Active Chilled Beam: Coil, Primary Air and Water Flow

Sensible cooling of an active chilled beam from its coil's specific capacity and from primary air, the chilled water flow and the dew-point margin.

Method: Active chilled beam sensible balance

Input parameters

Unit system: SI

Parameter	Value	Unit
Beam active length	2.4000	m
Coil specific capacity per kelvin per metre	45.000	
Room temperature	24.000	°C
Room relative humidity	50.000	%
Water supply temperature	14.000	°C
Water temperature rise	2.5000	K
Primary air flow	25.000	L/s
Primary air supply temperature	14.000	°C

Calculated results

Parameter	Value	Unit
Coil sensible capacity	945.00	W
Primary air sensible capacity	301.80	W
Total sensible capacity	1,246.8	W
Chilled water flow	0.090301	L/s
Water supply margin above room dew point	1.0536	K

Notes for this case

• Coil capacity = q′·L·(T_room − T_w,mean), q′ from the maker for the beam's primary air nozzle pressure; primary air adds ρc_pV̇(T_r − T_pa) (ρ = 1.2 kg/m³). Chilled beams are sensible-only: keep supply water at least about 1 K above the room dew point and handle latent load with dry primary air.

Formula and method

$$\dot{Q}_{coil} = q' L (T_r - \bar{T}_w), \quad \dot{Q}_{pa} = \rho c_p \dot{V}_{pa} (T_r - T_{pa}), \quad \dot{V}_w = \frac{\dot{Q}_{coil}}{\rho_w c_w \Delta T_w}$$

Variables

L	Beam active length	m
q'	Coil specific capacity per kelvin per metre	-
T_r	Room temperature	K
φ_r	Room relative humidity	-
$T_{w,in}$	Water supply temperature	K
ΔT_w	Water temperature rise	K
$\dot{V}_{pa}$	Primary air flow	m³/s
T_{pa}	Primary air supply temperature	K
$\dot{Q}_{coil}$	Coil sensible capacity	W

$\dot{Q}_{pa}$	Primary air sensible capacity	W
$\dot{Q}$	Total sensible capacity	W
$\dot{V}_w$	Chilled water flow	m³/s
$T_{w,in} - T_d$	Water supply margin above room dew point	K

Method and standards

Chilled beam.

Assumptions and limits

- Maker's specific capacity at the operating nozzle pressure; sensible only.

References

Active chilled beam sensible balance

Report details

Report reference	FCC-T627-7APT (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/chillers/chilled-beam-capacity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.