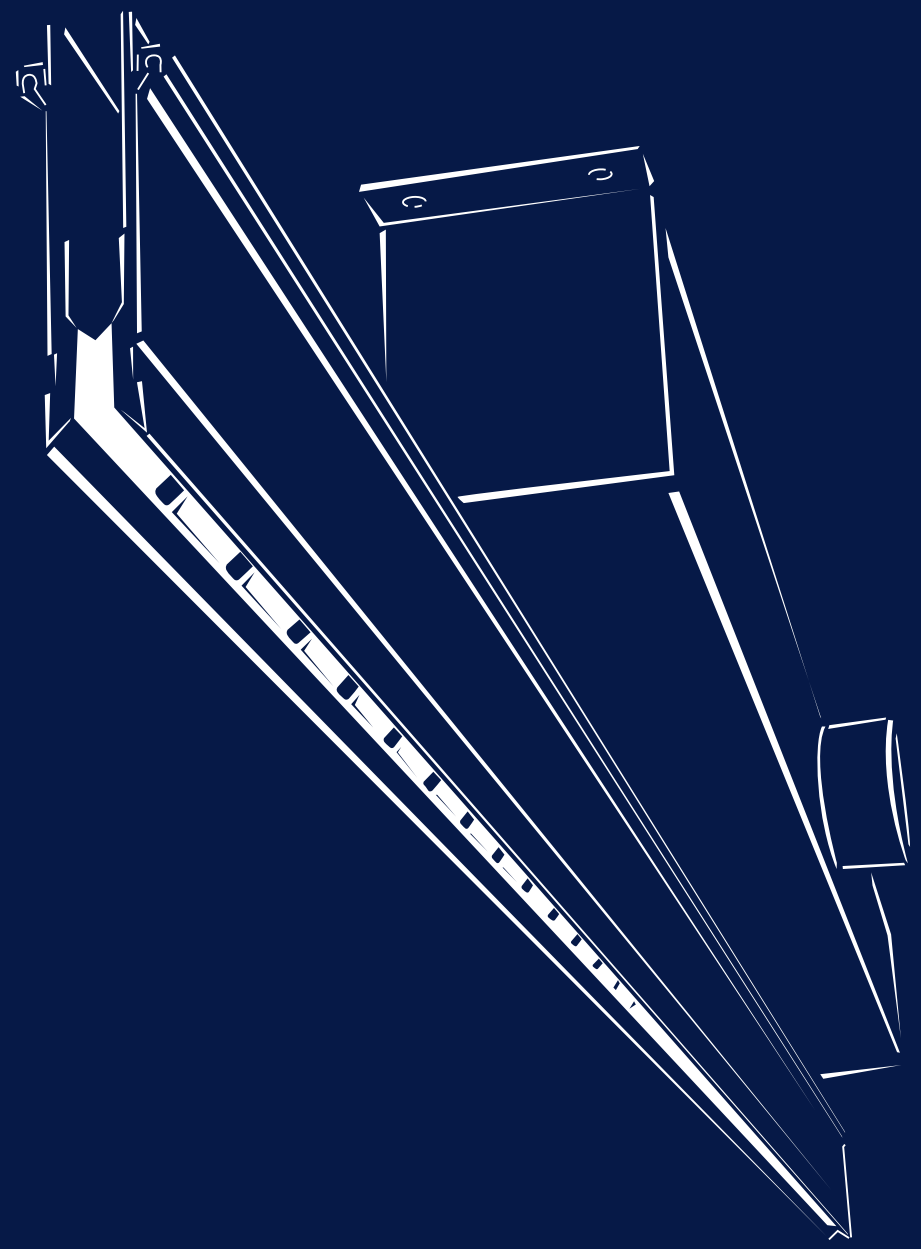

HC CLI-MATE® Linear Jet Flo, Type CSV

HC BARCOL-AIR

This product has been patent protected.
(patent pending 1033659)

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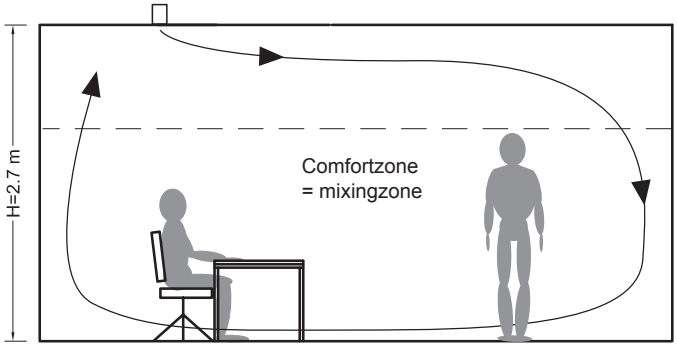
Air distribution & applications

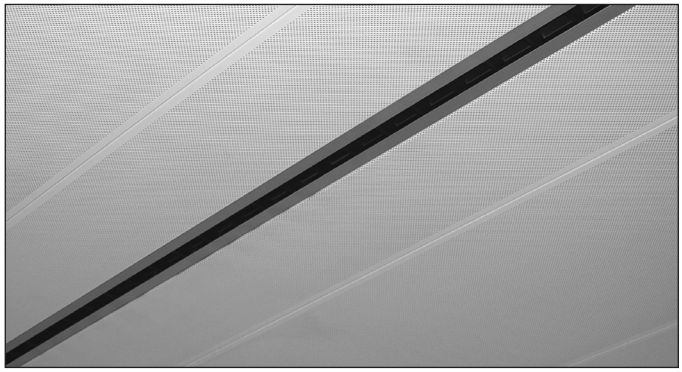
In a climate installation can be chosen for several reasons for application of a chilled ceiling.

In accordance with the building regulations a minimum quantity of fresh air and extra air for additional cooling is required.

There are several solutions to bring fresh air into the room. The most obvious method is the use of linear diffuser's because they can be used easily between the panels of the ceiling.
Further ethics aspects can be an imported wish by the architect.



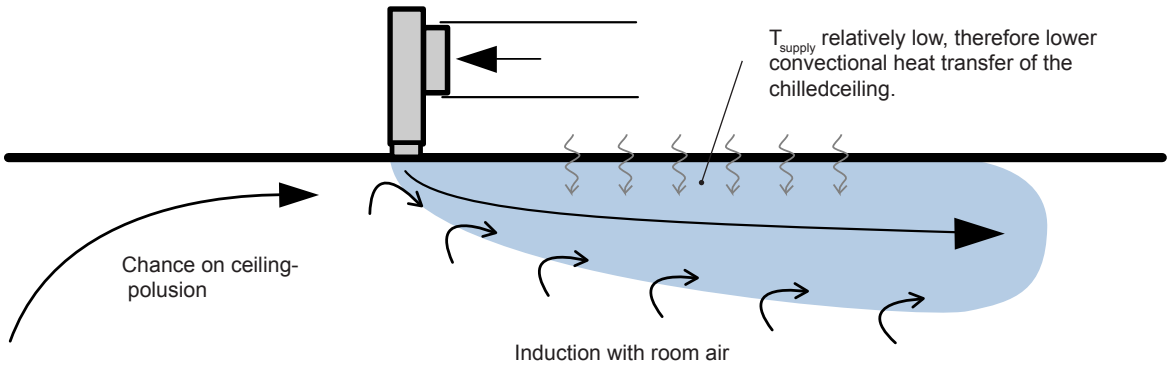
Conventional Linear Diffuser: swirl and mixing in the comfortzone



Example: conventional linear diffuser mounted in between metal ceiling tiles (width including flanges 71 mm)

Conventional linear diffusers.

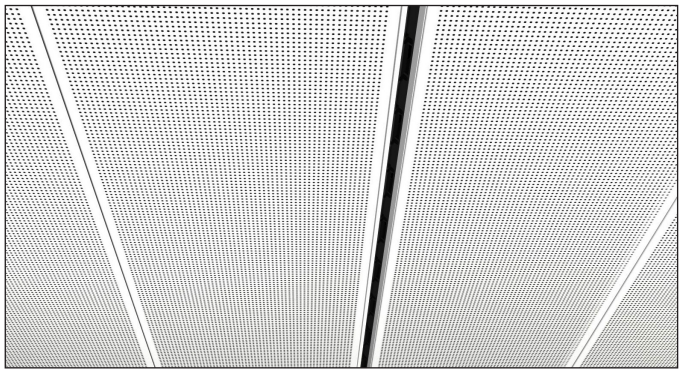
This air pattern of a conventional linear diffuser is aimed along the ceiling where diffusers uses the coanda effect. These air patterns are relatively sensitive for the temperature of the ceiling. A swirl is created in the room, which creates a good mixture of the supply air and the room air.
This swirl will be created by the throw from the ceiling which eventually reaches the comfortzone.
Although the air speeds have decreased sufficiently along the floor an air movement in the direction of the supply grill excists, while underneath the grill the room air moves upwards.This upward swirl can result in polution of the diffuser and/or ceiling.Besides the velocities along the floor can become critical and can create uncomfortable situations.



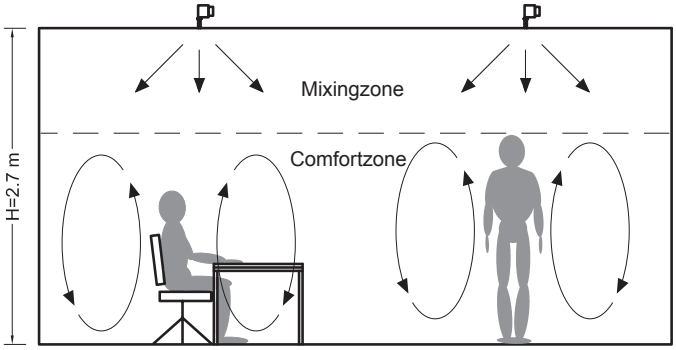
Conventional Linear Diffuser: air pattern with Coanda-effect,induction functioning and convectional transfer of the chilled ceiling.

HC CLI-MATE® Linear Jet Flo, type CSV

With the CSV Linear Jet Flo the supply air will be supplied into the room with small jets in three different directions. The small dimensions and the mutual different air pattern of these supply jets resulting, intensive mixing with the room air. Here with we achieve that the mixing of air takes place entirely above the comfortzone.



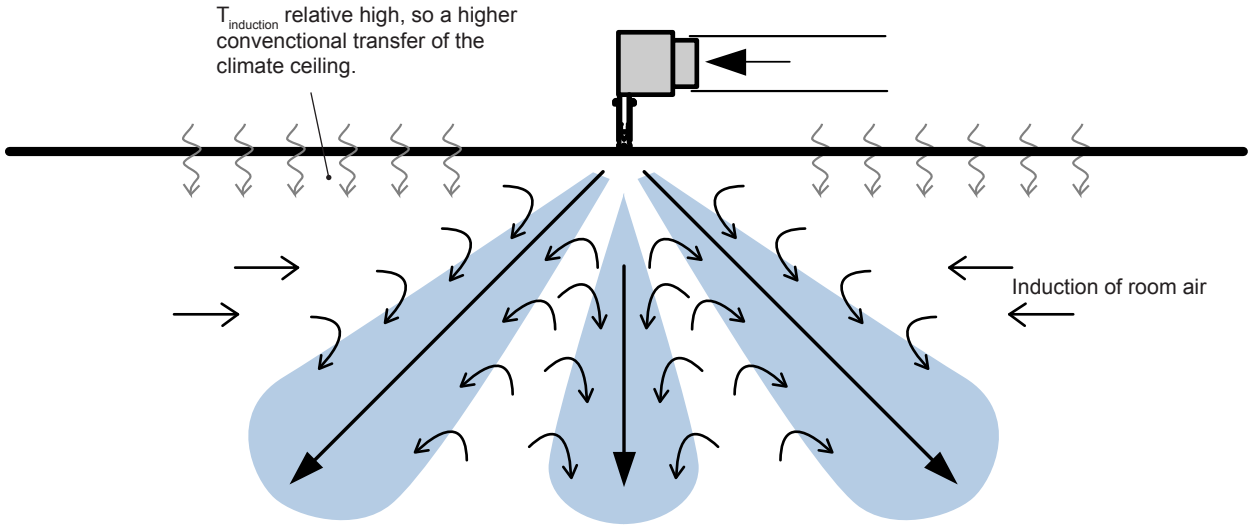
Example: Linear Jet Flo between ceilingplates (width 20 mm)



Linear Jet Flo: mixing above the comfortzone

In the comfortzone the air distribution takes place by free convection; around persons and heat sources the room air moves up and in between down low. The air velocities that arise are low, so that no draughts will occur. Because of the absence of an upword return swirls polution of ceiling and/or diffuser will not occur.

The air distribution of a straallijnrooster CSV is hardly sensitive for the temperature of the ceiling because the distributes air goes directly into the comfort zone and avoids contact with the ceiling that eliminates the Coanda effect. Because of this the diffuser is very suitable to combine with a climateceiling. In addition the downard aimed air pattern creates a local inductionstream of the room air along the ceiling which stimulates the heattransfer of the ceiling.



Linear Jet Flo: air pattern without Coanda-effect, induction functioning and convectional transfer of the climate ceiling.

Example measuring air pattern conform ISO-7726

Climateroom

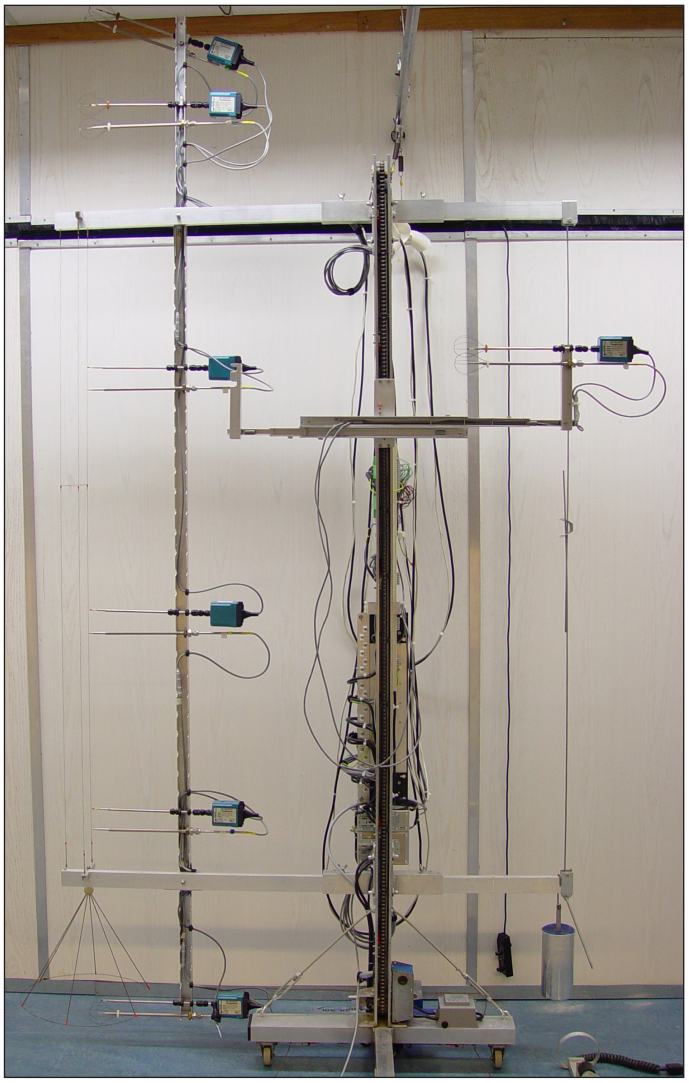
Our climateroom offers the possibility to simulate office rooms on real scale. In several mock up's under summer - and winter conditions tests are performed, to determine the room temperatures and the end velocities in the comfortzone. In the past 25 years more than 250 full-scale climate tests have been carried out.

Data Aquisition System

All measuring data is collected and processed with a, by "labVIEW®" supported, automatic "Data Acquisition System". "labVIEW®" is a software program of National Instruments for virtual instrumentation.

Measuringrobots

The most important part of the test facility, is the automatic moving measuring robot with accurate air temperature and velocity sensors. The height of the measuring sensors is according NEN-ISO standards 0,1 – 0,6 – 1,1 and 1,7 meter above the floor. These heights represent ankles, bottom, trunk and head of the human body. The robot measures the area from floor to ceiling and from front to back of the test room.
Extra sensors are mounted on the robot on other heights and in different measuring areas to detect possible irregularities (for instance asymmetry) of the air pattern. Extra sensors are also mounted 5 cm below the ceiling to check the air pattern of the supply diffusers.



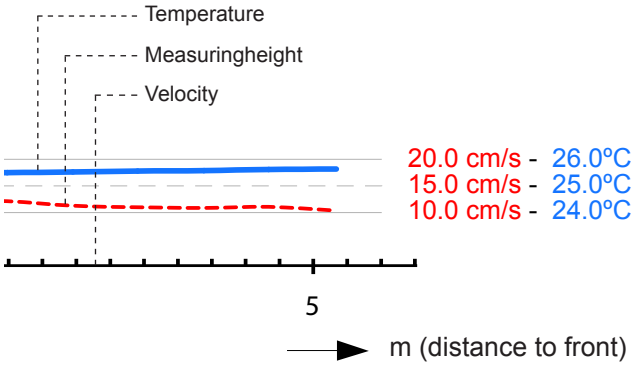
Measuringrobot

Measuring results

The resluts from "LABVIEW®"-measuring are presented as followed:

1. Graphic reproduction of the room temperature and the air velocity profile in a section of the room, the "temperature/velocity-traverse".
2. The same data in given in a table.

In the temperature/velocity-traverses on vertical ash the temperatures are reflected in ^{0}C and the axle Air velocity's cm's. Horizontal dotted lines indicates the measurinheight. Besides these lines serve as a reference for the particular measuring heights.



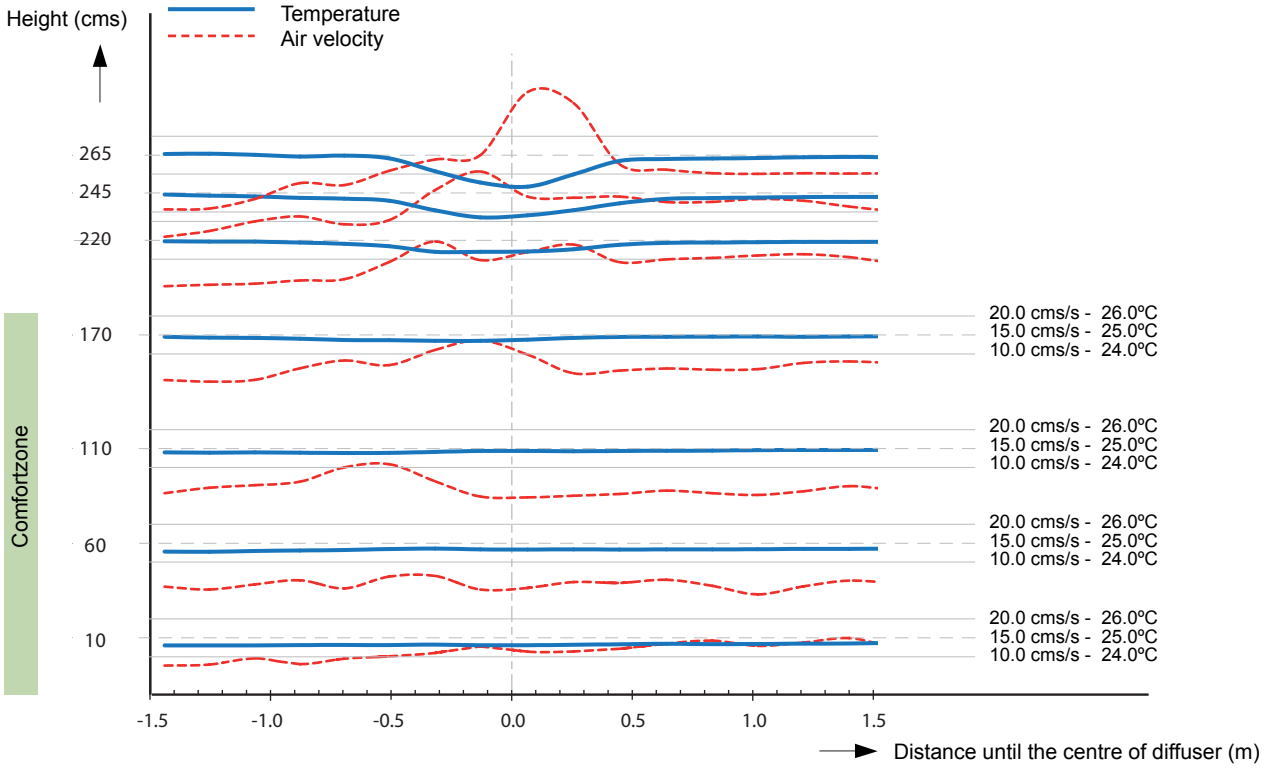
Test measuring cooling situation with 1 diffuser:

CSV-Diffuser 1500 mm (1200 mm active),
diffuser width (C) = 20 mm

Cooling situation:

a.	Room temperature 1.5 m	24.9 ºC
	Supply air temperature	18.0 ºC
b.	Room with 100% glass facade at 1 side	
c.	Air supply	60 m³/h
	Temperature difference	-7 K

Graph 1: Measuring results CSV 1500 mm (1200 mm active, C=20 mm)



Model 1: Test results CSV 1500 mm (1200 mm active, C=20 mm)

Height	Air velocity																	
																		= comfortzone
2.65 m	cm/s	0.7	0.9	3.4	7.6	7.1	10.8	13.9	15.0	31.7	28.7	12.6	11.2	10.2	10.1	10.2	10.1	10.2
2.45 m	cm/s	3.4	5.0	7.5	8.8	6.7	7.8	15.8	20.7	14.1	13.7	14.0	12.6	12.6	13.4	13.0	11.4	10.4
2.2 m	cm/s	2.8	3.2	3.5	4.4	4.7	9.3	14.7	9.8	11.9	13.9	9.2	10.0	10.3	11.0	11.3	10.6	9.0
1.7 m	cm/s	3.1	2.6	3.1	6.2	8.3	7.0	11.0	13.6	9.8	4.9	5.6	6.1	5.8	6.0	7.6	8.0	7.5
1.1 m	cm/s	3.2	4.6	5.3	6.2	10.0	10.8	6.3	2.3	2.1	2.5	3.0	3.8	3.2	2.7	3.7	5.1	4.2
0.6 m	cm/s	3.5	2.7	4.1	5.2	3.0	6.2	6.3	2.7	3.2	4.7	4.5	5.3	3.7	1.5	3.6	5.1	4.4
0.1 m	cm/s	7.7	7.9	9.6	8.0	9.5	10.1	11.0	12.7	11.3	11.4	12.1	13.5	14.3	12.9	13.7	14.9	12.6
Height	Air temperature																	= comfortzone
2.65 m	°C	25.1	25.1	25.0	24.9	25.0	24.8	24.1	23.6	23.3	24.0	24.7	24.8	24.8	24.8	24.9	24.9	24.9
2.45 m	°C	24.9	24.9	24.8	24.7	24.7	24.6	24.1	23.7	23.8	24.1	24.5	24.7	24.7	24.8	24.8	24.8	24.8
2.2 m	°C	25.0	24.9	24.9	24.9	24.8	24.7	24.4	24.4	24.4	24.5	24.8	24.9	24.9	24.9	24.9	24.9	24.9
1.7 m	°C	24.9	24.9	24.8	24.8	24.7	24.7	24.7	24.7	24.7	24.8	24.9	24.9	24.9	24.9	24.9	24.9	24.9
1.1 m	°C	24.8	24.8	24.8	24.8	24.8	24.8	24.8	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9
0.6 m	°C	24.6	24.5	24.6	24.6	24.6	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7
0.1 m	°C	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.7	24.7	24.7	24.7	24.7	24.7	24.7
X-coordinate	m	1.6	1.4	1.2	1.0	0.8	0.6	0.4	0.2	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6

See page 7 for our conclusion concerning the test results.

Example test results room conditions accordance ISO-7726

Test measuring heating situation with 4 diffuser:

4 CSV-diffusers 1200 mm (600 mm active),
Diffuser width (C) = 20 mm

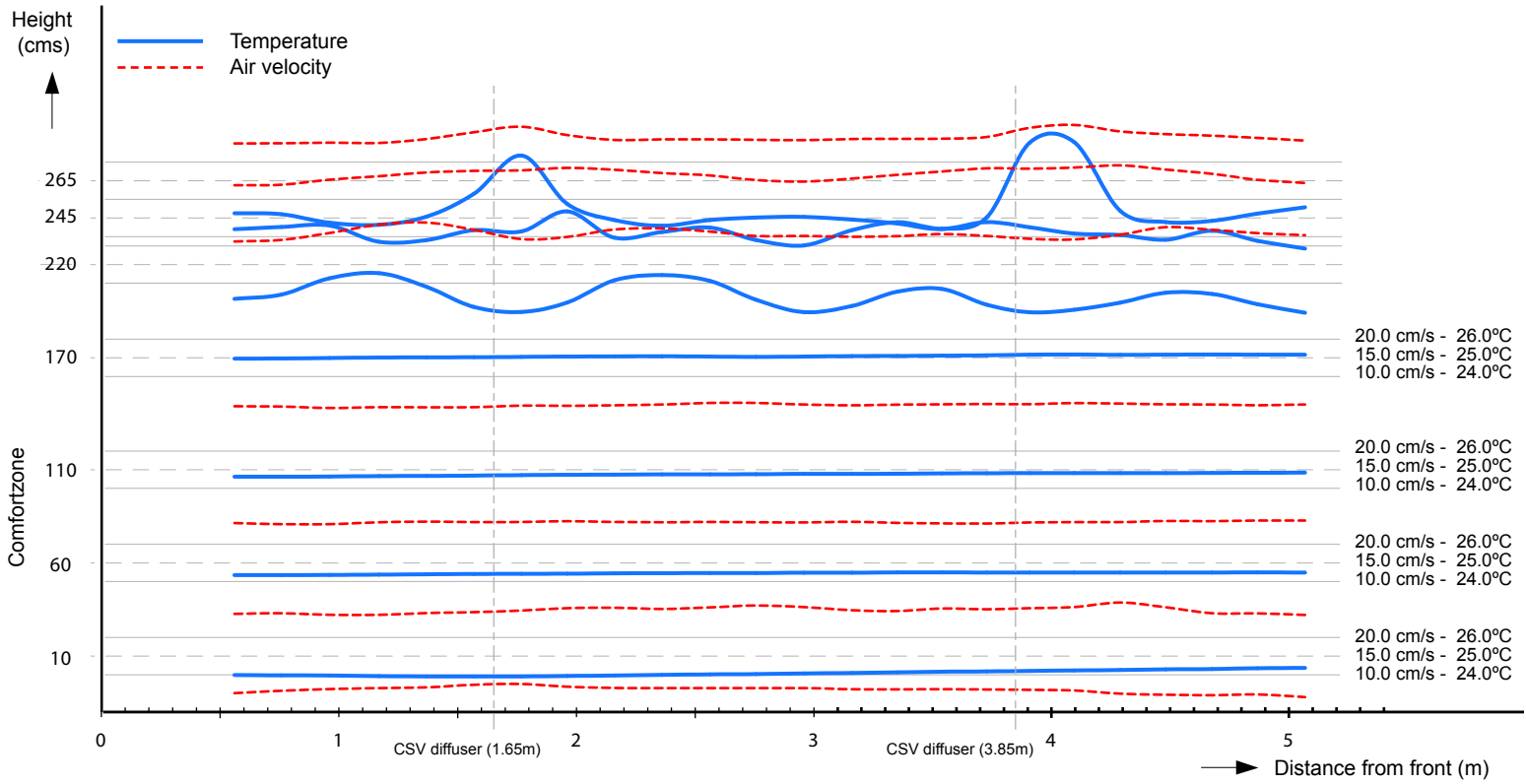
Heating situation:

a. Room temperature 1.5 m 20.9 ºC
Supply air temperature 28.1 ºC
Window area temperature 16.9 ºC
Wall temperature 20.8 ºC
Plenum temperature 22.2 ºC

b. Room with 100% glass facade at 1 side.

c. Air supply 4 x 33 m^3/h
Temperature difference +7 K
Air changes per hour 2.5

Graph 2 : Test results CSV 1500 mm (1200 mm active, C=20 mm)



See page 7 for our conclusion concerning the test results.

Example measuring room conditions in accordance with ISO-7726

Model 2: Test results 4 x CSV 1200 mm (600 mm actief, C=20 mm)

Height	Air velocity	= comfortzone																							
2.65 m	cm/s	6.2	6.0	3.7	3.1	5.3	11.4	21.7	8.7	4.4	2.9	4.4	5.1	5.2	4.5	3.5	2.0	5.1	25.1	25.3	6.8	3.8	4.2	6.1	7.8
2.45 m	cm/s	11.9	12.5	12.9	8.5	9.0	11.7	11.3	16.7	9.6	11.2	12.4	9.0	7.6	11.7	13.8	12.0	13.8	12.4	10.8	10.4	9.1	11.5	8.8	6.7
2.2 m	cm/s	5.7	6.9	11.3	12.6	9.0	3.6	2.2	4.8	10.7	12.1	10.6	5.5	2.2	3.9	7.7	8.4	4.2	2.2	2.8	4.7	7.4	7.1	4.3	2.0
1.7 m	cm/s	1.9	1.9	1.5	1.7	1.7	1.7	2.1	2.1	2.2	2.4	2.8	2.8	2.4	2.2	2.4	2.5	2.5	2.5	2.8	2.6	2.5	2.4	2.2	2.4
1.1 m	cm/s	0.6	0.3	0.3	0.8	1.0	0.9	0.9	1.1	0.9	0.8	0.9	0.8	0.8	1.0	0.7	0.5	0.5	0.8	0.9	0.9	1.2	1.1	1.3	1.3
0.6 m	cm/s	1.3	1.4	1.0	1.0	1.5	1.7	2.1	2.8	2.9	2.6	3.0	3.5	3.1	2.2	2.0	2.7	2.5	2.8	3.1	4.3	3.0	1.4	1.4	0.9
0.1 m	cm/s	5.0	5.6	6.1	6.4	6.6	7.2	7.5	6.7	6.4	6.3	6.3	6.3	6.3	6.0	6.0	6.1	6.0	5.9	5.7	4.8	4.6	4.4	4.7	4.0
Height	Air temperature	= comfortzone																							
2.65 m	°C	23.0	23.0	23.0	23.0	23.2	23.6	23.9	23.4	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.3	23.8	24.0	23.6	23.5	23.4	23.3	23.1
2.45 m	°C	22.7	22.8	23.0	23.2	23.4	23.5	23.5	23.7	23.6	23.4	23.3	23.0	22.9	23.1	23.3	23.5	23.7	23.6	23.7	23.8	23.6	23.4	23.0	22.9
2.2 m	°C	22.2	22.3	22.7	23.1	23.2	22.9	22.4	22.5	22.9	22.9	22.8	22.5	22.5	22.5	22.5	22.6	22.5	22.4	22.3	22.6	23.0	22.9	22.7	22.6
1.7 m	°C	20.9	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.1	21.1	21.1	21.0	21.1	21.1	21.1	21.1	21.1	21.2	21.2	21.1	21.2	21.2	21.2	21.2
1.1 m	°C	20.6	20.6	20.6	20.6	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8
0.6 m	°C	20.3	20.3	20.3	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
0.1 m	°C	20.0	20.0	19.9	19.9	19.9	19.9	19.9	19.9	19.9	20.0	20.0	20.0	20.1	20.1	20.1	20.1	20.2	20.2	20.2	20.2	20.3	20.3	20.3	20.3

X-co-ordinates	m	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2

Conclusion:

The measuringresults show that, with a typical heat loss and air changes a temperature rate excist that complies to ISO-7730 (3 K/m in the comfortzone) and the DIN 1946 (2 K/m in the comfortzone).

Technical Information & Specifications

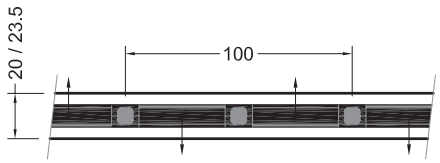
Technical Information

Features:
- Esthetical design.
- Adjustable air pattern. By the special internal parts is a draught pattern is possible without the use of the Coanda-effect.
- Indication air quantities:
  20 mm width: ca. 55 m^3/h/m
  23.5 mm width: ca. 83 m^3/h/m
- Suitable for climate ceiling.

Construction:
- Diffuser width: 20 en 23.5 mm.
- Internal parts: black synthetic material (polyamide, PA66; UV resistant)
- Frame: extruded aluminium, finish RAL9010.
- Plenumbox: galvanized sheet steel.
- The plenumlength will be selected based on airvolume and can be equal or shorter than diffuserlenght.
- Other dimensions upon request.

Delivery:
- The plenumbox and the diffusers are supplied together

Mounting:
- Suitable for mounting between ceilingplates.
- The flanges of a plenum are provided with brackets.
- For mounting next to a lightning-armature an excentric construction of plenum is possible.
- We recommend to drop the diffuser 1 mm below the ceiling. Herewith an optimum performance will be achived.



Variable air pattern per 100 mm

Streaming angle: 45º left - straight vertical - 45º right

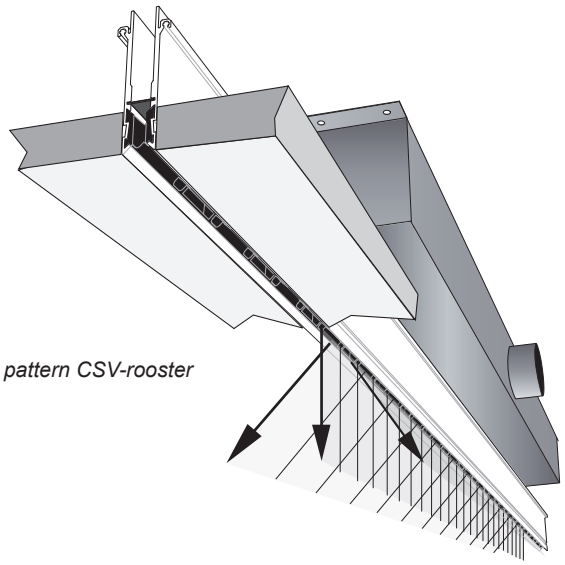
Current types

- CSVOOO4 Dummy, diffuserwidth (C = 20 mm) width.
- CSVO1O4 Diffuser (C=20 mm) with uninsulated plenum box.
- CSVO3O4 Diffuser (C=20 mm) with insulated plenum box.
- CSV2OO4 Dummy, diffuserwidth (C = 23.5 mm) width.
- CSV21O4 Diffuser (C=23.5 mm) with uninsulated plenum box.
- CSV23O4 Diffuser (C=23.5 mm) with insulated plenum box.

Specifications

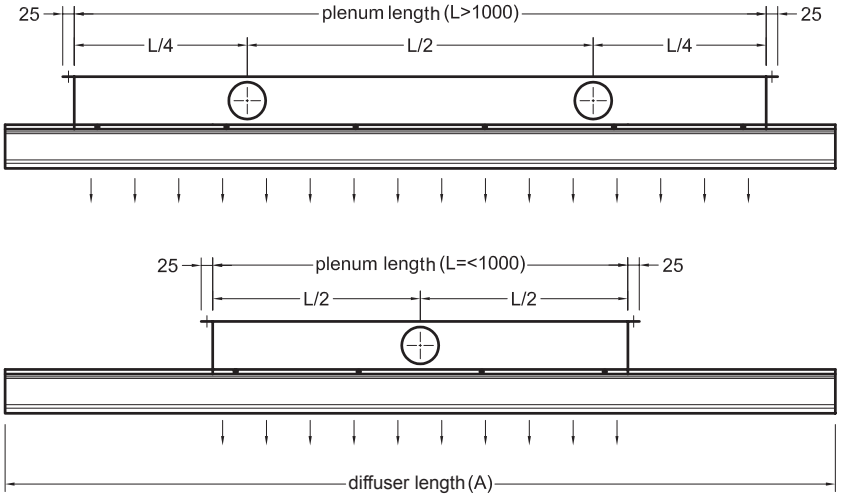
Example 1:
Linear diffuser with 20 mm width, with associated uninsulated plenum. The diffuser is provided with internal parts with a variable supply air pattern with draught-free supply air without the Coanda-effect. The diffuser has a lenght of 1720 mm, which the plenum has a lenght of 900 mm .
Finish: RAL9010 (internal parts are black).
HC Barcol-Air type: CSVO1O4-1720-0900

Example 2:
Linear diffuser with 23.5 mm width with associated uninsulated plenum. The diffuser is provided with internal parts with a variable supply air pattern with draught-free supply air without the Coanda-effect.The diffuser has a lenght of 1500 mm, which the plenum has a lenght of 900 mm .
Finish: RAL9010.
HC Barcol-Air type: CSV21O4-1500-1200

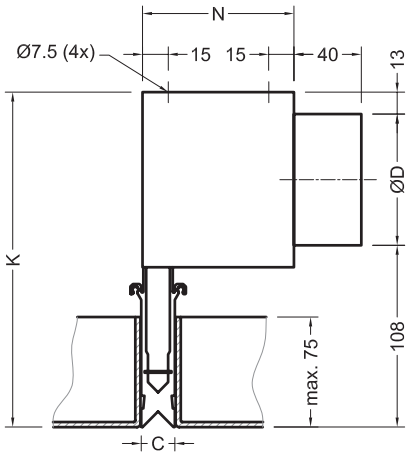


Air pattern CSV-rooster

Dimensions & Selectiondata



Example excentric plenum for mounting next to a lightning-armature:



Notes:

1. *All dimensions are in millimetres.*
2. *Dimension A, is the "actual" length = 1800 mm.*
3. *Other dimensions and configurations upon request.*

Table 2: Dimensions plenumbox

	C=20	C=23.5
D	78	98
K	199	219
N	90	95

Table 3 : Selection table cooling (C = 20 mm, ΔT = -7K, at T_{room}=25⁰ C)

Plenum-box-length	m³/h	X¹=1.6 m	X=1.0 m	ΔP (Pa)	LpA dB(A)
		cm/s	cm/s		
600	28	8	11	7	27
	33	8	12	10	28
	38	9	12	13	29
900	44	11	12	8	28
	49	13	14	10	29
	54	15	16	12	30
1200	60	11	13	6	28
	65	12	14	7	29
	70	14	15	9	31
1500	77	11	13	8	29
	82	13	16	9	30
	87	15	17	10	31

Table 4: Selection table cooling (C = 23.5 mm, ΔT = -7K, at T_{room}=25⁰ C)

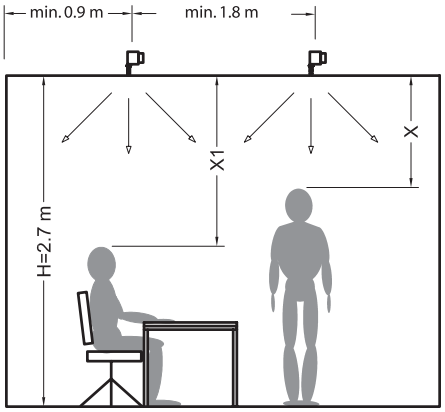
Plenum-box-length	m³/h	X¹=1.6 m	X=1.0 m	ΔP (Pa)	LpA dB(A)
		cm/s	cm/s		
600	40	9	11	8	28
	50	9	12	11	29
	60	10	13	13	30
900	65	12	13	9	29
	75	13	14	11	30
	85	15	16	13	31
1200	90	12	14	7	29
	100	13	14	8	30
	110	14	15	10	33
1500	115	12	14	9	30
	125	14	16	10	31
	135	16	17	12	33

Table 5: Correction ΔT

ΔT (K)	air velocity factor
7	-
10	1.08
12	1.15
14	1.25

Table 6: Correction room height

H (m)	air velocity factor
2.7	-
3.0	0.8



Notes:

1. *The air velocities are measured conform ISO7726, the results has been reviewed to ISO-7730.*
2. *In the mentioned LpA-valves a room absobtion of 10 dB is allowed for.*
3. *The insertion loss of an insulated plenumbox can be found in tabel 7 below.*

Table 7: Insertion loss insulated plenumbox

L plenum	600	900	1200	1500
dB(A)	-2	-3	-3	-3

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