CSA
CHILLED SAILS

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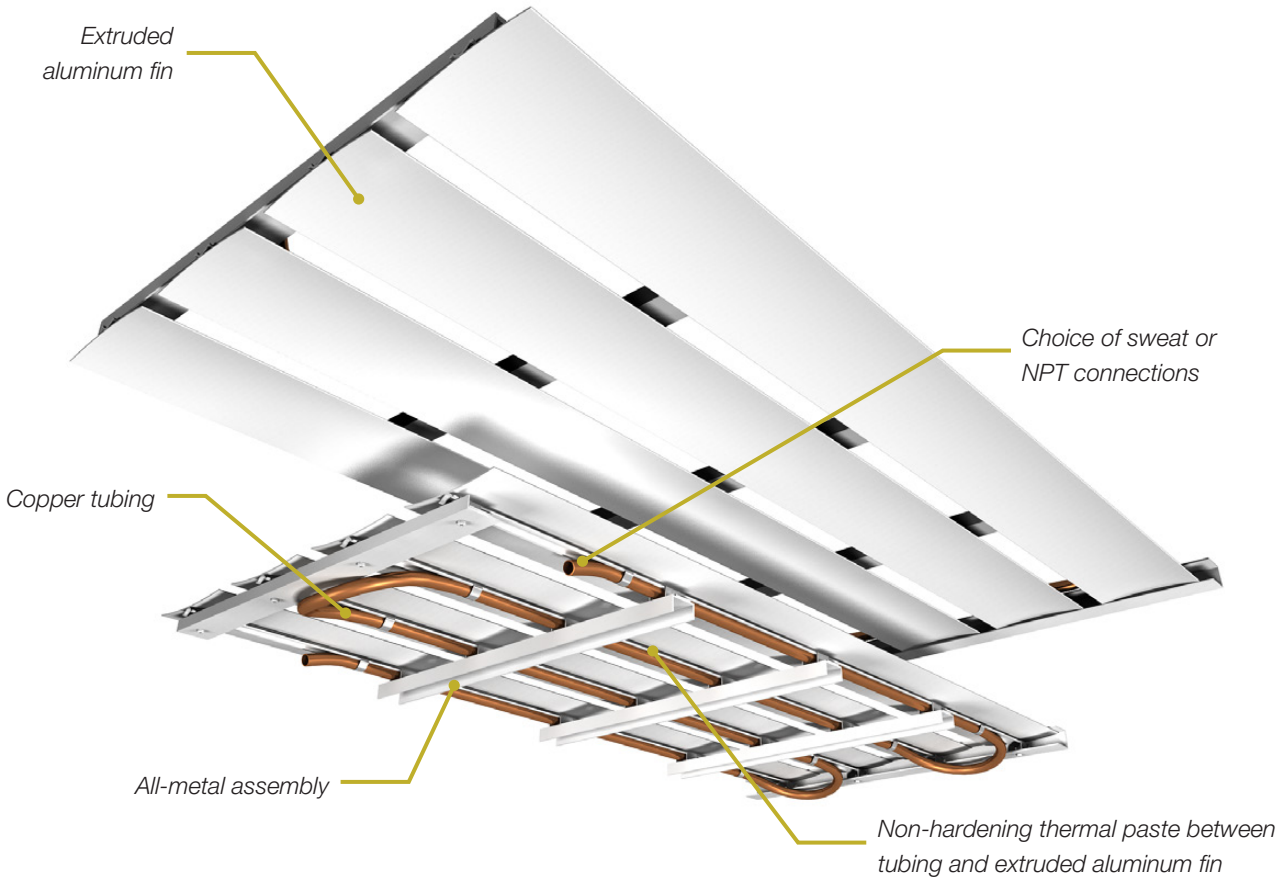
Chilled Sails

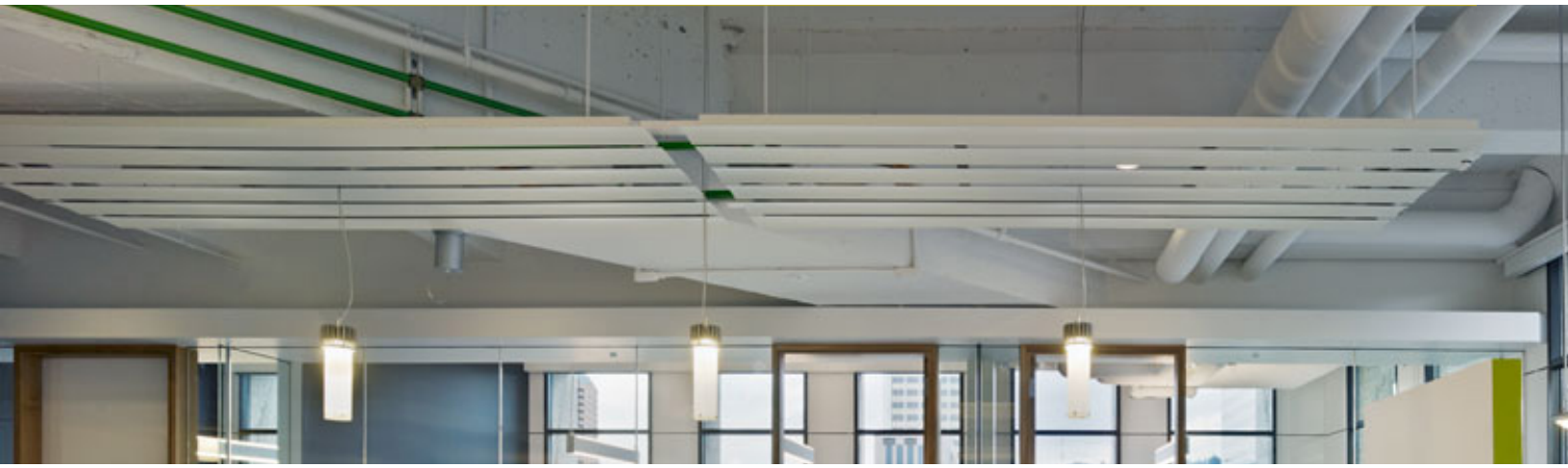
Chilled Sails couple the radiant cooling and heating effects of standard radiant panels with a convective component for increased performance. The unique shape of chilled sails provides more surface area than a traditional radiant panel, increasing radiant capacity while achieving the high comfort of radiant systems.

Typical applications include offices, conference rooms, theaters, studios, lobbies, retrofit projects as well as any area were radiant panel use is appropriate.



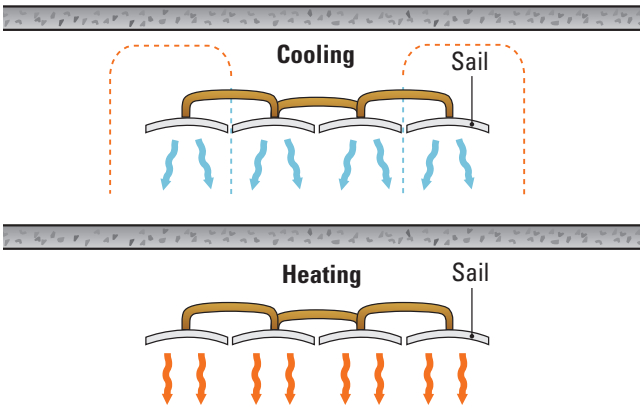
CONSTRUCTION

+ Size
  - Metric
  - Imperial
+ Connections
  - NPT
  - Sweat
+ Finish
  - Standard white (B12) for exposed units
  - Standard black (B17) for concealed units
  - Custom colours available upon request



ENERGY EFFICIENT

+ Hydronic systems efficiently satisfy the sensible loads of a space while relying on a separate air-side system to provide ventilation and satisfy latent loads.
+ Hybrid air-hydronic systems require significantly lower supply air volumes than all-air systems, reducing fan power requirements by 60-80% and resulting in a smaller, more efficient system.



Chilled Sails Airflow in Cooling and Heating

SUPERIOR THERMAL COMFORT

+ Radiant cooling and heating efficiently conditions a space while maintaining a high degree of thermal comfort.
+ As a result of the reduced supply air volume requirements associated with hydronic-air systems, air velocities are kept low, minimizing draught risk and fan energy.
+ For superior thermal comfort, chilled sails work to change the operative temperature of a space including both the air temperature and the surface temperatures within the space. All-air systems change only the air temperature, neglecting surface temperatures that are an important aspect in determining thermal comfort.

HEAT TRANSFER

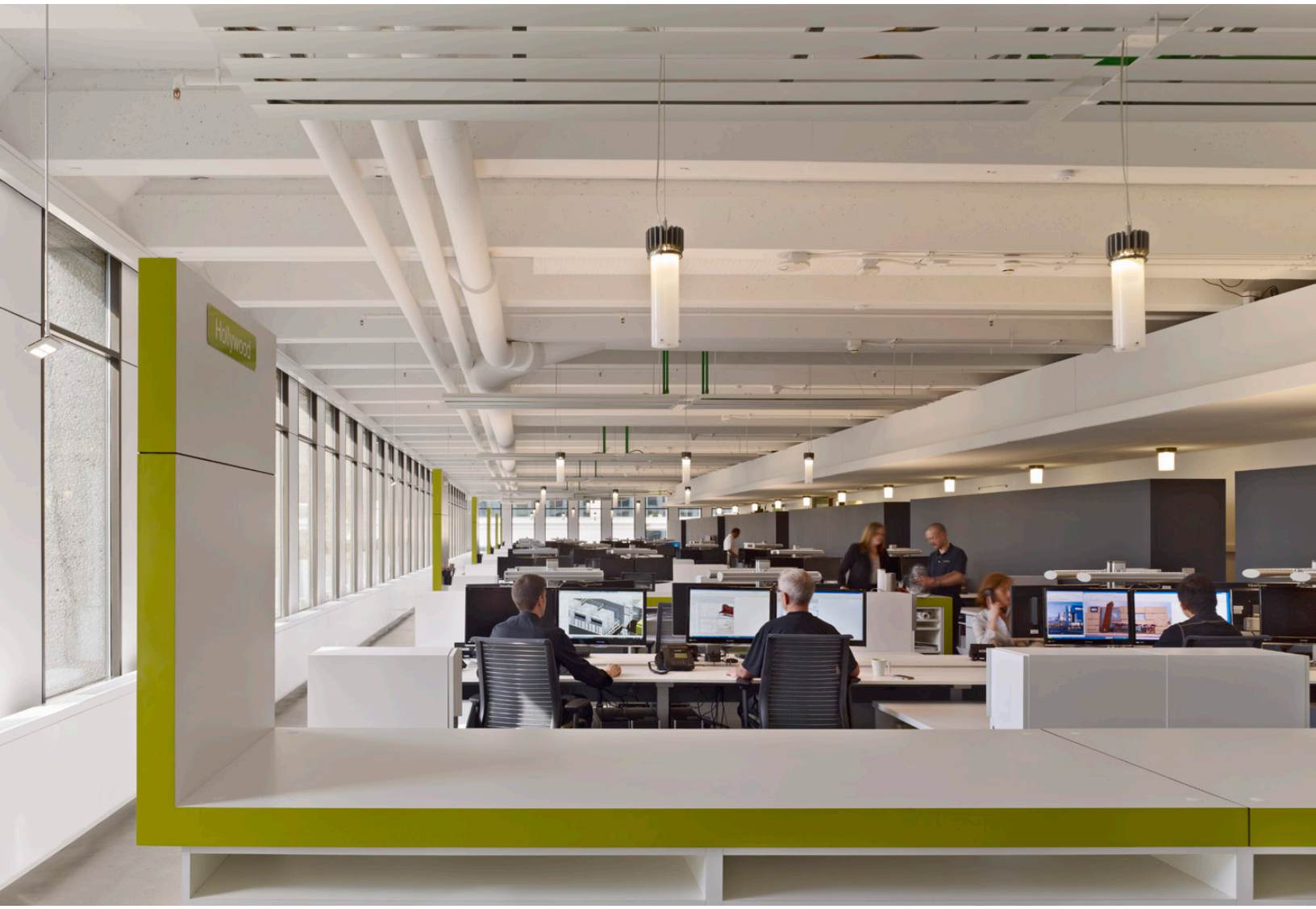
+ The heat transfer from the sail to the room has three components: natural convection with the room air, thermal radiation with the room surfaces, and thermal radiation from the top of the sail with the ceiling.
+ In cooling mode, the majority of the heat transfer occurs via natural convection as warm air rises due to natural buoyancy forces, passes over the chilled sails, cools, and then sinks down into the occupied zone. In cooling, the approximate breakdown of heat transfer is 30% by thermal radiation and 70% by natural convection.
+ In heating mode, heat is transferred mainly through thermal radiation with room surfaces, where it increases the average unheated surface temperature of the room. As warm air rises past the heated sails, natural convection occurs, which results in warmer return air.

MINIMAL SPACE REQUIREMENT

+ The reduced supply air volume of hydronic systems reduces ductwork requirements allowing smaller plenum heights and reduced riser spaces, making radiant systems ideal for installation in tight spaces and creating the potential for lower construction costs, higher ceilings and more usable floor space.
+ Air-handling equipment can be downsized, saving initial cost, energy costs and providing more flexibility in equipment location.

IDEAL FOR ARCHITECTURAL APPLICATIONS

+ In exposed applications, chilled sails are typically installed in interior spaces as a cloud ceiling, in a suspended ceiling, or in a T-bar application with a standard white finish.
+ In concealed applications, chilled sails are typically hidden behind perforated panels (with a minimum of 65% free area) in the ceiling with a standard black finish. They can also be placed around utilities such as lights, sprinklers, air outlets, etc. for integration with any building design.



PERFORMANCE DATA

Imperial

24 in. x 48 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
14	317
16	370
18	424
20	479

Based on 2ºF water temperature drop.

24 in. x 72 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
10	322
12	398
14	476
16	555
18	636
20	719

Based on 2ºF water temperature drop.

24 in. x 96 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
14	635
16	740
18	848
20	959

Based on 4ºF water temperature drop.

24 in. x 60 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
12	332
14	397
16	463
18	530
20	599

Based on 2ºF water temperature drop.

24 in. x 84 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
14	555
16	645
18	735
20	825

Based on 2ºF water temperature drop.

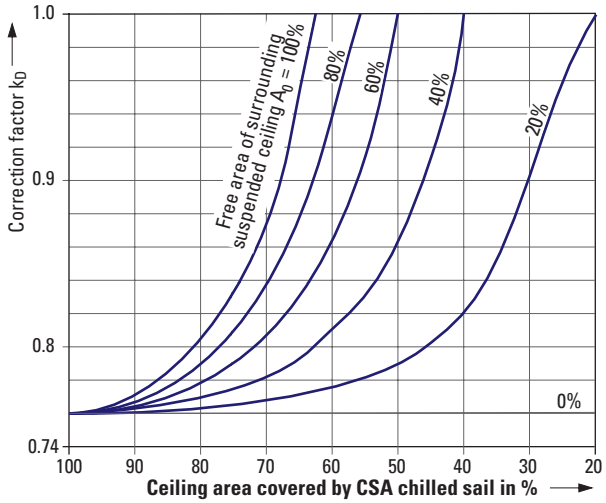
48 in. x 48 in.

(T_{Room} - MWT) (°F)	Capacity (BTU/hr)
14	635
16	738
18	841
20	944

Based on 4ºF water temperature drop.

Performance Notes:

1. T_{Room} - MWT is the difference in temperature between the Room air temperature and the average water temperature. The average water temperature is calculated as follows (LWT + EWT)/2. Units are °F.
2. Chilled water flow rate is in USGPM.
3. Capacity is in BTU per hour.
4. Capacity is based on panel being installed with no suspended false ceiling.
5. Capacity is based on occupation density of 50%. Occupation density refers to percentage of ceiling covered by chilled panels. Contact Price Application Engineering for occupation densities other than 50%.



Correction factor k_D for the influence of the free area (A_0) of the surrounding ceiling and the covered area on the cooling output (applies to metal ceilings with thickness 's' < .04 in. (1 mm).

Clearance h in in. (mm) Correction factor k_A

h ≥ 5 (125)	1.00
4 (100) ≤ h < 5 (125)	0.95
2 (50) ≤ h < 4 (100)	0.86

Correction factor kA for the influence of the clearance between the concrete ceiling and the top side of the CSA chilled sail.

PERFORMANCE DATA

Metric

600 mm x 1200 mm

(T_{Room} - MWT) (°C)	Capacity (W)
7.8	93
8.9	108
10.0	124
11.1	140

Based on 1.1ºC water temperature drop.

600 mm x 1800 mm

(T_{Room} - MWT) (°C)	Capacity (W)
5.6	94
6.7	117
7.8	140
8.9	163
10.0	186
11.1	211

Based on 1.1ºC water temperature drop.

600 mm x 2400 mm

(T_{Room} - MWT) (°C)	Capacity (W)
7.8	186
8.9	217
10.0	249
11.1	281

Based on 2.2ºC water temperature drop.

600 mm x 1500 mm

(T_{Room} - MWT) (°C)	Capacity (W)
6.7	97
7.8	116
8.9	136
10.0	155
11.1	176

Based on 1.1ºC water temperature drop.

600 mm x 2100 mm

(T_{Room} - MWT) (°C)	Capacity (W)
7.8	163
8.9	189
10.0	215
11.1	242

Based on 1.1ºC water temperature drop.

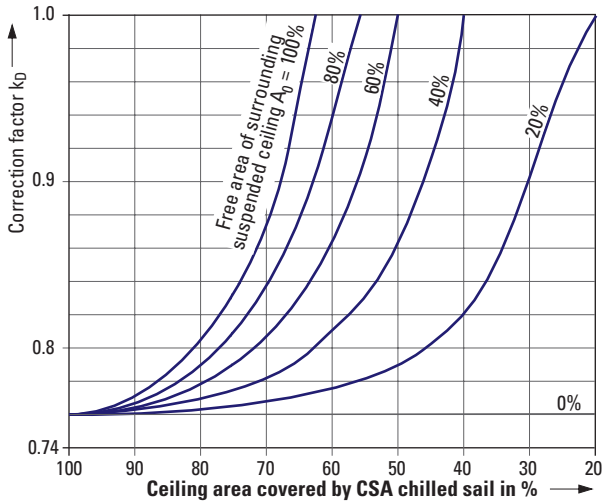
1200 mm x 1200 mm

(T_{Room} - MWT) (°C)	Capacity (W)
7.8	186
8.9	216
10.0	246
11.1	277

Based on 2.2ºC water temperature drop.

Performance Notes:

1. T_{Room} - MWT is the difference in temperature between the Room air temperature and the average water temperature. The average water temperature is calculated as follows (LWT + EWT)/2. Units are °C.
2. Chilled water flow rate is in liters per minute (lpm).
3. Capacity is in Watts (W).
4. Capacity is based on panel being installed with no suspended false ceiling.
5. Capacity is based on occupation density of 50%. Occupation density refers to percentage of ceiling covered by chilled panels. Contact Price Application Engineering for occupation densities other than 50%.



Correction factor k_D for the influence of the free area (A_0) of the surrounding ceiling and the covered area on the cooling output (applies to metal ceilings with thickness 's' < .04 in. (1 mm).

Clearance h in in. (mm) Correction factor k_A

h ≥ 5 (125)	1.00
4 (100) ≤ h < 5 (125)	0.95
2 (50) ≤ h < 4 (100)	0.86

Correction factor kA for the influence of the clearance between the concrete ceiling and the top side of the CSA chilled sail.

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