

FRB

Exposed passive chilled beam for suspended installation



FRB

- ▶ FRB is a passive chilled beam for comfort cooling especially designed for visible/suspended installation in the room.
- ▶ High cooling capacity, even when there is a large difference in temperature between the coolant supply and the return temperature.
- ▶ A small, compact unit available in two widths.

Key figures

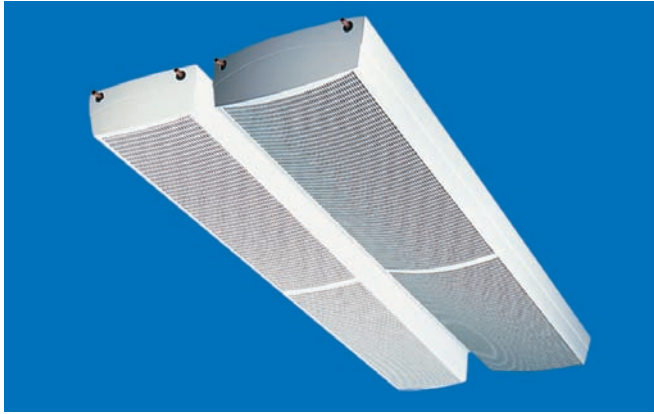
Cooling capacity

| Size | P_k (W/m) | ΔT_{mk} (°C) |
|---------|-------------|----------------------|
| FRB 430 | 252 W/m | 10 |
| FRB 290 | 160 W/m | 10 |

Length: From 1.2 to 3.9 m.

Width: 290 and 430 mm.

Height: 123 and 133 mm.



Function

- Cooling

Application

Suitable for all types of room that are cooled with a water based system:

- Offices (cellular offices and open)
- Hotels
- Class rooms
- Conference rooms
- Computer rooms
- Restaurants
- Banks
- Shops

Advantages of FRB

- FRB is a very compact passive chilled beam. The low build-in height, choice of two widths, plus the fact that water is used as an energy transfer medium, means that the system requires a minimum of space.
- The high performance of this chilled beam means that it maintains high cooling capacity even at low Dt_{mk} , thus making it possible to increase the temperature difference between the flow and return. This gives the product good operating properties and high output efficiency.
- FRB is specially designed for suspended installation. The softened form of the beam means that it blends into the room environments in a natural way.
- FRB is particularly suitable for areas where heating and ventilation have already been installed, and require supplementary cooling.
- The system has no moving parts, generates no sound and is maintenance free.
- Connection details and valves are easily covered by a neat connection cover. The cover is mounted after that the beam is hanged and connected.

Installation

FRB is designed for suspended installation.

Connection dimensions: Cooling (water): plain pipe ends
Cu Ø12 x 1.0 mm.

Suspension:

The units are equipped with mounting brackets designed for the SYST MS assembly set. The assembly sets are available in various variants to fit various suspended distances. The SYST MS must be specified and ordered separately.

Standard product range held in stock

For particulars of the standard product range held in stock, visit www.swegon.com.

Range available on order

Width: 290 and 430 mm.

Length: From 1.2 to 3.9 in increments of 300 mm.

Colour: RAL 9010 gloss value 30+6%.

Design: With horizontal connection at the end-H or with the 300 mm connection area and internal connections –I.

Function

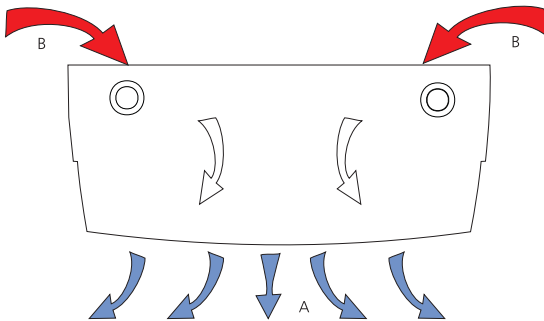


Figure 1. Cooling. A = chilled air B = warm room air

Assembly

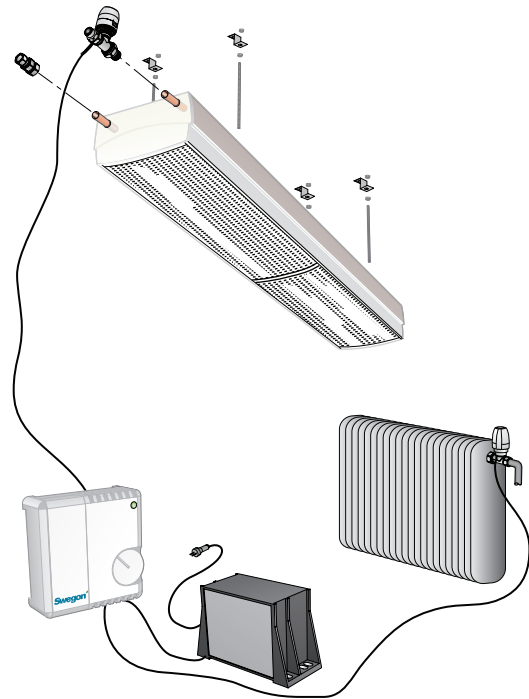


Figure 2. Assembly.

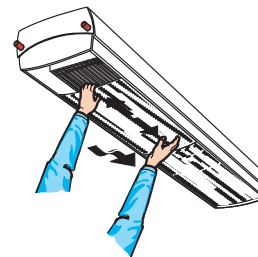


Figure 3. Maintenance, sliding lower section.

Special models

Colour

FRB is available on request in optional colours.

Accessories

Connection cover

The connection cover is fitted over the extended section of the chilled beam to conceal the pipe connections.

Flexible connection hose

Flexible hose with either quick connect couplings at both ends for connection to $\text{Ø}12 \times 1.0$ mm pipes or with quick connect coupling at one end and a male thread G20ID for connection to a valve at the other end. Supplied individually.

MS assembly set

The assembly set for suspended installation consists of threaded rods of different length (200; 500 and 1000 mm). Specify the length desired to meet site design requirements. The set also contains plastic sleeves to make the installation more attractive. The necessary ceiling brackets, nuts and washers are included in the supply.

Extended connection pipe

Pipe extension with compression ring coupling at one end for connection to the chilled beam. Supplied in pairs.

Recommended limit values -Water

| | |
|---|--|
| Max. recommended working pressure: | 600 kPa |
| Max. recommended test pressure when testing the completed installation: | 900 kPa |
| Min. cooling water flow: | 0.03 l/s |
| Temperature increase cooling water: | 2–5°C |
| Min. supply temperature: | Should always be selected so that the system works without condensation. |

Ensures that any air in the system can be expelled at the minimum water flow rate per circuit.

Accessories

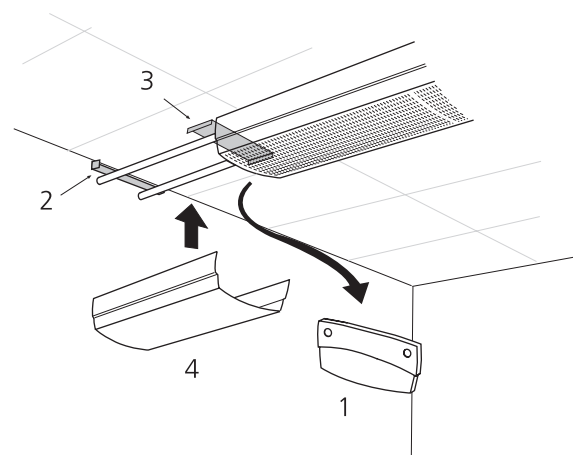


Figure 4. Cover for connection against a wall.

1. Dismount the plastic end cover of the beam.
2. Fasten the wall attachment to the wall.
3. Insert the attachment plate on the top of the beam.
4. Fit the cover into the wall attachment and to the beam. Lock the position of the cover with the attachment plate by pushing the plate back.

Technical specification

Cooling

The cooling capacity is measured according to EN 14 518 and is calculated for a constant water flow according to Diagram 2.

Diagram 1. The function between the cooling capacity P_k (W), temperature change ΔT_k (°C) and cooling water flow q_k (l/s).

Diagram 2. The function between the cooling capacity P_k (W) and the cooling water flow q_k (l/s). Different water flow rates affect the output capacity, to a certain degree. By checking the obtained water flow value using diagram 2 the documented capacities in tables 1-2 may, to a certain degree, need to be adjusted upwards or downwards.

Selection guides tables 1-2.

The following can be read off from the selection tables:

- Chilled beam's length (m)
- Water cooling capacity P_k (W)
- Pressure drop constant

Units of measurement

- P: Capacity in W, kW
- t_r : Room temperature °C
- t_m : Mean water temperature °C
- v: Velocity m/s
- q: Flow l/s
- p: Pressure Pa, kPa
- Δp : Pressure drop Pa, kPa
- ΔT_m : Temperature difference [$t_r - t_m$] °C
- ΔT : Temperature difference between supply-return, °C

Supplemental index: k = Cooling

The pressure drop on the water side is calculated according to the formula:

$$\Delta p_k = (q_k / k_{pk})^2 \text{ [kPa] where:}$$

Δp_k = The pressure drop in the water circuit (kPa)

q_k = The water flow (l/s), taken from Diagram 1

k_{pk} = Pressure constant

Diagram 1. Water flow - cooling effect.

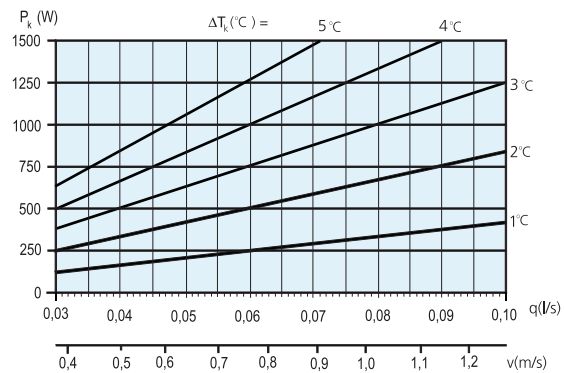
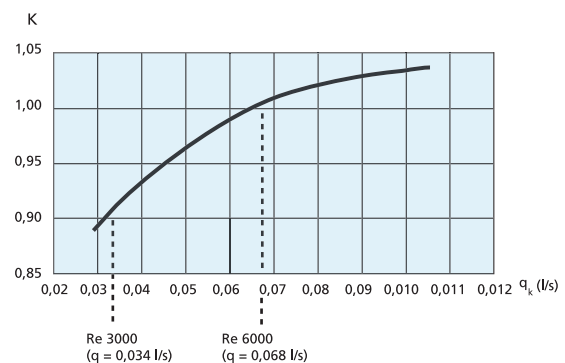


Diagram 2. Water flow - capacity correction.



K = capacity correction factor for FRB 290 and FRB 430.

Table 1. Data - cooling. Selection guide FRB 290.

| Unit's length m | ΔT_{mv} | Cooling capacity water (W) | | | | | | | k_{pk} |
|--------------------|-----------------|----------------------------|-----|-----|-----|-----|-----|-----|----------|
| | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 1,2 | | 81 | 102 | 125 | 147 | 168 | 190 | 213 | 0,0371 |
| 1,5 | | 108 | 136 | 162 | 188 | 216 | 245 | 273 | 0,0339 |
| 1,8 | | 137 | 167 | 198 | 230 | 264 | 299 | 334 | 0,0314 |
| 2,1 | | 162 | 197 | 234 | 272 | 312 | 353 | 395 | 0,0294 |
| 2,4 | | 186 | 227 | 270 | 314 | 360 | 408 | 455 | 0,0277 |
| 2,7 | | 211 | 257 | 306 | 356 | 408 | 462 | 516 | 0,0263 |
| 3,0 | | 236 | 288 | 342 | 398 | 456 | 516 | 577 | 0,0251 |
| 3,3 | | 261 | 318 | 378 | 439 | 503 | 570 | 637 | 0,0240 |
| 3,6 | | 286 | 348 | 414 | 481 | 551 | 625 | 698 | 0,0231 |
| 3,9 | | 310 | 379 | 450 | 523 | 599 | 679 | 759 | 0,0223 |

Table 2. Data - cooling. Selection guide FRB 430.

| Unit's length m | ΔT_{mv} | Cooling capacity water (W) | | | | | | | k_{pk} |
|--------------------|-----------------|----------------------------|-----|-----|-----|-----|------|------|----------|
| | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 1,2 | | 130 | 162 | 195 | 230 | 266 | 303 | 342 | 0,0300 |
| 1,5 | | 169 | 209 | 251 | 295 | 342 | 390 | 440 | 0,0275 |
| 1,8 | | 206 | 255 | 307 | 361 | 418 | 476 | 537 | 0,0255 |
| 2,1 | | 244 | 301 | 362 | 426 | 493 | 563 | 635 | 0,0239 |
| 2,4 | | 281 | 348 | 418 | 492 | 569 | 649 | 732 | 0,0225 |
| 2,7 | | 318 | 394 | 474 | 558 | 645 | 736 | 830 | 0,0214 |
| 3,0 | | 356 | 440 | 530 | 623 | 721 | 822 | 927 | 0,0204 |
| 3,3 | | 393 | 487 | 585 | 689 | 797 | 909 | 1025 | 0,0195 |
| 3,6 | | 431 | 533 | 641 | 754 | 872 | 995 | 1122 | 0,0188 |
| 3,9 | | 468 | 579 | 697 | 820 | 948 | 1082 | 1220 | 0,0181 |

For variants with a connection section the capacity data is read for the closest previous length. Example: The cooling capacity for FRB 290 - 2.1 m with connection section is read in the table 1 for length 1.8 m

Pressure drop diagram

Diagram 3. FRB 290: pressure drop Δp_k (kPa) in the cooling circuit as a function of the cooling water flow q_k (l/s) and unit's length.

Diagram 4. FRB 430: pressure drop Δp_k (kPa) in the cooling circuit as a function of the cooling water flow q_k (l/s) and unit's length.

Diagram 3. FRB 290, pressure drop - water flow.

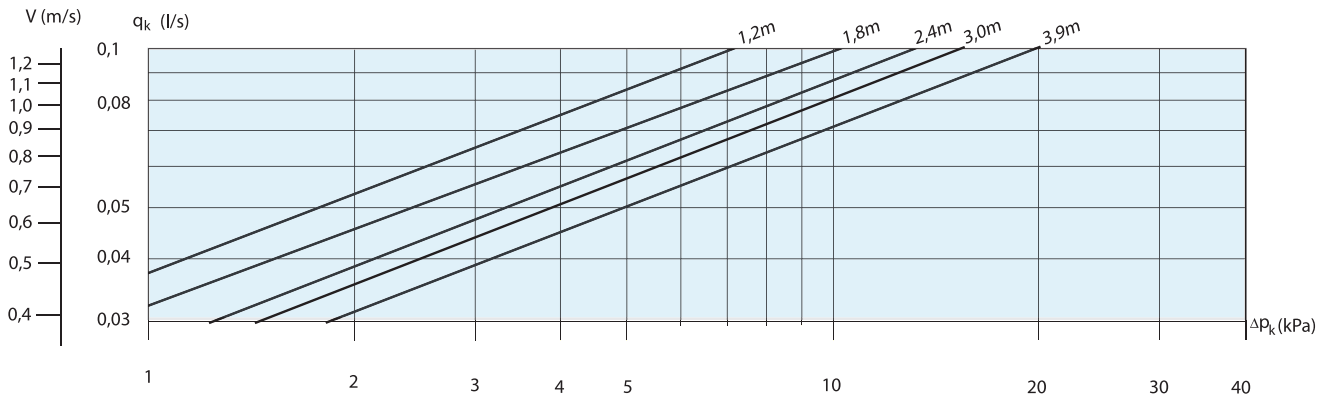


Diagram 4. FRB 430, pressure drop - water flow.

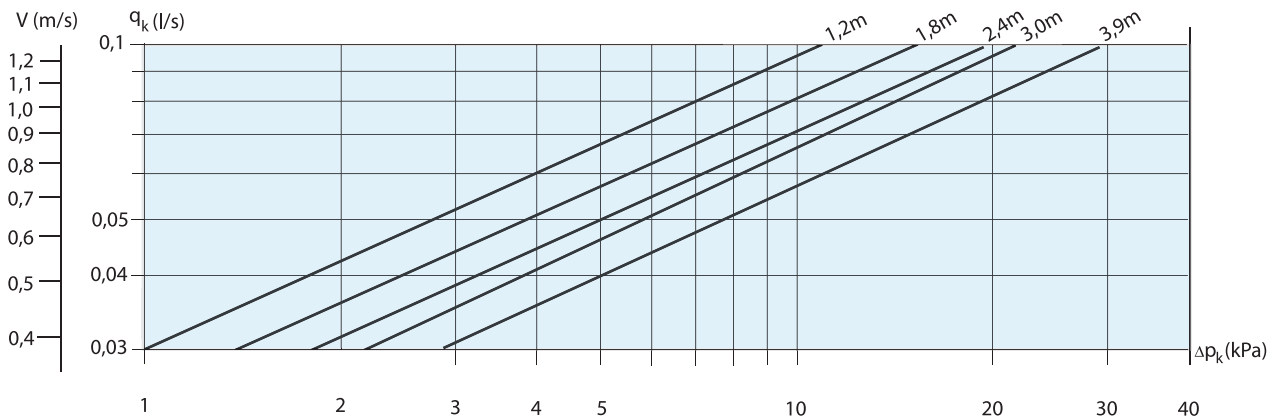


Diagram 5. FRB 290 - the relation between the circulation air openings and the output. The cooling capacity is corrected according to the size of the circulation openings as per the following $P = P_{\text{table1}} \cdot K_s$.

Diagram 6. FRB 430 - the relation between the circulation air openings and the output. The cooling capacity is corrected according to the size of the circulation openings as per the following $P = P_{\text{table2}} \cdot K_s$.

Diagram 5. FRB 290, reduction factor

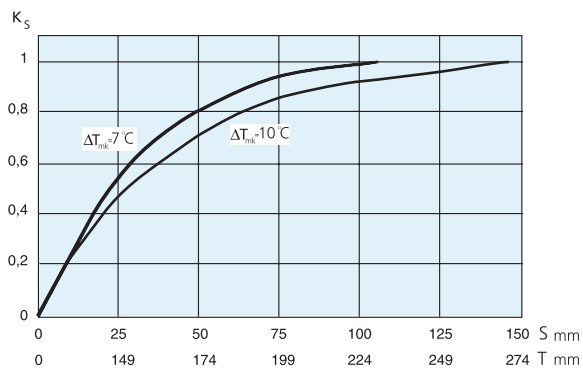
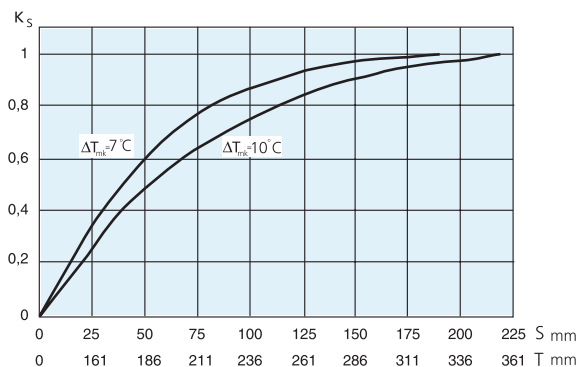


Diagram 6. FRB 430, reduction factor



S = Ceiling spacing

T = Total installation height including circulation air gap

K_s = Effect reduction factor

The ceiling spacing is valid when there is circulation air from two sides. When there is circulation air only from one side the same effect reduction factors is applied if the ceiling spacing is increased 1,5 times.

Circulation air openings

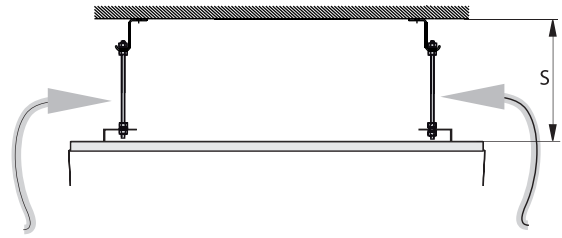


Figure 5. Circulation air openings. With circulation air measurement from one side only the opening "S" is increased by 1.5 times.

Example FRB 430

The new tenant changes the activities in the building and requires more cooling than the existing ventilation system can provide. The additional cooling requirement is 2600 W.

Planned room temperature: 25°C

Cooling water temperature: 14/17 gives: $\Delta T_k = 3^\circ\text{C}$; $\Delta T_{mk} = 9.5^\circ\text{C}$

SOLUTION

Cooling capacity

Table 2 gives for the length 3.0 m cooling effect 672 W (at $\Delta T_{mk} = 9.5^\circ\text{C}$). A requirement of 2600 W requires $2600 / 672 = 4$ three metre lengths. A selection of 4 x FRB 430 - 3.0 is made.

Cooling water

With the cooling capacity requirement $2600 / 4 = 650$ W per three metre length, the requisite water flow is read off from **Diagram 1**. With the temperature increase $\Delta T_k = 3^\circ\text{C}$ the water flow 0.052 l/s is given.

The pressure drop is calculated based on the water flow 0.052 l/s and the pressure drop constant $k_{pk} = 0.0204$, which is taken from **Table 2**. The pressure drop is then: $\Delta p_k = (q_k / k_{pk})^2 = (0.052 / 0.0204)^2 = 6,5$ kPa.

Solution

Select four 3.0 metre long FRB 430 to be installed at least 210 mm from the ceiling to obtain a sufficiently large gap for the circulated air (shown in **Diagram 6**)

Dimensions

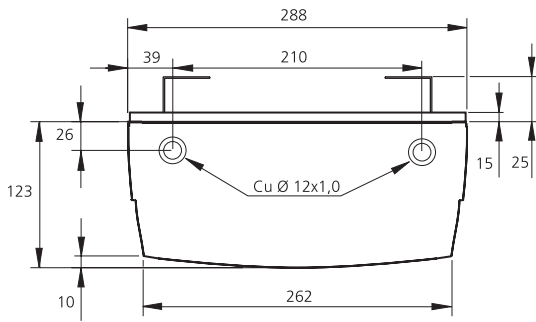


Figure 6. FRB 290, end view.

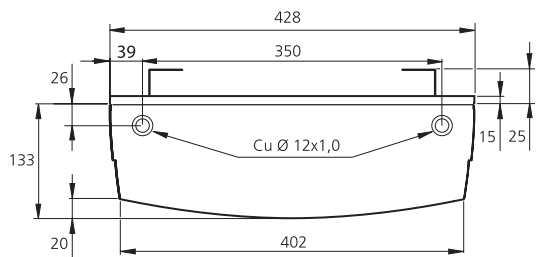


Figure 7. FRB 430, end view.

Length FRB

| | |
|---|--|
| Nominal size FRB 290 and FRB 430 (m) : | 1.2, 1.5, 1.8, 2.1, 2.4, 2.7, 3.0, 3.3, 3.6 and 3.9 m. |
| Length FRB 290 | Nominal - 28 mm. (+4/-2) |
| Length FRB 430 | Nominal - 12 mm. (+4/-2) |
| Size of lower section's subdivision $L_u = L/2$ | |

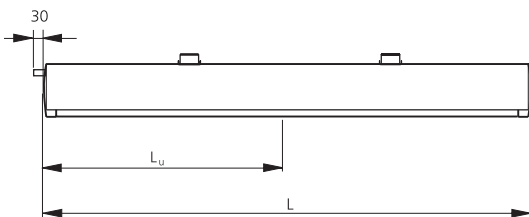


Figure 8. Connection -H, side view.
 L = length FRB
 L_u = length of lower section's subdivision

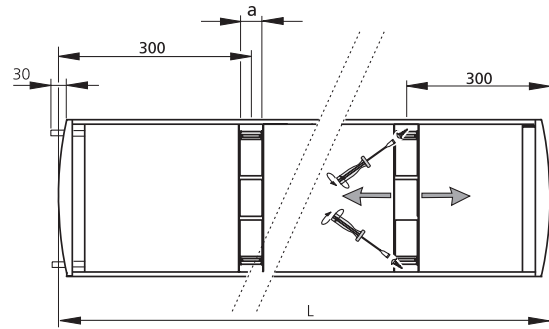


Figure 9. Horizontal connection at the end -H, top view.
 a = adjustment allowance suspension fittings 43 mm.

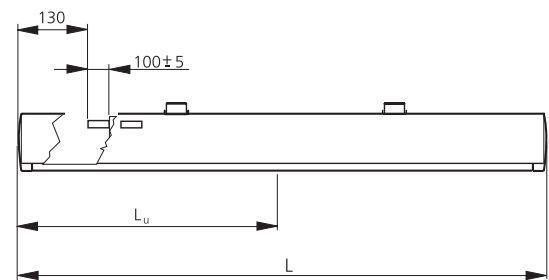


Figure 10. Connection -I, side view.
 L = length FRB
 L_u = length of lower section's subdivision

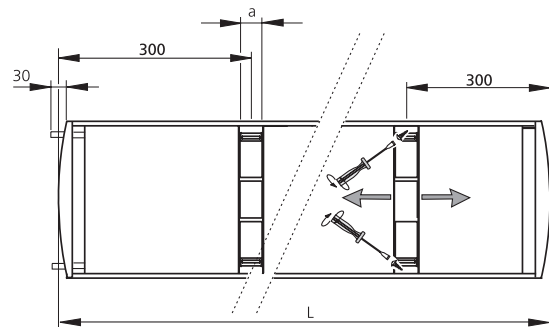


Figure 11. Connection -I, top view.
 a = adjustment allowance suspension fittings 43 mm.

Installation measurements

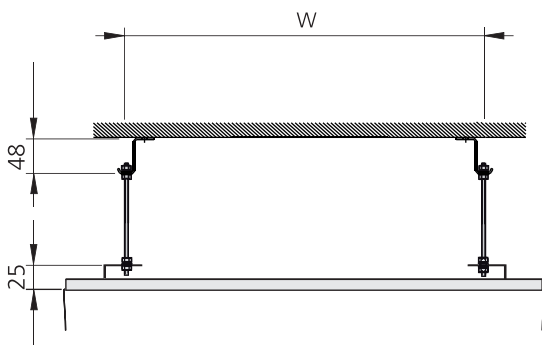


Figure 12. Assembly fittings SYST MS.

FRB 290: $W = 188 \text{ mm}$

FRB 430: $W = 328 \text{ mm}$

Limits of contract

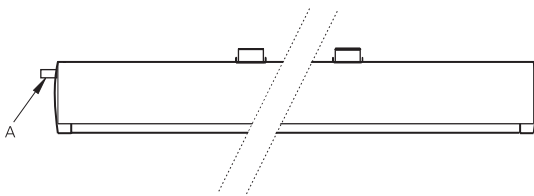


Figure 13. Connection, side view.

A = cooling: the plumbing contractor connections to pipe Cu 12 x 1.0 mm

Specification

Cooling system type FRB for cooling.

The units are supplied enamelled in Swegon white standard colour RAL 9010 gloss value $30 \pm 6\%$.

Limits of contract

Swegon limits of contract are at the connection points for water (in accordance with the **figure 13** under Dimensions - Limits of contract/connection points). At these connection points the plumbing contractor connects to plain pipe ends, fills the system, vents and carries out pressure testing.

The units are supplied exclusive of assembly kits. These are to be ordered separately.

Weight

| Weight per metre FRB 290 | |
|--------------------------|----------|
| Dry weight | 5.0 kg/m |
| Weight, water-filled | 5.5 kg/m |

| Weight per metre FRB 430 | |
|--------------------------|----------|
| Dry weight | 7.3 kg/m |
| Weight, water-filled | 8.0 kg/m |

Specification

Product

| | | | | |
|---|----|------|------|---|
| FRB | b- | aaa- | bbb- | c |
| Version: | | | | |
| Size: | | | | |
| 290 = width 290 | | | | |
| 430 = width 430 | | | | |
| Length: | | | | |
| 1.2, 1.5, 1.8, 2.1, 2.4, 2.7, 3.0, 3.3, 3.6, 3.9 m. | | | | |
| Connection: | | | | |
| H = horizontal connection outside the end | | | | |
| I = connection section, inside | | | | |

Accessories

| | | | | |
|-----------------------|--------|------|------|-----|
| Connection cover | FRB b- | T-KA | aaa- | bbb |
| Version: | | | | |
| Type: | | | | |
| Size: | | | | |
| 290 and 430 | | | | |
| Length: | | | | |
| 120, 300, 500 and 700 | | | | |

| | | | |
|-------------------|---------|-----|-----|
| Loose endplates | FRBT GL | aa- | bbb |
| UH = without hole | | | |
| MH = with hole | | | |
| Size: | | | |
| 290, 430 | | | |

| | | |
|-------------------|---------|-----|
| Extension pipe, 2 | SYST FR | aaa |
| Length: | | |
| 300 or 430 mm | | |

| | | | | |
|--------------------------------------|---------|-------|----|---------|
| Assembly set | SYST MS | aaaa- | b- | RAL9010 |
| For suspended installation | | | | |
| Length drop rod: | | | | |
| 200, 500, 1000 mm | | | | |
| 1 = only the drop rod | | | | |
| 2 = double drop rods with tread lock | | | | |

| | | | |
|-----------------------------------|------------|------|----|
| Flexible connection hose | SYST FH F1 | aaa- | 12 |
| (1) | | | |
| compression ring on pipe (Ø12 mm) | | | |
| Length: | | | |
| 300, 500 and 700 mm | | | |

| | | | |
|---------------------------|-------------|------|----|
| Flexible connection hose | SYST FH F20 | aaa- | 12 |
| (1) | | | |
| Push-on coupling (Ø12 mm) | | | |
| against pipe on both ends | | | |
| Length: | | | |
| 275, 475 and 675 mm | | | |

| | | | |
|--------------------------------------|-------------|------|----|
| Flexible connection hose (1) | SYST FH F30 | aaa- | 12 |
| Push-on coupling (Ø12 mm) | | | |
| against a pipe on the one end, | | | |
| a G20ID sleeve nut on the other end. | | | |
| Length: | | | |
| 200, 400 and 600 mm | | | |

Explanatory text

Example of the explanatory text.

Swegon passive chilled beam FRB for individually suspended installation on ceilings, with the following functions:

- Cooling
- For individually suspended installation
- Connection section (optional)
- Low build-in height
- Sliding lower section
- The units delivered enamelled in white standard finish RAL 9010
- Limit of contract at connection points for water according to principal drawing.
- At connection points the plumbing contractor connects to plain pipe ends, cooling 12 x1.0 mm.
- The plumbing contractor fills, vents and pressure tests and bears responsibility that the planned water flow reaches each system branch and beam.

Accessories:

- Assembly set SYST MS aaaa - b - RAL9010 xx, qty
- Flexible connection hose SYST FH F1 aaa- 12 xx, qty etc.

Size:

KB XX-1 FRB aaa - bbb xx, qty

KB XX-1 FRB aaa - bbb xx, qty

etc.

- Control equipment, see separate section in the catalogue Indoor Climate Systems