FAN-COILS

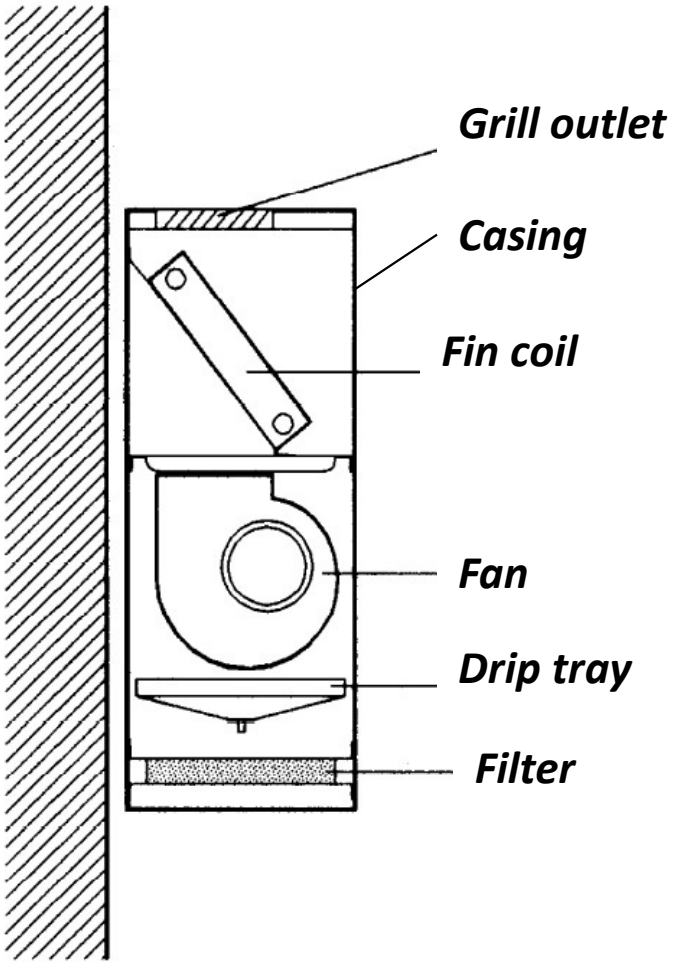
ACTIVE BEAMS / CHILLED BEAMS

UNIT HEATERS

Fan-coils 1/3

(heating and cooling)

- Terminal units which release (heating) and extract (cooling) heat in the room by means of forced convection.
- They are made of:
  - One or two fin coils
  - One or two fans
  - An air filter
  - A drip tray
  - A casing
- They can be iof different types
  - Vertical
  - Horizontal
  - Cassette



Drip tray: Raccolta condensa

Fan-coils 2/3

- The choice can be done according to the following issues:
  - Power delivered by the fan-coil
  - Volume flow rate fo the fan
  - Outlet air temperature
  - Noise of the unit
- These data are provided by the manufacturer based on laboratory tests.
- Fan-coils are uaually fed by water:
  - cooling: water at 7°C (supply) / 12°C (return)
  - heating: water at 45°C (supply) / 40°C (return)

  In the past greater temperatures for heating were used, today lower temperature can be provided (in this case the fan-coil will be larger)

Fan-coils 3/3

The following aspects should be appropriate:

- Subdivide the power in different fan-coils in order to get more uniform conditions of the air
- Check that the volume flow rate of the fan-coils is not lower than 3÷4 times the volume of the room (3÷4 ACR)
- The outlet temperature of the air from the fan-coils in heating would be between 35 and 45°C
- Connect each fan-coil with the circuit draining the condensed water, if cooling is required

Fan-coils: Selection

- Based on the peak power in heating and cooling, in usual rooms one fan-coil is sufficient. Sometimes (if the peak load is limited in adjacent rooms a fan-coil can be installed in a common area and by means of ducts the fan-coil can provide heating and cooling in the rooms (ducted fan-coil). In this case the rooms need to have the similar loads (same exposition).

- Else, if the peak load of a room fits with the power output of a fan-coil, one fan-coil can be installed

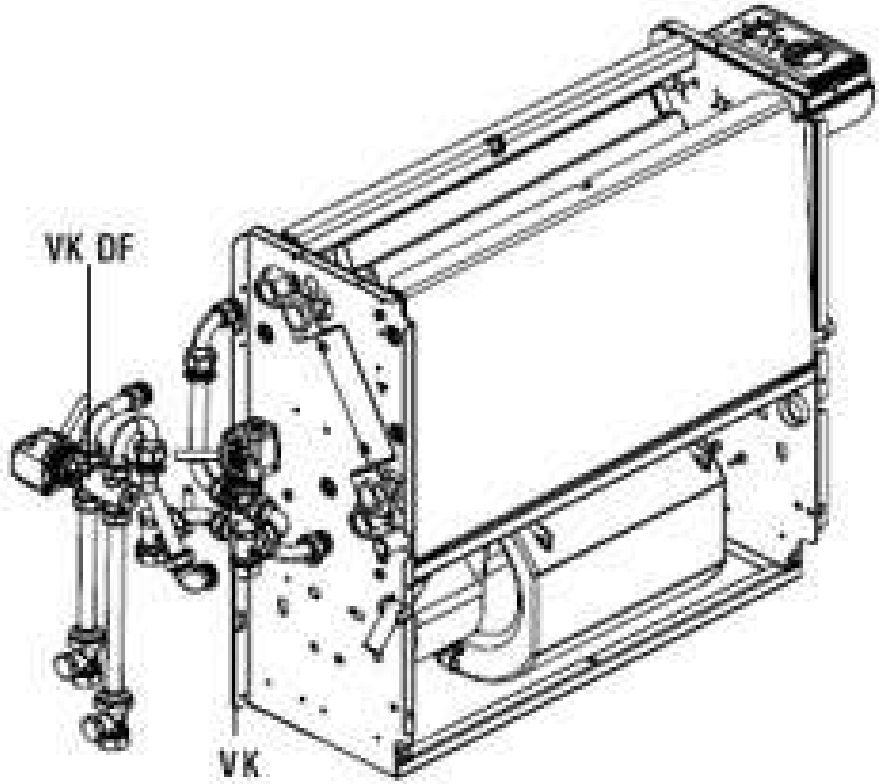
Fan-coils: Selection

- If the room has relevant dimensions more fan-coil units may be installed. In this case the sum of the flow rate of the fan-coils should be equal to 3 ACR.
- The heating and cooling power of a fan-coil is function of the velocity of the fan, the water temperature and the room temperature.
- Usually the velocities of the fan-coils have 3 to 5 possible velocities. The greater the velocity the higher the noise. Hence the velocity if the fan should be selected depending on the type of installation. In residelntial buildings or in hotels the 1st velocity should be selected for the peak load. In office rooms an intermediate velocity could be selected. Today there are also variable speed fans.

Tbs_1	°C	19											
Tw_1 / Tw_2	°C	50 / 45						60 / 50					
	Vr	PT		Qw		Δpw		PT		Qw		Δpw	
		W	kcal/h	l/s	l/h	kPa	m H_2O	W	kcal/h	l/s	l/h	kPa	m H_2O
FC/NT 11	3	1418	1219	0,069	248	20,85	2,13	1798	1546	0,044	158	9,17	0,94
	2	1177	1012	0,057	205	15,05	1,54	1499	1289	0,036	130	6,67	0,68
	1	880	757	0,043	155	9,05	0,92	1125	968	0,027	97	4,04	0,41
FC/NT 22	3	2048	1761	0,099	356	27,96	2,85	2580	2219	0,063	227	12,15	1,24
	2	1729	1487	0,084	302	20,81	2,12	2186	1880	0,053	191	9,09	0,93
	1	1294	1113	0,063	227	12,52	1,28	1640	1410	0,040	144	5,49	0,56
FC/NT 33	3	3197	2749	0,155	558	18,49	1,89	4031	3467	0,098	353	8,05	0,82
	2	2687	2311	0,130	468	13,63	1,39	3403	2927	0,083	299	5,97	0,61
	1	2006	1725	0,097	349	8,18	0,83	2552	2195	0,062	223	3,61	0,37
FC/NT 44	3	3782	3253	0,183	659	24,99	2,55	4779	4110	0,116	418	10,91	1,11
	2	3233	2780	0,156	562	18,99	1,94	4099	3525	0,100	360	8,35	0,85
	1	2443	2101	0,118	425	11,64	1,19	3119	2682	0,076	274	5,17	0,53

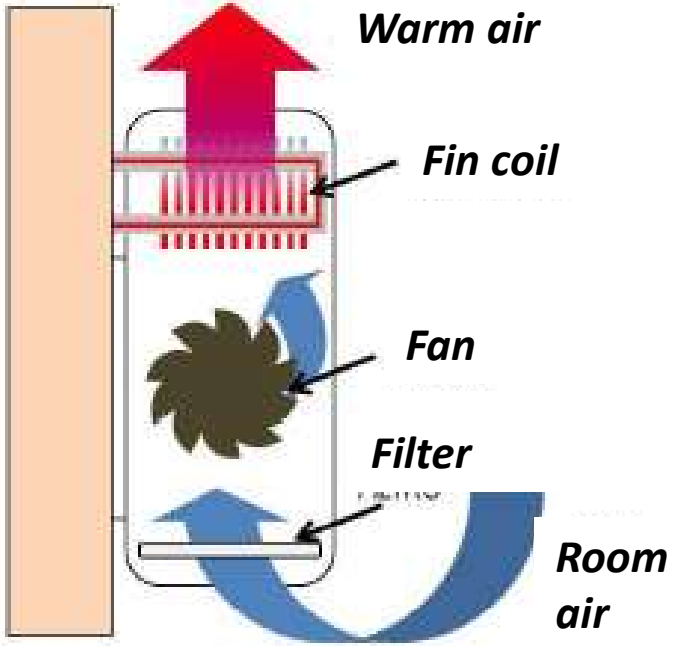
$Tbs_1 / Tbu_1 (UR_1)$	°C	25 / 18 (51%)											
Tw_1 / Tw_2	°C	6 / 11						7 / 12					
	Vr	PFT		PFS		Qw		Δpw		PFT		PFS		Qw		Δpw	
		W	Frig/h	W	Frig/h	l/s	l/h	kPa	m H_2O	W	Frig/h	W	Frig/h	l/s	l/h	kPa	m H_2O
FC/NT 11	3	931	801	706	607	0,044	158	11,05	1,13	814	700	659	567	0,039	140	8,69	0,89
	2	785	675	579	498	0,037	133	8,21	0,84	687	591	539	464	0,033	119	6,46	0,66
	1	600	516	428	368	0,029	104	5,12	0,52	526	452	397	341	0,025	90	4,05	0,41
FC/NT 22	3	1298	1116	1053	906	0,062	223	14,67	1,50	1116	960	982	845	0,053	191	11,19	1,14
	2	1102	948	866	745	0,053	191	11,01	1,12	945	813	804	691	0,045	162	8,37	0,85
	1	825	710	622	535	0,039	140	6,63	0,68	702	604	572	492	0,033	119	4,97	0,51
FC/NT 33	3	1951	1678	1583	1361	0,093	335	9,17	0,94	1668	1434	1472	1266	0,080	288	6,93	0,71
	2	1649	1418	1298	1116	0,079	284	6,83	0,70	1402	1206	1200	1032	0,067	241	5,11	0,52
	1	1228	1056	934	803	0,059	212	4,08	0,42	1026	882	852	733	0,049	176	2,96	0,30
FC/NT 44	3	2423	2084	1933	1662	0,115	414	13,25	1,35	2112	1816	1811	1557	0,101	364	10,36	1,06
	2	2091	1798	1620	1393	0,100	360	10,25	1,05	1820	1565	1512	1300	0,087	313	7,99	0,81
	1	1599	1375	1189	1023	0,076	274	6,40	0,65	1384	1190	1102	948	0,066	238	4,95	0,50

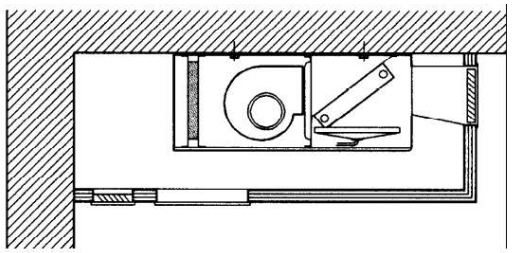
Examples of fan-coils



Flush mounted

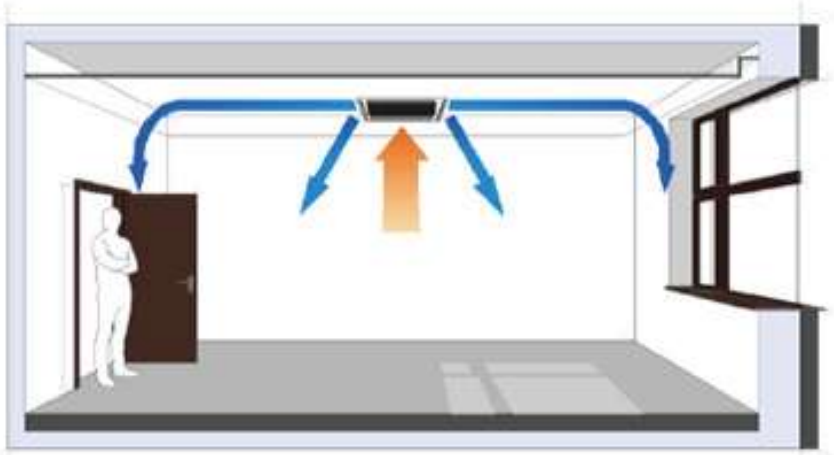
(a incasso)



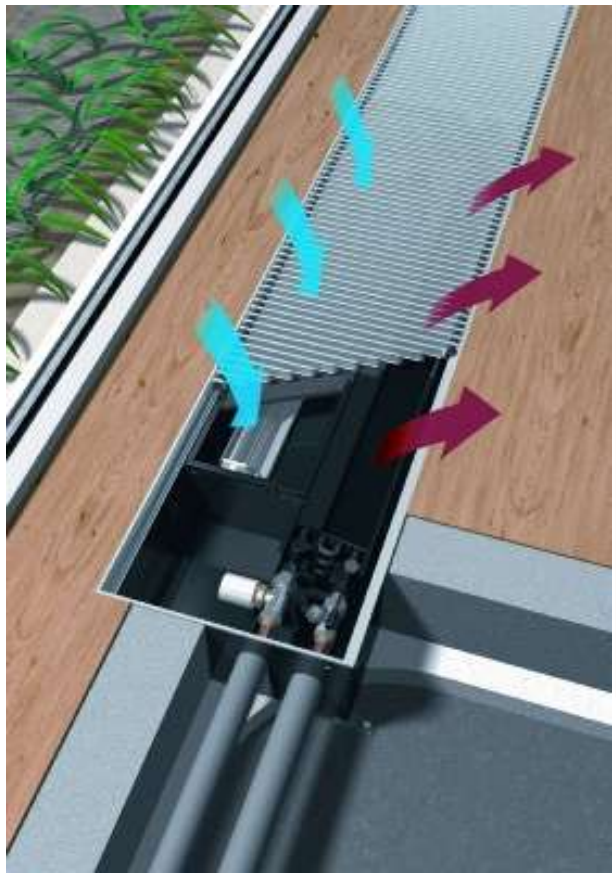


Ceiling mounted

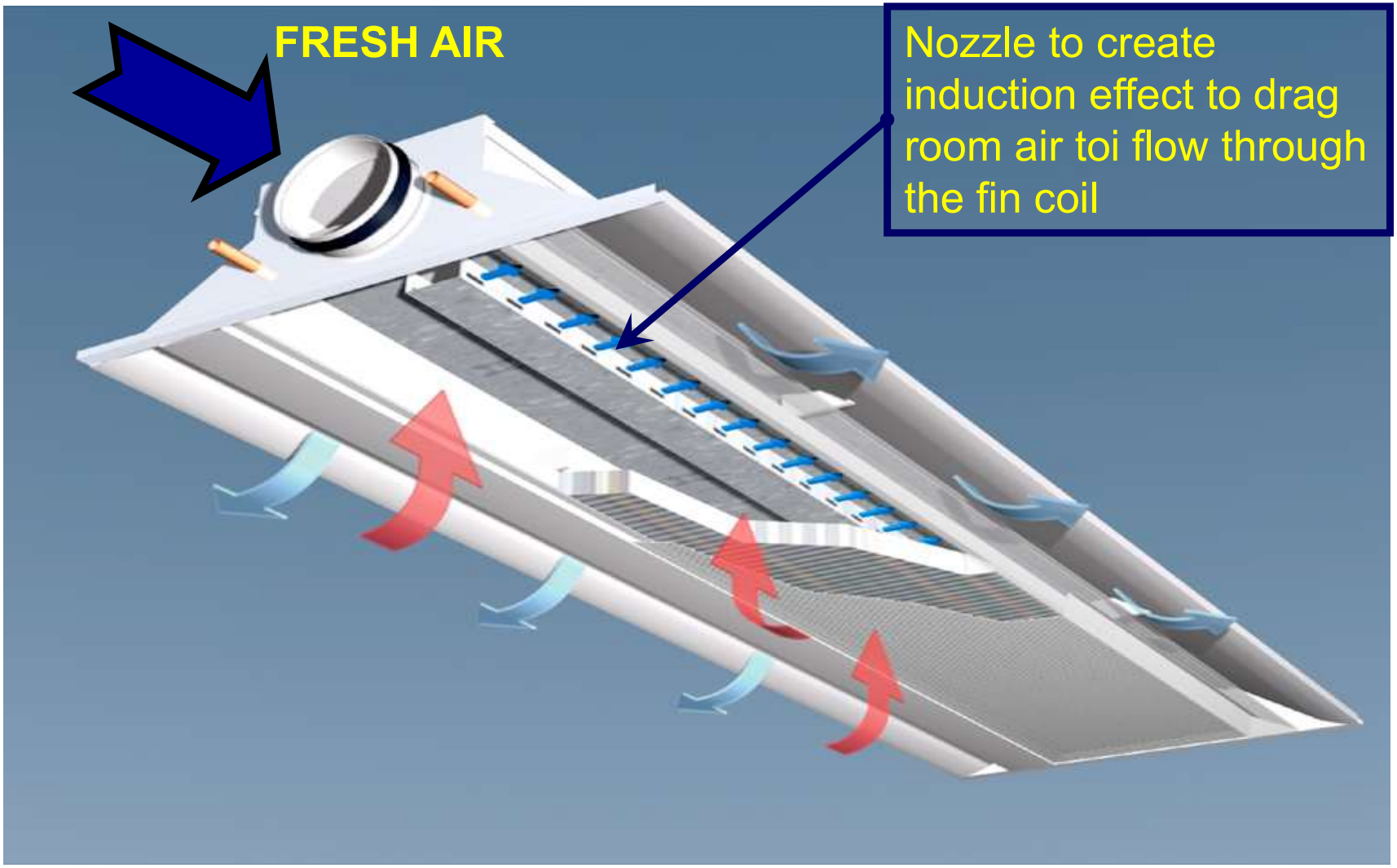
Cassette installation



Built-in floor installation



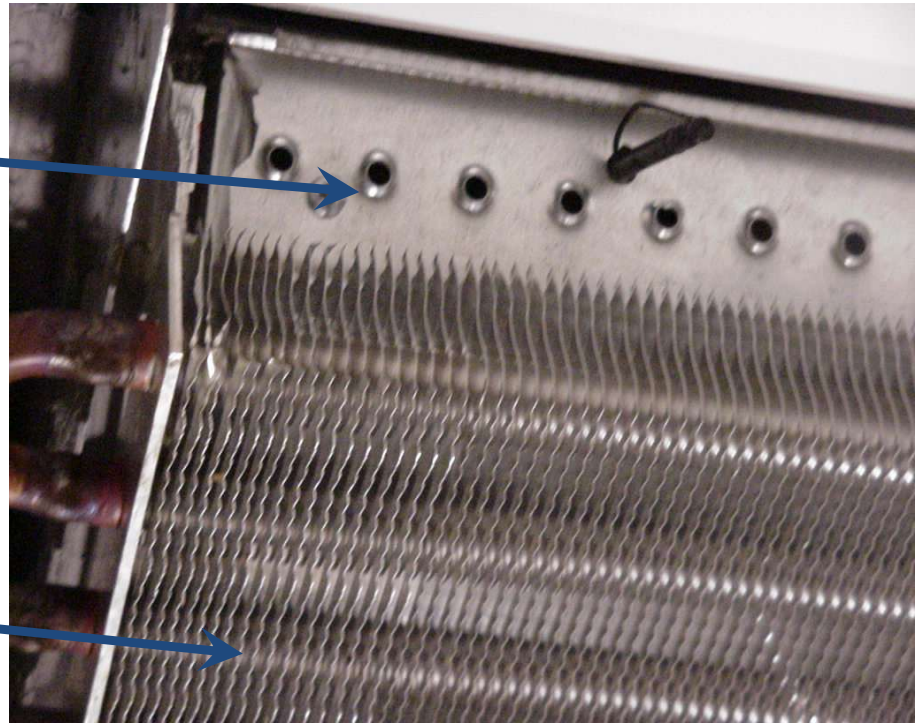
Active beams

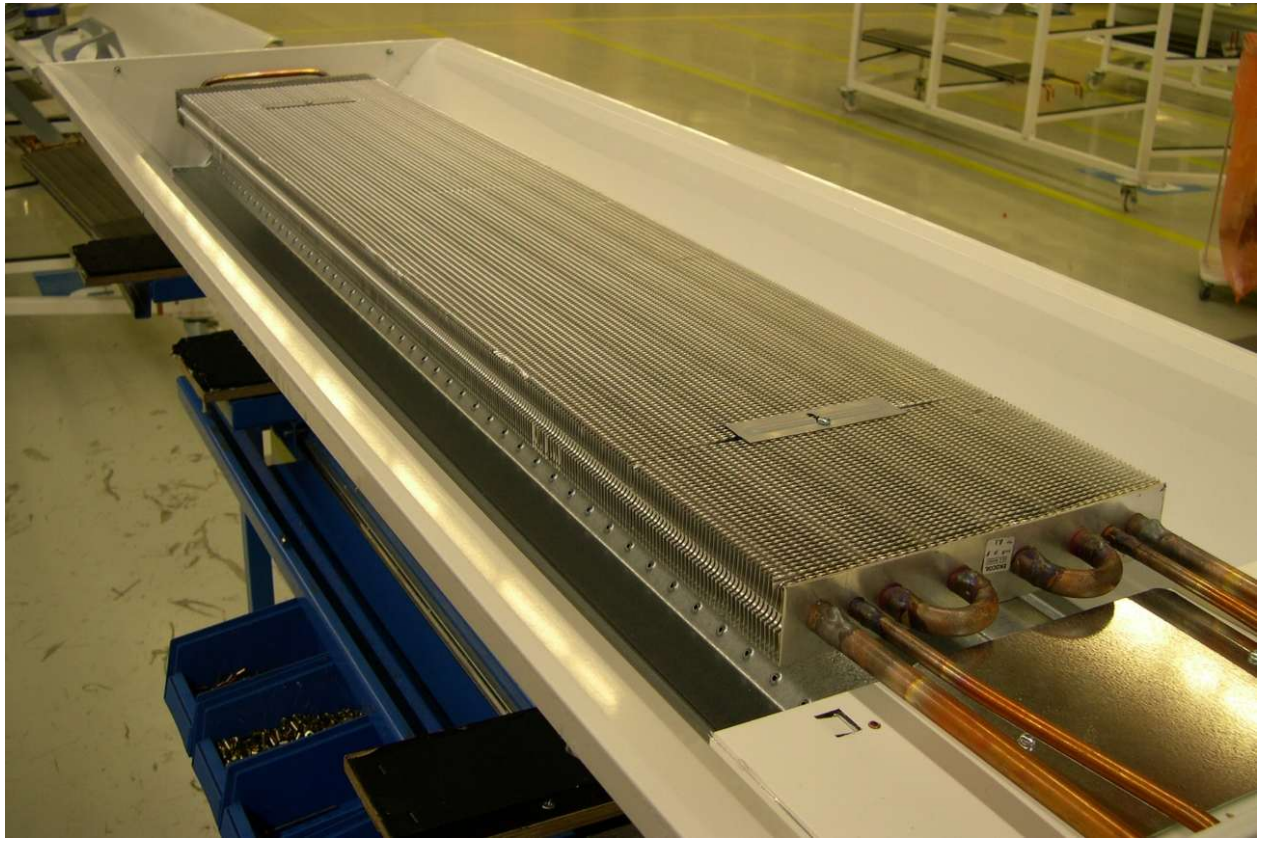


The system combines fresh air and a water terminal unit

Nozzles

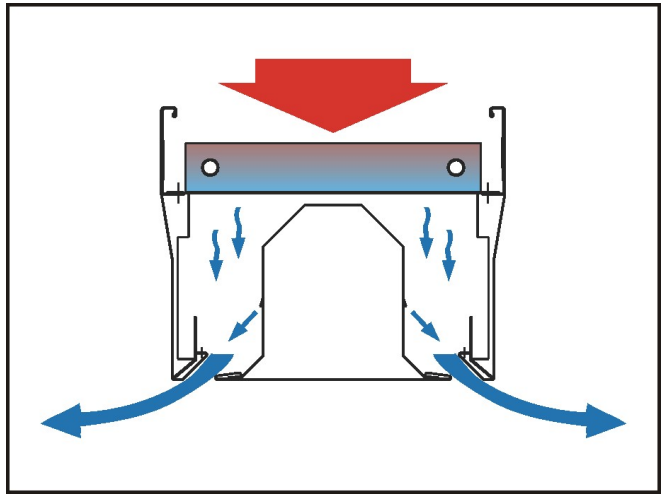
Fin coil



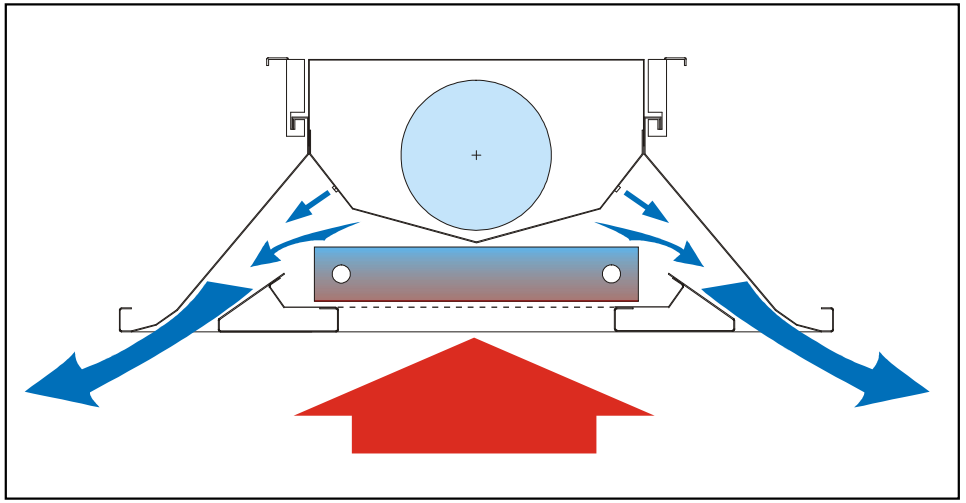


Ceiling installation, with and without false ceiling

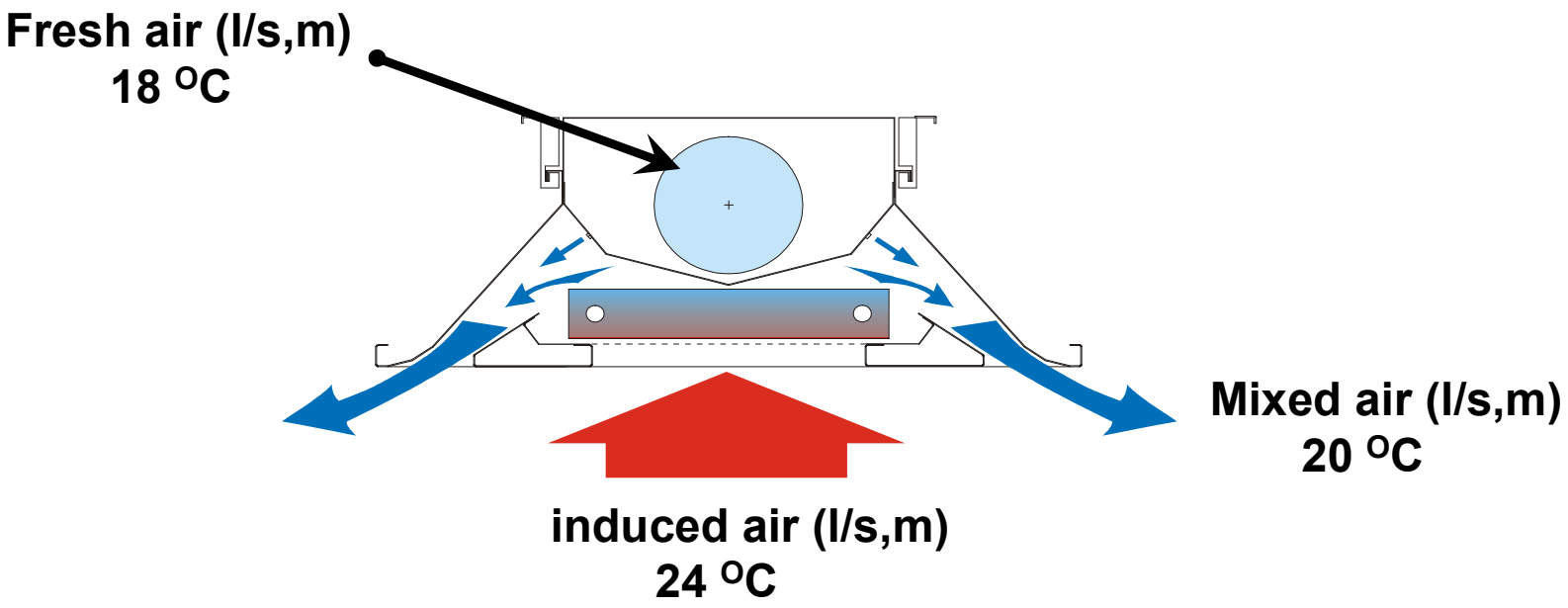
Open beams



Closed beams



High induction



Fin coil power	Primary air	Induced air	Mixed air
250 W/m	15 l/s,m	30 l/s,m	45 l/s,m
350 W/m	15 l/s,m	45 l/s,m	60 l/s,m
500 W/m	15 l/s,m	60 l/s,m	75 l/s,m
700 W/m	15 l/s,m	90 l/s,m	105 l/s,m

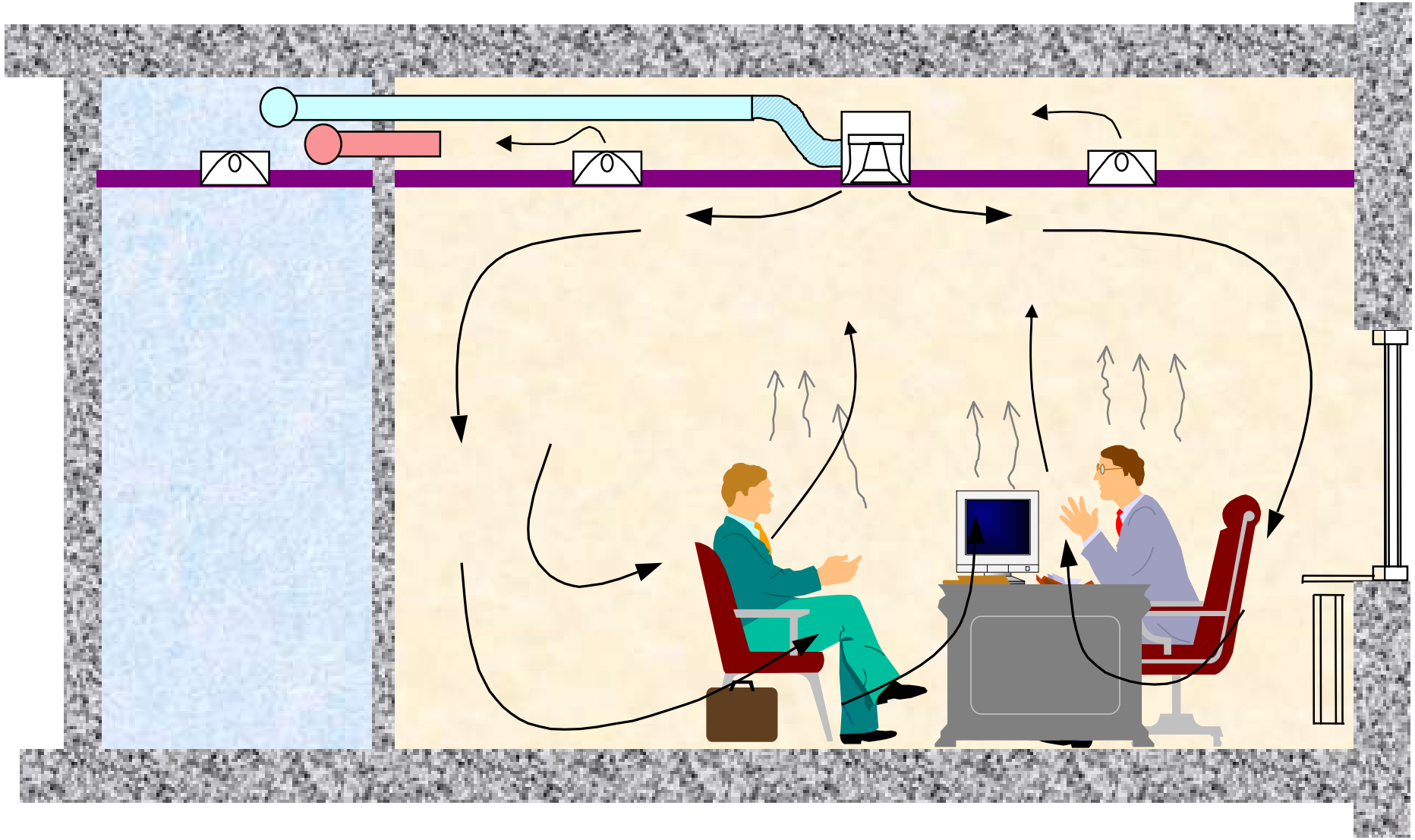
Precautions

- **Fresh air has to be completely dehumidified by the AHU**
- **The temperature of the water has to be constant (usually 15÷16 °C) and has to be always above the dew point temperature (e.g. if the air is at 25°C with RH = 50%, the dew point temperature $t_{dew\ point}$ = 14 °C)**
- **Condensing sensor on the pipes**
- **Sensor for the opening of windows**
- **The water temperature has to be greater the if the air is not dehumidified, and always above the dew point temperature**

Active chilled beams :
Recommended values
“Chilled Beam Application Guidebook – REHVA “

	COOLING	HEATING
Heating and cooling		
Optimal thermal load:	60÷80 W/m^2	25÷35 W/m^2
Maximum thermal load:	< 120 W/m^2	< 50 W/m^2
Optimal specific thermal load:	< 250 W/m	< 150 W/m
Maximum specific thermal load:	<350 W/m	< 150 W/m
Fresh air		
Specific flow rate:	5÷15 l/s m	5÷15 l/s m
Optimal temperature of supply air:	18÷ 20 °C	19÷21 °C
Pressure drop:	30÷120 Pa	30÷120 Pa

Active system:
usually it is preferable to install above the occupants (minimum velocity) and possibly in the centre of the room.
If the active beam is put in a peripheral position, it is recommended to use the unilateral flow.



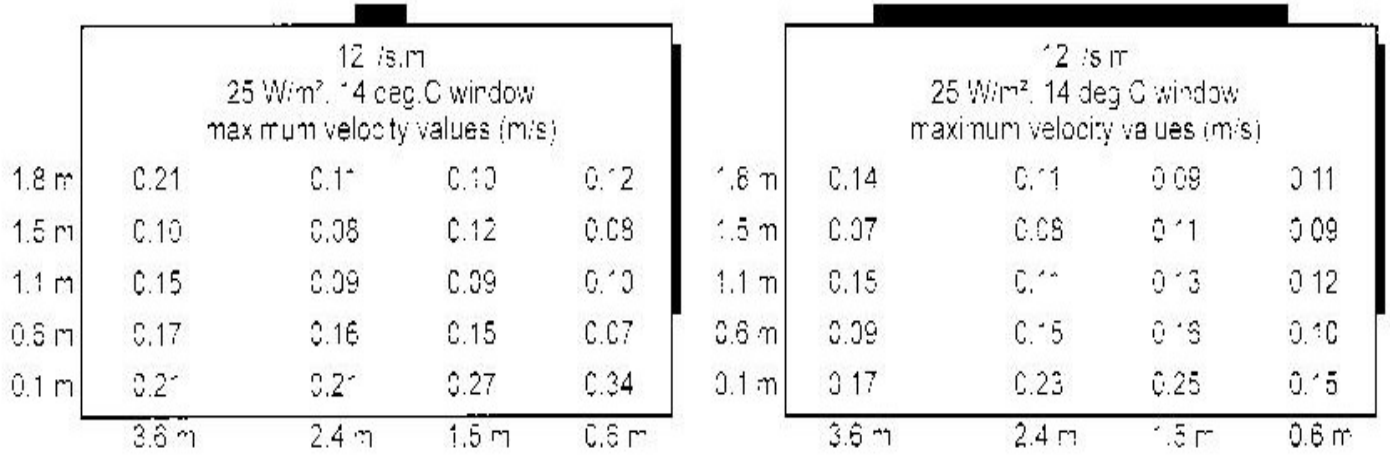
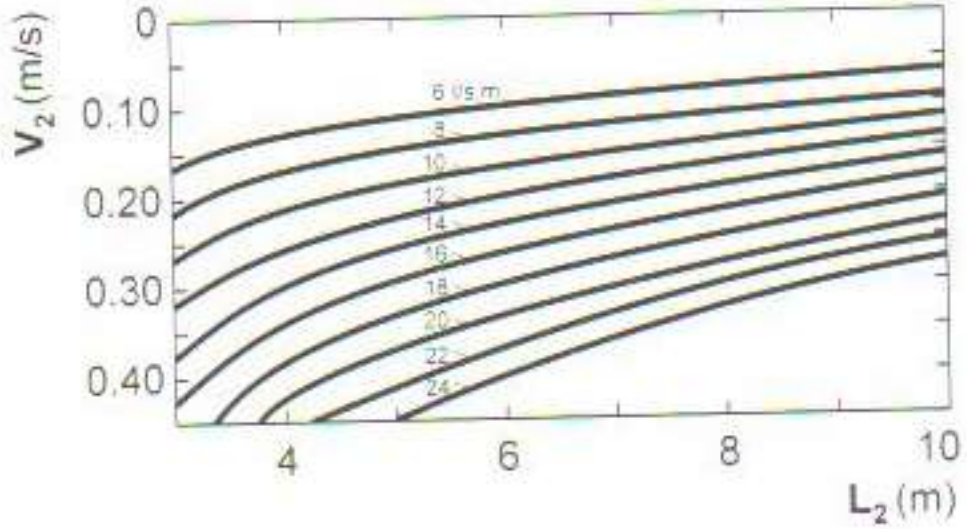


Figure 4.9 Room air velocities in the intermediate season with the same beam installed either crosswise or lengthwise in the room. [11]



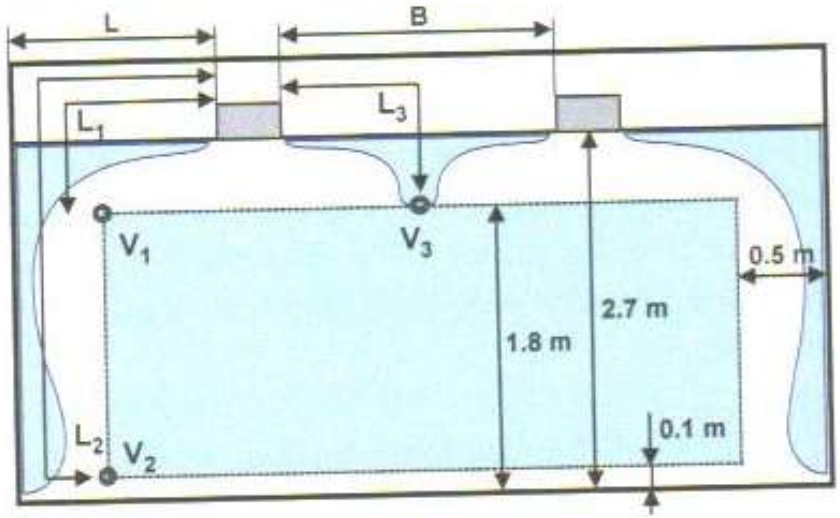


Figure 6.1 Example of velocity data of active chilled beam. Three critical points should be studied. Normally, velocity V_2 is the most critical.

Unit heaters

They are usually installed on the top of the room. They can be used in industrial applications, workshops, and in other environments where the aesthetic does not play a relevant role.
They are cheap and can be installed quite easily. Unit heaters can provide heating and cooling.
Noise can be critical and it has to be considered carefully.