented with ceiling fans that blow the warm air down from the ceiling to the occupied zone.

Definitions:

P_a = Heating/Cooling capacity air [W]
P_w = Heating/Cooling water [W]
P_{tot} = Heating/Cooling capacity total [W]
q_{ma} = Air mass flow rate [kg/s]
q_a = Primary air flow rate [l/s]
c_{pa} = Specific heat capacity air [1,004 kJ/kg K]
t_r = Room air temperature [°C]
t_{wi} = Water inlet temperature [°C]
t_{wo} = Water outlet temperature [°C]
Δt_{ra} = Temp. diff., room air and primary air temp. [K]
Δt_{rw} = Temp. diff., room air and mean water temp. [K]
Δt_w = Temp. diff. water circuit [K]
$e_{\Delta tw}$ = Capacity correction for temperature
e_{qw} = Capacity correction for water flow
P_{Lt} = Specific heating/cooling capacity [W/(m K)]

Heating and cooling panels Atrium/Loggia

Dimensioning

Heating panels Atrium-H and Loggia heating strips

Follow the instructions below, to calculate the heating capacity P_W provided by the heating panel/heating strips.

1. Calculate Δt_{rw}.
2. Product length L minus 0.1 m, to obtain the active length L_{act}.
3. Find the specific heating capacity P_{Lt}, relative to Δt_{rw}, in diagram 1.
4. Multiply the specific heating capacity with the active length L_{act}.

Example 1, Heating:
What is the heating capacity P_w of a 6.0 m suspended Loggia 87?

The room's winter temperature is assumed to be 21°C. The heating water temperature in/out is 56/46°C.

Answer:
Temperature difference:
$\Delta t_{rw} = (t_{wi} + t_{wo})/2 - t_r$
Δt_{rw} = (56°C + 46°C) / 2 - 21°C = 30 K.

Active length:
L_{act}= 6.0 m - 0.1 m = 5.9 m.

Read off from diagram 1. P_{LT} = 280 W/m.

The Heating capacity P_w is:
P_w = 280 W/m x 5.9 m = 1652 W.

NB! The capacity diagram applies at the nominal flow rate in one strip of q_{wnom} = 0.011 l/s. Follow the steps in example 3 to obtain the right capacity at other flows.

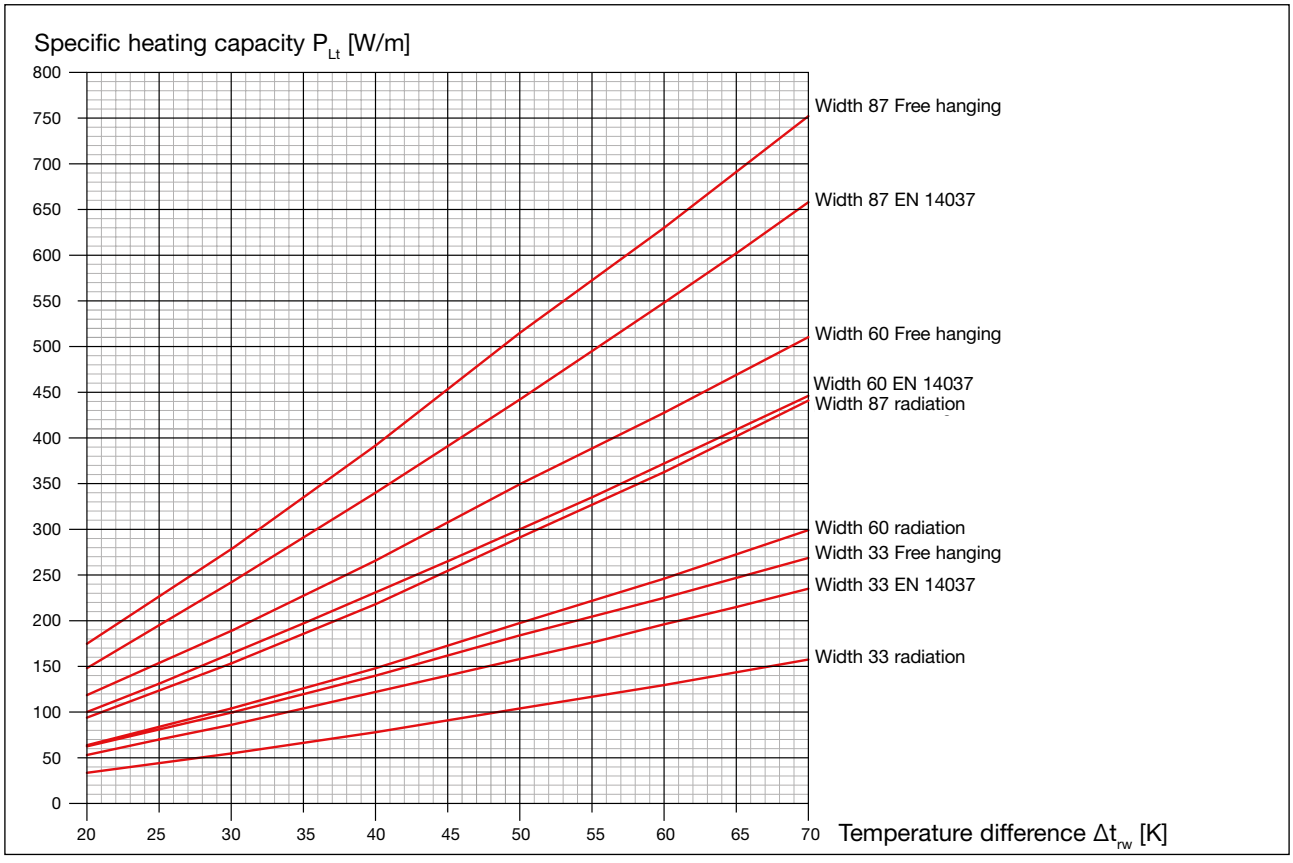

Diagram 1. Atrium-H and Loggia, specific heating capacity P_{Lt} per active length at nominal flow in one strip q_{wnom} = 0.011 l/s in relation to Temperature difference Δt_{rw} .

Heating and cooling panels Atrium/Loggia

Dimensioning

Cooling panel Atrium-C

Follow the instructions below, to calculate the cooling capacity provided by the cooling panel.

1. Calculate Δt_{rw}.
2. Product length L minus 0.1 m, to obtain the active length L_{act}.
3. Find the specific heating capacity P_{Lt}, relative to Δt_{rw}, in diagram 2.
   For suspended installation, the capacity increases by 10%, so multiply by 1.1.
4. Multiply the specific heating capacity with the active length L_{act}.

Example 2:
What is the cooling capacity of a 5.4 m Atrium-C 60, with Ø10 water connection and suspended installation?

The room's summer temperature t_r is assumed to be 24.5ºC. The cooling water temperature in /out of Atrium is 14/17ºC.

Answer:
Temperature difference:
$\Delta t_{rw} = (t_{wi} + t_{wo})/2 - t_r$
Δt_{rw} = (14ºC + 17ºC) / 2 - 24.5ºC = 9 K.

Active length:
L_{act} = 5.4 m - 0.1 m = 5.3 m.

Read off from diagram 2. P_{LT} = 59 W/m.

Multiply the specific cooling capacity by the factor for suspended installation => 59 W x 1.1 = 64,9 ≈ 65 W/m.

The cooling capacity P_w is:
P_w = 65 W/m x 5.3 m ≈ 345 W.

NB! The capacity diagram applies at a nominal flow in one strip q_{wnom} = 0.025 l/s. Follow the steps in example 4, to obtain the right capacity at other flows.

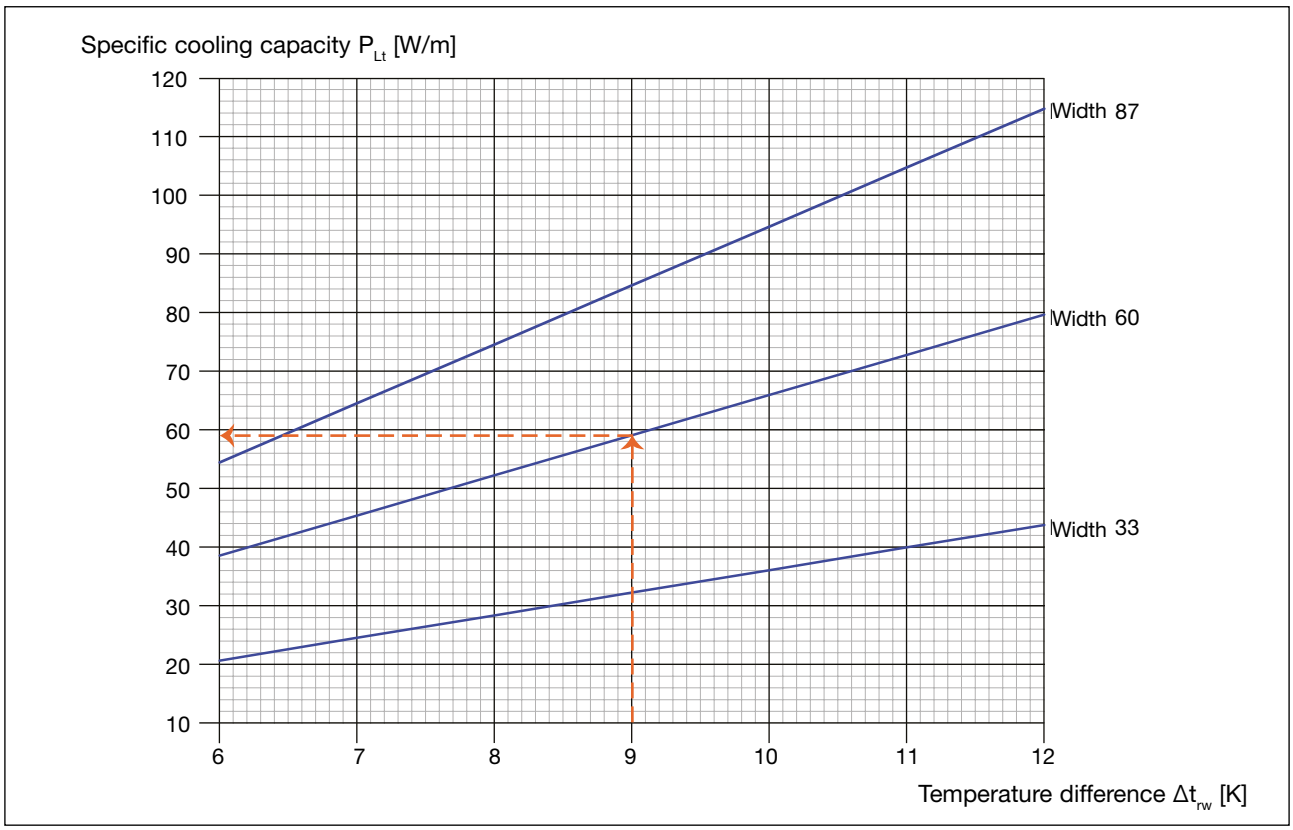

Diagram 2. Atrium-C installed direct to the ceiling, specific cooling capacity P_{Lt} per active length at the nominal flow in one strip q_{wnom} = 0.025 l/s.

Heating and cooling panels Atrium/Loggia

Dimensioning

Capacity correction for water flow e_{qw}

Follow the steps below:
1. Calculate the water flow with the current capacity P_w.
2. Read off the number of parallel circuits in table 1.
3. Calculate the water flow in one strip.
4. Read off the capacity correction for waterflow e_{qw} from diagram 3.
5. Multiply the capacity P_w by the capacity correction e_{qw}.
6. Repeat steps 1 through 5 with the new capacity.

Size	Model		
	33	60	87
ø10	1	1	1
ø12	2	2	
ø15		4	3
ø22			6

Table 1. Number of parallel circuits for Atrium H & C - Loggia depending on model and connection option.

Example 3 Heating:
Loggia 87 with Ø15 water connection gives:
P_w = 1652 W (From example 1).

Temperature difference was:
Δt_w = 56°C - 46°C = 10 K.

To calculate the water flow rate, use formula:
$q_w = P_w / (c_{pw} \times \Delta t_w)$
q_w = 1652 W / (4200 Ws/ (kg K) x 10 K) = 0.0393 l/s

In table 1, read off the number of parallel circuits for Loggia 87 Ø15. The value is 3. Calculate the water flow rate in one strip: q_w = 0.0393 l/s / 3 = 0.0131 l/s

Read off the capacity correction e_{qw} from diagram 3. The value is 1.01. Calculate the new capacity:
P_w = 1652 W x 1.01 = 1669 W.

Use the new capacity to calculate the water flow rate:
q_w = 1669 W / (4200 Ws/ (kg K) x 10 K) = 0.0397 l/s

Calculate the water flow rate in one strip:
q_w = 0.0397 l/s / 3 = 0.0132 l/s.

The new capacity correction e_{qw} will then be 1.005 and the new capacity is calculated to be:
P_w = 1669 W x 1.005 = 1677 W.

NOTE! Your calculations will be more accurate the more times you keep repeating step 1-5.

Example 4 Cooling:
Atrium-C 60 5.4 with Ø10 water connection gives:
P_w = 345 W (From example 2).

Temperature difference was:
Δt_w = 17°C - 14°C = 3 K.

To calculate the water flow rate, use formula:
$q_w = P_w / (c_{pw} \times \Delta t_w)$
q_w = 345 W / (4200 Ws/ (kg K) x 3 K) = 0.0273 l/s

In table 1, read off the number of parallel circuits for Atrium-C 87 with Ø10 connection. The value is 1. Calculate the water flow rate in one strip:
q_w = 0.0273 l/s / 1 = 0.0273 l/s.

Read off the capacity correction e_{qw} from diagram 3. The value is 1.011. Calculate the new capacity:
P_w = 345 W x 1.011 = 348 W.

Use the new capacity to calculate the water flow rate:
q_w = 348 W / (4200 Ws/ (kg K) x 3 K) = 0.0276 l/s

Read off the capacity correction e_{qw} from diagram 3. The value is 1.013. Calculate the new capacity :
P_w = 345 W x 1.013 = 349 W.

NOTE! Your calculations will be more accurate the more times you keep repeating step 1-5.

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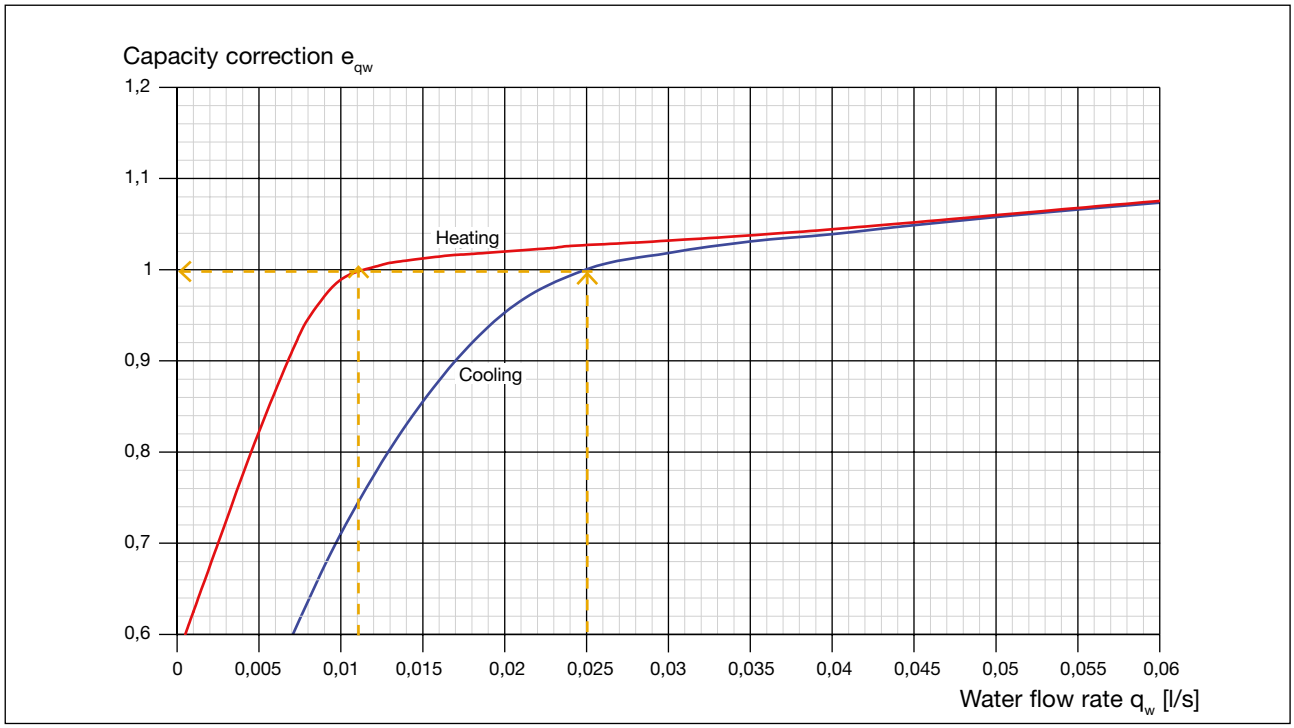

Diagram 3. Capacity correction e_{qw} as a function of waterflow q_w.

Heating and cooling panels Atrium/Loggia

Flow – pressure drop for coupling 1

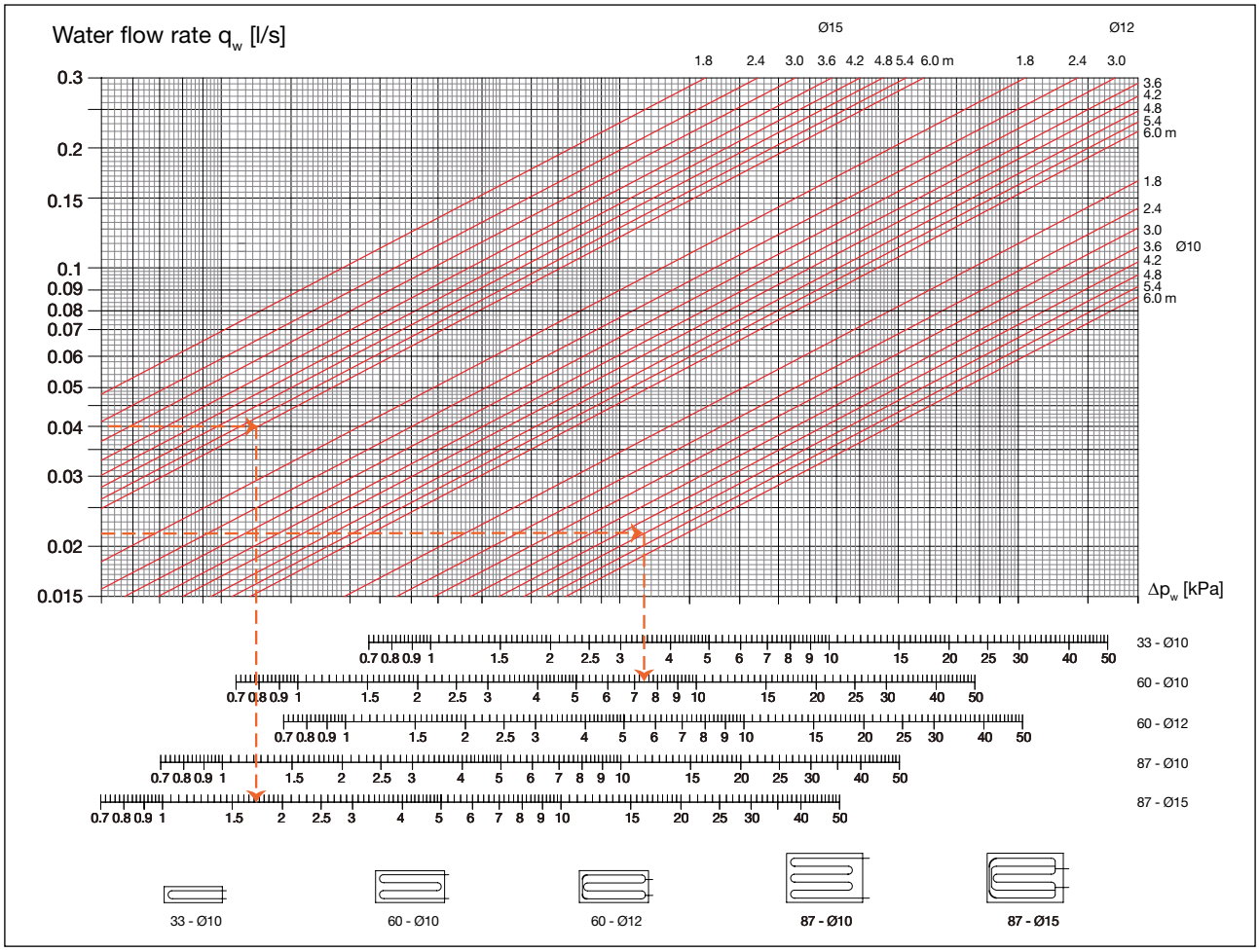

Diagram 4. Panels, pressure drop at 60° C. For pressure drops at temperatures other than 60° C, the pressure drop is multiplied by the pressure drop factor (see diagram 7).

Definitions:
q_w = Water flow rate [l/s]
P_w = Cooling/heating capacity water [W]
c_{pw} = Specific heat capacity water [4200 Ws/(kg K)]
Δt_w = Temperature difference water circuit [K]

Example 5:
Loggia-87 6 m with Ø15 water connection provides a capacity from:
P_w = 1669 W at Δt_w = 10 K (from Example 3 Heating)
$t_{wio} = 0.5 \times (t_{wo} + t_{wi}) = 0.5 \times (56°C + 46°C) = 51°C$
$q_w = P_w / (c_{pw} \times \Delta t_w)$
q_w = 1669 W / (4200 Ws/ (kg K) x 10 K) = 0.040 l/s

The pressure drop Δp_w in the water circuit is read off at 1.7 kPa from diagram 4. Read off the pressure drop factor at 51°C from diagram 7. The value is 1.04.

Calculate the new pressure drop:
Δp_w = 1.7 kPa x 1.04 = 1.8 kPa.

Example 6:
Atrium-C 60 4.8 m with Ø10 water connection provides a capacity from:
P_w = 270 W at Δt_w = 3 K , t_{wio} = 15°C
$q_w = P_w / (c_{pw} \times \Delta t_w)$
q_w = 270 W / (4200 Ws/ (kg K) x 3 K) = 0.0215 l/s

The pressure drop Δp_w in the water circuit is read off as 7.4 kPa from diagram 4. Read off the pressure drop factor at 15°C from diagram 7. The value is 1.27.

Calculate the new pressure drop:
Δp_w = 7.4 kPa x 1.27 = 9.4 kPa.

Heating and cooling panels Atrium/Loggia

Flow – pressure drop for coupling 13

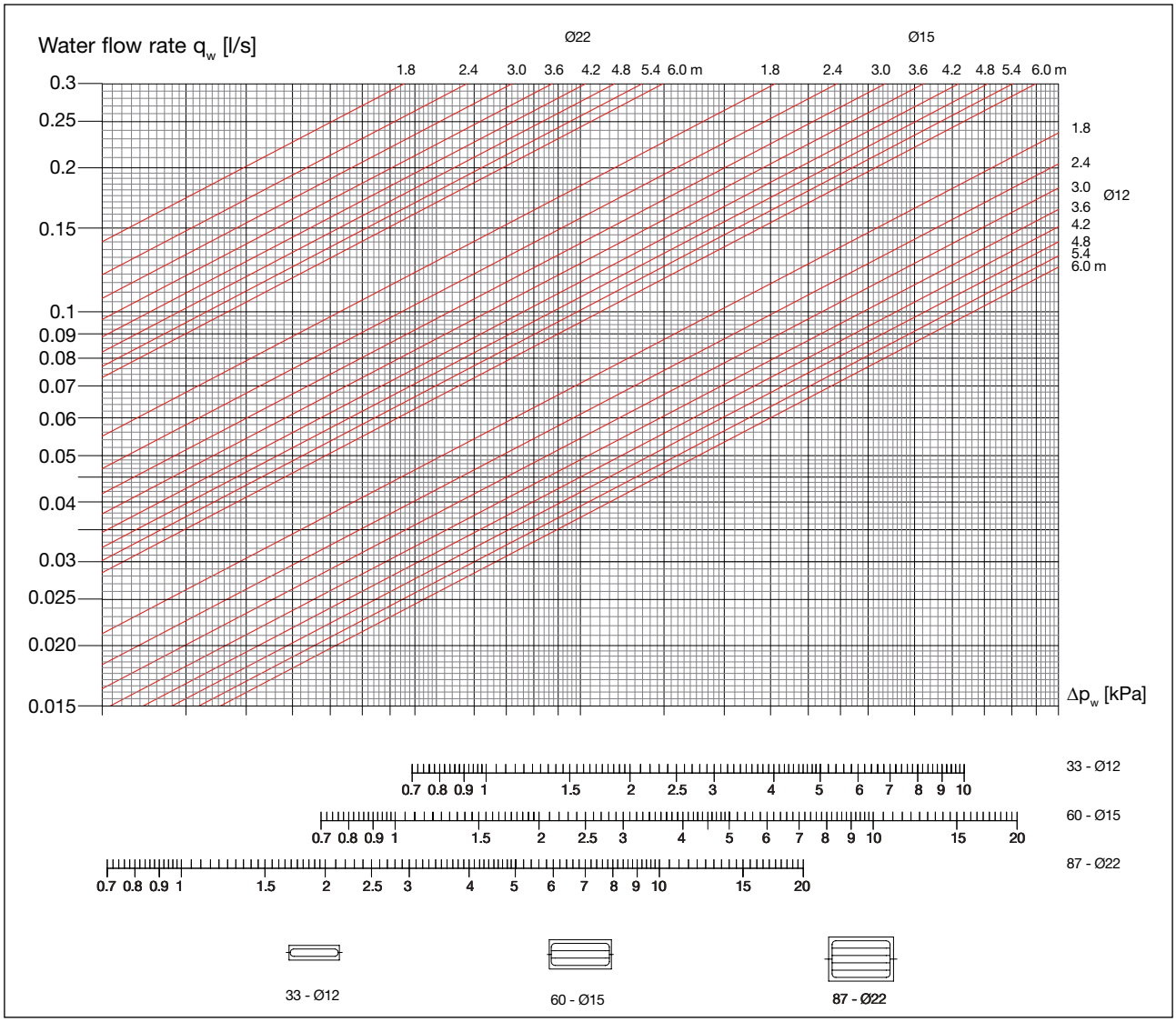

Diagram 5. Panels, pressure drop at 60° C. For pressure drops at temperatures other than 60° C, the pressure drop is multiplied by the pressure drop factor (see diagram 7).

Heating and cooling panels Atrium/Loggia

Flow – pressure drop for coupling 1 + 13

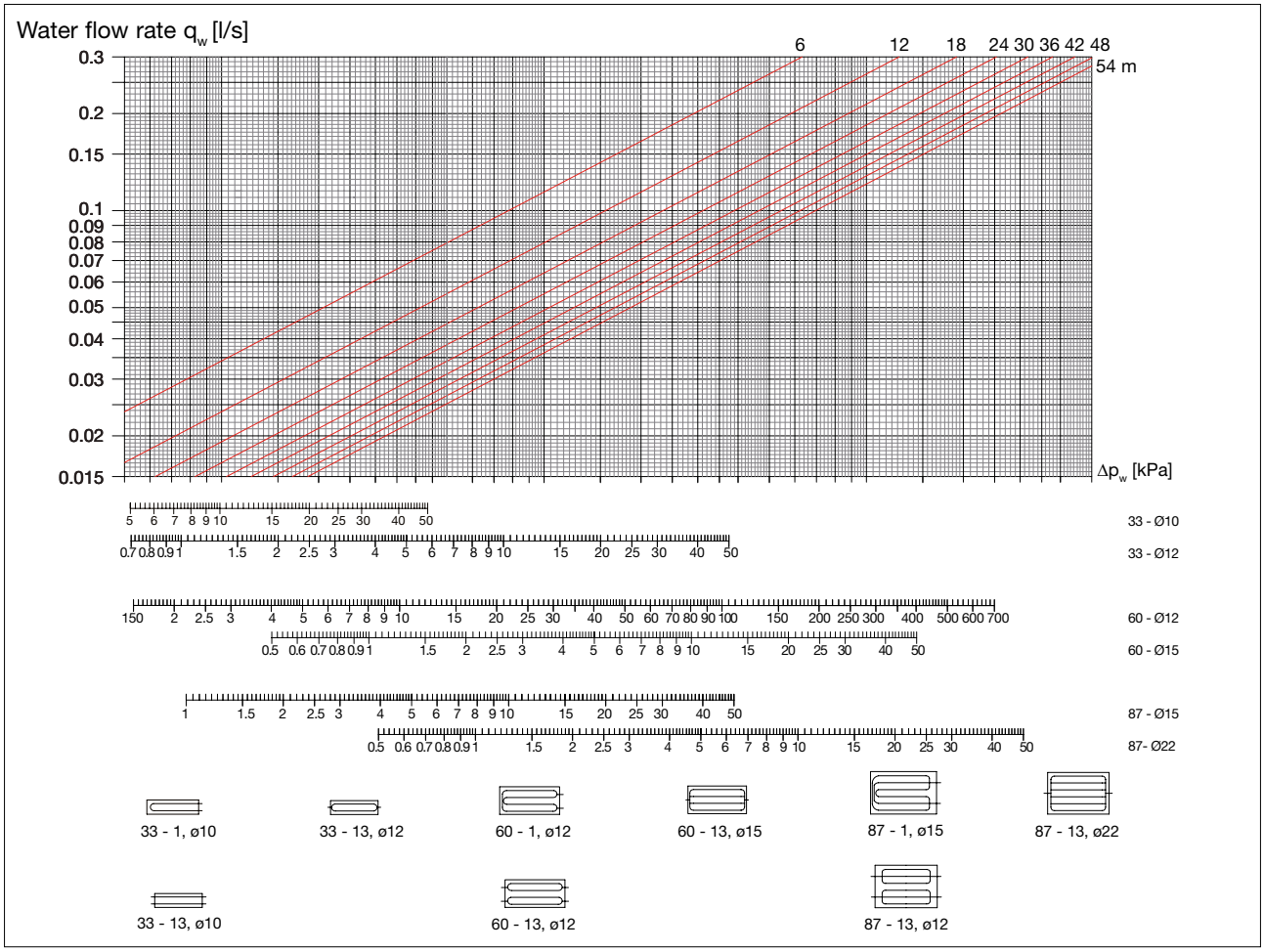

Diagram 6. Panels, pressure drop at 60° C. For pressure drops at temperatures other than 60° C, the pressure drop is multiplied by the pressure drop factor (see diagram 7).

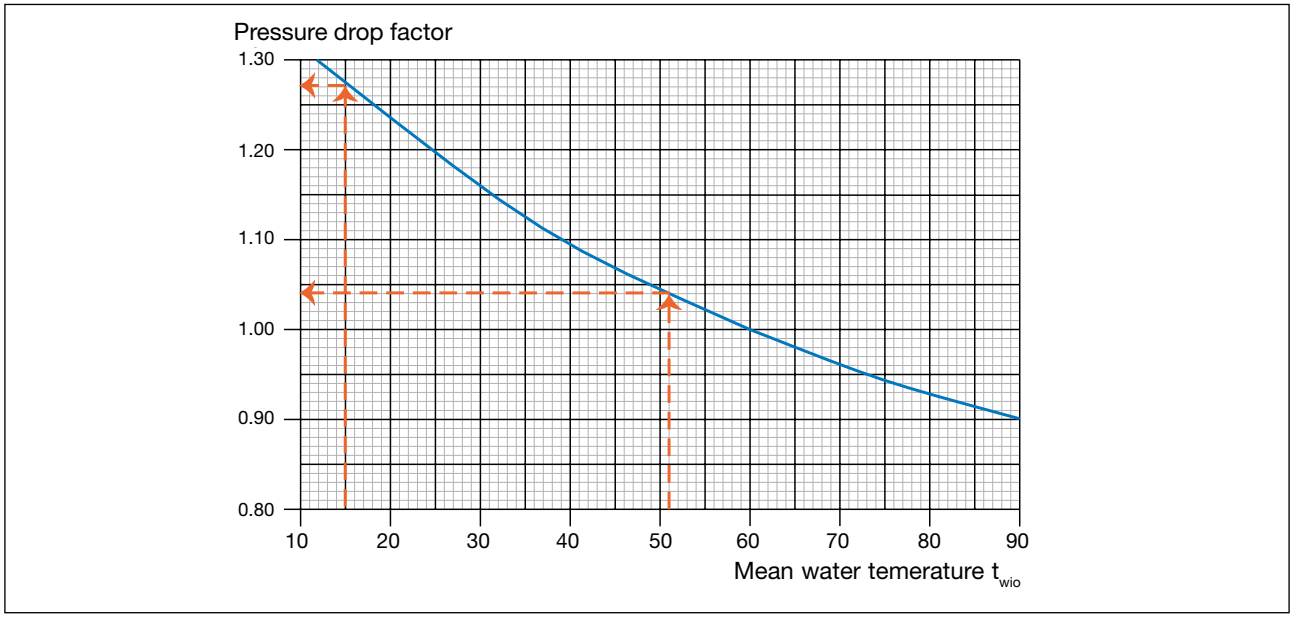

Diagram 7. Temperature adjusted pressure drop factor.

Heating and cooling panels Atrium/Loggia

Coupling & connection

Atrium-C, Loggia and Atrium-H are supplied in lengths of up to 6 metres. When the required length is longer than 6 metres, panels can be coupled in series.

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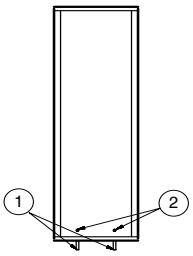		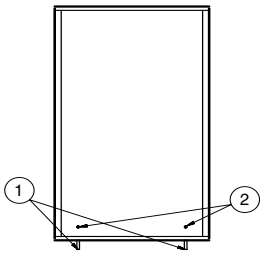		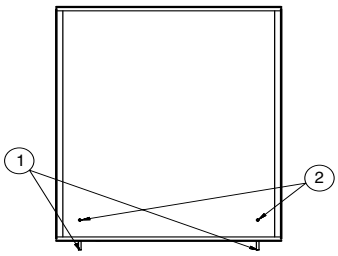	
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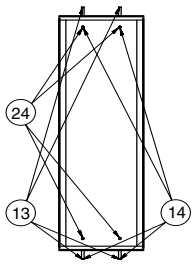		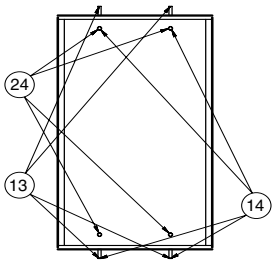		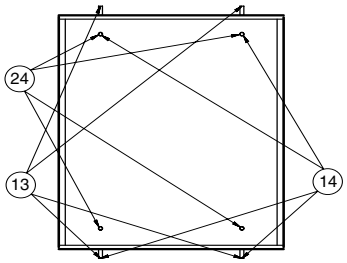	
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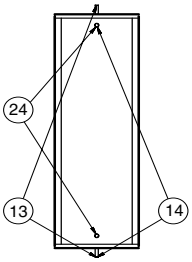		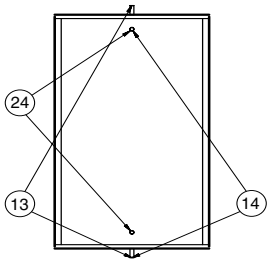		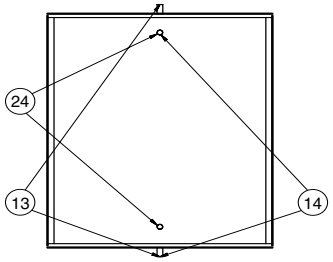	
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Table 4. Atrium-C, Loggia and Atrium-H, coupling and connection options.

NB! Connections should be made with compression couplings, press couplings or Tectite.

When applying the Atrium beam into a false ceiling, Coupling option 2 should always be used to clear the pipes from the supporting frames of the ceiling (T-bar).

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Coupling & Connection

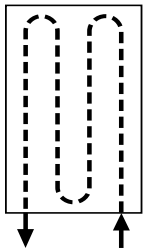
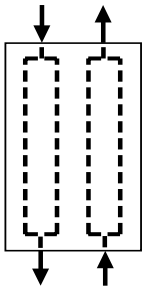
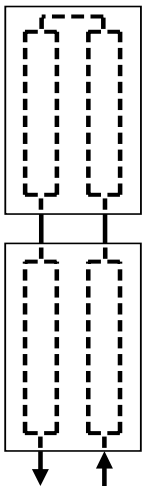
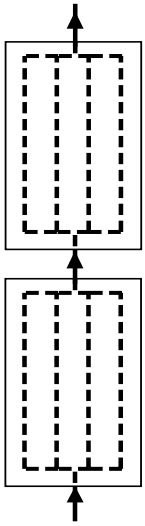
			
1 (1 connected) The supply and return for this model are located in the same end-piece. This coupling is only available with one pipe dimension per panel width. Width 33: Ø10 mm Width 60: Ø10 + Ø12 mm Width 87: Ø10 + Ø15 mm	13 (double circuit) This model has the supply in one end-piece and the return in the other one. This coupling is only available with one pipe dimension per panel width. Width 33: Ø10 mm Width 60: Ø12 mm Width 87: Ø15 mm	1+13 (1 connected + double circuit) This model is a combination of 1 connected panel + 1 double circuit. This coupling is available with only one pipe dimension per panel width. Width 33: Ø10 mm Width 60: Ø12 mm Width 87: Ø15 mm	13+13 (straight through) This model has the supply in one end-piece and the return in the other one. This coupling is only available with one pipe dimension per panel width. Width 33: Ø12 mm Width 60: Ø15 mm Width 87: Ø22 mm

Table 5. Atrium and Loggia coupling & connection

Minimum permitted flow, non-horisontal mounting q_{wmin} (l/s)	**Width 33 Cooling**	**Width 33 Heating**	**Width 60 Cooling**	**Width 60 Heating**	**Width 87 Cooling**	**Width 87 Heating**
dim Ø10	0.013	0.015	0.013	0.015	0.013	0.015
dim Ø12	0.026	0.030	0.026	0.030		-
dim Ø15	-	-	0.052	0.060	0.039	0.045
dim Ø22	-	-	-	-	0.078	0.090
Max. working pressure (bar)	10					
Max. test pressure (bar)	16					

Table 6. Atrium and Loggia, recommended minimal water flow rates q_{wmin}.

NB! If the panel is not mounted in a horisontal plane, the recommended minimal water flow rates q_{wmin} should be maintained, to avoid air build up. No separate air release valve is then required for the panel.

Heating and cooling panels Atrium/Loggia

Width and height, cm

Figure 3. Atrium and Loggia are manufactured as standard in three widths, 33, 60 and 87 cm, and one height, 6 cm. Actual width dimension is -8 mm.*

Length, m

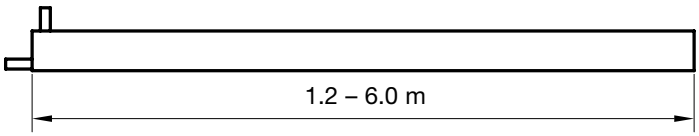
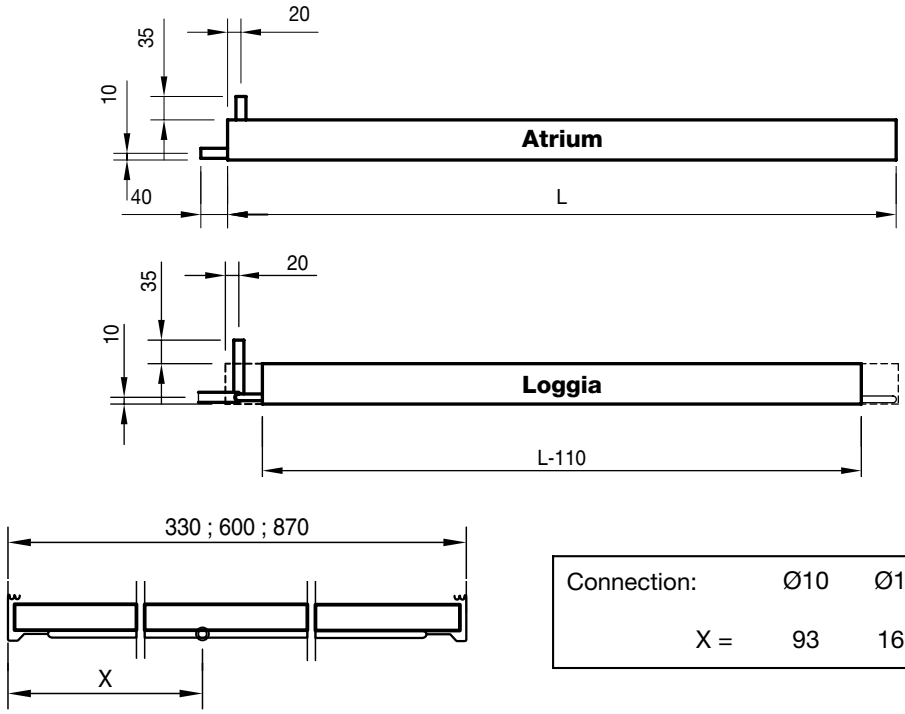


Figure 4. Atrium and Loggia are manufactured as standard in lengths from 1.2 m to 6.0 m in steps of 0.1 m. Actual length dimension is -12 mm.

Dimensions, mm



Connection:	Ø10	Ø12	Ø15	Ø22
X =	93	160	295	430

Table 5. Atrium and Loggia dimensions, water coupling & connection.

Weight and water volume

	Atrium C / H and Loggia 33	Atrium C / H and Loggia 60	Atrium C / H and Loggia 87
Weight, [kg/m]	1.3	2.2	3.1
Water content, [l/m]	0.18	0.35	0.53
Copper pipes, quality	EN 12735-2 CU-DHP		
Pressure class	PN10		
Expantion at VS: + 55/45° C	0.7 mm/m		
Expantion at VS: + 80/60° C	1.2 mm/m		

Table 7. Atrium and Loggia, weight and water volume.

* The width fits a standard T support (600 mm modules)

Heating and cooling panels Atrium/Loggia

Installation examples

Atrium can be installed in three different ways; on to the ceiling (see figures 7 to 8), suspended (see figures 9 to 10) or integrated into a suspended ceiling (see figures 11 to 12). Securing plates are used for installation on the ceiling and support rods for installation in a suspended ceiling. Loggia is available for suspended installation and installation on the ceiling.

NB! Make sure that expansion factors are taken into consideration when the panels are mounted on the ceiling, for example, pipes between panels or pipes with fixed connections should be fitted with an extension loop.

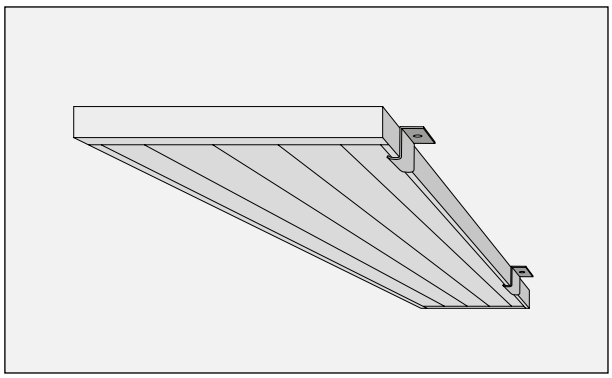


Figure 7. Atrium installed with securing plates on a ceiling.

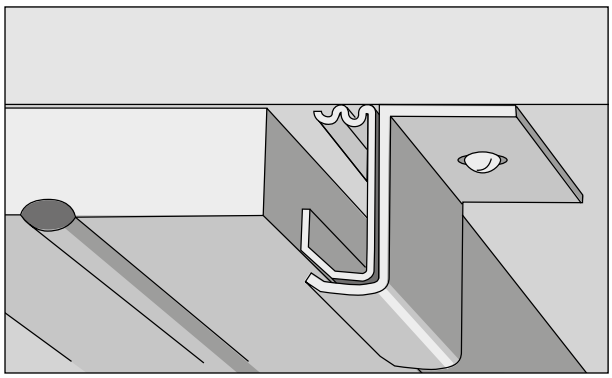


Figure 8. Atrium on a ceiling, securing plates.

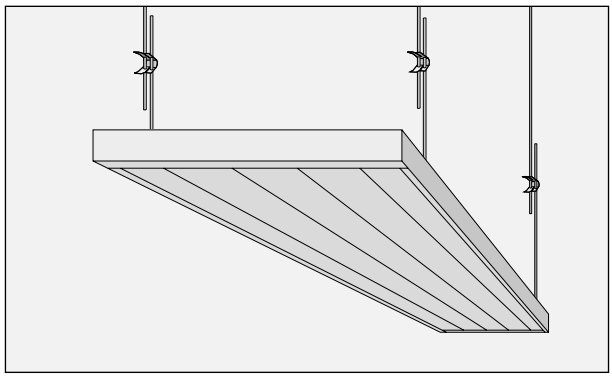


Figure 9. Atrium suspended on adjustable drop rods.

Figure 10. Atrium suspended on adjustable drop rods.

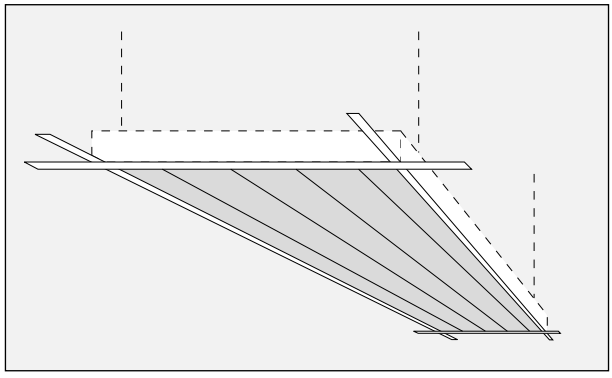


Figure 11. Atrium integrated into a suspended ceiling, support rods are recommended.

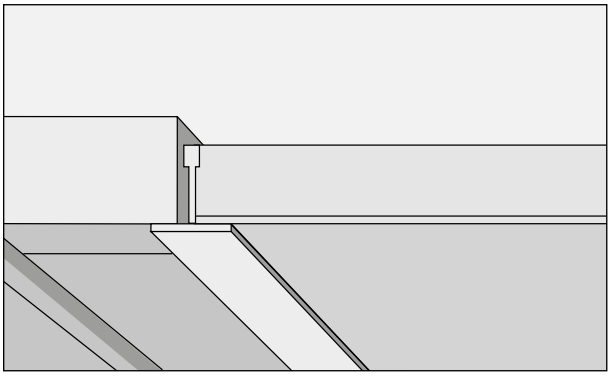


Figure 12. Atrium integrated with support rods in a suspended ceiling.

Heating and cooling panels Atrium/Loggia

Control

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

Designations

Product:	**Atrium C, Atrium H, Loggia**
Width, cm:	33, 60, 87
Connection dim. Water, mm:	10, 12, 15, 22
Coupling options:	1, 2, 13, 14, 23, 24
Length, m:	1.2 m – 6.0 m
Plus features:	See page 6

Programme text

Panels from Lindab	**Qty**
Product	
Atrium H - 60 - 10 - 1 - 4.8 m	10
Plus features:	
Hygienic design	
Accessories:	
Connection cover, length = 300 mm:	10
Product	
Atrium C - 87 - 15 - 1 - 6.0 m	30
Plus features:	
Colour, RAL 9005 (black)	
Perforation	
Accessories:	
Regula Combi	30
Regula Secura	30
Control valve, cooling	30
Actuator, cooling	30

Order code

Product	**Atrium H**	**60**	**10**	**1**	**4.8m**
Type					
Atrium H, Atrium C					
C = cooling					
H = heating					
Loggia					
Width					
33 - 60 - 87 cm					
Water connection					
10 - 12 - 15 - 22 mm					
Air coupling					
1 - 2 - 13 - 14 - 23 - 24					
Length					
1.2 m - 6.0 m					

Example: Atrium-H-60-10-1-4,8m