Price Chilled Sails couple the radiant cooling and heating effects of standard radiant panels with a convective component for increased performance. Their unique shape gives them more surface area than a traditional radiant panel, increasing their radiant capacity and still achieving the high comfort of radiant systems.

Well suited for renovations and retrofit applications.

www.price-hvac.com for additional product information including product videos and brochures.
Product Overview

Operation
Chilled sails provide a functional and unique alternative to conventional radiant panels. Sails couple the radiant cooling effects of standard radiant panels with a convective component. In cooling mode, chilled sails create natural convection by cooling the surrounding air as it passes over the surface facing the plenum. As the air falls into the occupied zone where warm air is pulled over the sail, the convective cooling capacity of the sail is coupled with the radiant capacity of the cool sail surface, resulting in a cooling capacity greater than that of standard radiant panels. In cooling, the approximate breakdown of heat mode transfer of chilled sails is 30% by thermal radiation and 70% by natural convection.

A general air flow diagram of an exposed chilled sail in heating and cooling mode can be seen to the right. In certain applications, sails can also be used for heating. In heating mode, the sails use radiation only to heat the zone below. Because sails have no insulation on their reverse side, heat is radiated not only towards the room, but also towards the building structure. As the slab warms, it helps heat the room to a small extent by thermal radiation and natural convection.

A chilled sail transfers heat to a room with a combination of radiation and natural convection. Because chilled sails have no insulation on their reverse sides, heat is transferred from the copper tubing/fin to the slab and plenum.

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 either the suspended ceiling or the fixed ceiling, depending on the design details. 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 heating mode, heat is transferred mainly through thermal radiation with room surfaces, where it increases the average unheated surface temperature of the room (AUST). As warm air rises past the heated sails, natural convection occurs, which results in warmer return air. Because sails are water-only systems, they can only handle the sensible portion of a building load and must be paired with a fresh air system for ventilation and latent load removal.

Applications
The cooling capacity and unique design of chilled sails makes them an excellent alternative to panel systems, particularly in applications that have an architectural focus. Typical applications of chilled sails include offices, meeting/conference rooms, theaters, studios, lobbies/foyers, waiting areas, or any areas where radiant panel use is appropriate. Chilled sails are designed for architectural appeal and are typically installed in T-bar ceiling grids or freely suspended.
Chilled Sails

Price Chilled Sails are designed to provide radiant and convective cooling and heating. Chilled sails allow air to pass through openings between their sails, thus increasing the capacity of the unit and providing an effective means of dealing with the sensible cooling load. In an exposed application, they 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. They can also be installed along a wall in a surface mounted application. In a concealed application, they 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., to incorporate into any building design.

Features
- Architecturally appealing
- Quiet operation
- Higher capacity
- Non-hardening thermal paste between tubing and extruded aluminum fin
- Choice of sweat or NPT connections

Options
- Metric sizing
- Special custom color finishes

Construction / Finish
- All-metal assembly
- Extruded aluminum fin
- Piping – ASTM B75 copper
  - 5/8” OD (1/2” nominal) copper tubes
- Finish – standard white (B19) (exposed) standard black (concealed)

Dimensional Data - Imperial (inches)

<table>
<thead>
<tr>
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<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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Dimensional Data - Metric (mm)

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<th>Min</th>
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</thead>
<tbody>
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Mounting Brackets Dimensional Data - Imperial, in. (Metric, mm)

<p>| | | |</p>
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<td></td>
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<td>48 - 114</td>
<td>115 - 162</td>
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<tr>
<td>0 - 1200</td>
<td>1221 - 2900</td>
<td>2901 - 4112</td>
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<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
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Overall Width (W) is equal to 5.980” multiplied by number of sails minus 0.980”.
Sail Handing / Coil Connection

Sail handing is required for odd pass sails. Orientation is taken with respect to looking at the wall or an imaginary wall and determining which end the supply is located on.

The image on the left shows a left-handed sail with supply connection located in the top left, and the image on the right shows right-handed sail with supply connection located in the top right.

Sails are available in 2 pipe configuration and all connections are ½” nom. copper sweat, male NPT or female NPT.

Installation

Chilled sails come with two L-angles on the ends and two to five cross braces (based on length) in the middle of the sail for bracing and hanging.

When handling the chilled sails, we recommend the use of clean white gloves to avoid smudging and marking the unit.

For installation, sails are hung or suspended as per local building codes, using:

- threaded rod
- carabineer
- hanger wire
- wire rope
- chain link
- gripple (by others)

All chilled sails must have at least one hanger wire on each cross brace.

When installing chilled sails for an exposed application in suspended ceiling, ensure that the top of the chilled sail is at least 2 in. [50 m] (5 in. [127 mm] for optimum performance) from the structure above. If placed next to solid ceiling tiles, ensure a ½ – 1 in. [13 – 25 mm] gap is allowed between the sail and the nearest T to allow room air to enter the plenum space. If mounted in visible sections, sails should be separated horizontally on the ends by ½ – 1 in. [13 – 25 mm] between sections.

When installing chilled sails for a concealed application above a perforated ceiling, ensure that the sail is at least 2 in. [50 m] (5 in. [127 mm] for optimum performance) from either the perforated ceiling or the overhead structure.

Use a heat pad between the chilled sail and copper pipe when making soldering connections as excessive heat can damage the paint finish.
**Performance Data**

### 24” x 48” CSA

<table>
<thead>
<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>317</td>
<td>0.35</td>
<td>0.216</td>
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<td>16</td>
<td>370</td>
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<td>18</td>
<td>424</td>
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<tr>
<td>20</td>
<td>479</td>
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<td>0.496</td>
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Based on 2°F water temperature drop.

### 24” x 72” CSA

<table>
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<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
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<td>14</td>
<td>476</td>
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<td>16</td>
<td>555</td>
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<td>20</td>
<td>719</td>
<td>0.80</td>
<td>1.494</td>
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Based on 2°F water temperature drop.

### 24” x 96” CSA

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<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
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<tbody>
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<td>20</td>
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Based on 4°F water temperature drop.

### 24” x 60” CSA

<table>
<thead>
<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
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<tr>
<td>12</td>
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<td>14</td>
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<tr>
<td>18</td>
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<td>20</td>
<td>599</td>
<td>0.66</td>
<td>0.893</td>
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</table>

Based on 2°F water temperature drop.

### 24” x 84” CSA

<table>
<thead>
<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>555</td>
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<td>0.247</td>
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<td>20</td>
<td>825</td>
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Based on 4°F water temperature drop.

### 48” x 48” CSA

<table>
<thead>
<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>332</td>
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<td>599</td>
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<td>0.893</td>
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</table>

Based on 4°F water temperature drop.

### 48” x 84” CSA

<table>
<thead>
<tr>
<th>(T\text{room} - MWT) (°F)</th>
<th>Capacity (BTU/hr)</th>
<th>Water Flowrate (usgpm)</th>
<th>Head Loss (ft wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>635</td>
<td>0.35</td>
<td>0.435</td>
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<tr>
<td>16</td>
<td>738</td>
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<td>18</td>
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<tr>
<td>20</td>
<td>944</td>
<td>0.52</td>
<td>0.800</td>
</tr>
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</table>

Based on 4°F water temperature drop.

**Performance Notes:**

1. \( T_{\text{room}} - MWT \) 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))**

Correction factor \( k_A \) for the influence of the clearance between the concrete ceiling and the top side of the CSA chilled sail.
Chilled Sails

SECTION 23 82 43 – RADIANT PANELS

PART 1 – GENERAL

1.1 Summary
A. This Section includes the following:
1. Chilled Sails

1.2 Related Documents
A. 230100 – Operation and Maintenance of HVAC Systems
B. 230500 – Common Work Results for HVAC
C. 230900 – Instrumentation and Control for HVAC
D. 232000 – HVAC Piping and Pumps

1.3 Submittals
A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, and accessories.
B. Shop Drawings: Detail equipment assemblies and indicated dimensions, required clearances, method of field assembly, components, and locations and size of each field connection.
1. Include a schedule showing unique model designation, room location, model number, size, & accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.
C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size & location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
D. Operation and Maintenance Data: For chilled sails, to be included operation and maintenance manuals.

1.4 Quality Assurance
A. Product Options: Drawings indicating size, profiles, and dimensional requirements of chilled sails and are based on the specific system indicated.
B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. Chilled sails and accessories shall be rated and tested for pressure as shown on the drawings.

1.5 Coordination
A. Coordinate layout and installation of chilled sails and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 – PRODUCTS

2.1 Manufacturers
A. In Part 2 articles where titles below introduce lists, the following requirements apply to selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 Chilled Sails
A. Approved Manufacturers:
1. Price
2. Alternates: Alternates or approved equals are acceptable if and only if a mock-up and witness test is performed to demonstrate that the substitution meets design criteria.
B. The chilled sails shall be constructed with ASTM B75 1/2” nominal copper tubing fitted into engineered heat sinks for optimal heat transfer from the cooling or heating fluid to the sail face. The coil copper tubing shall have ½” nominal end connections. The sail shall be constructed of one-piece extruded aluminum and feature integrated heat sinks with the copper pipe mechanically fastened to the heat sink. A non-hardening heat transfer paste is required between the tubing and the heat sink. The sail shall be constructed of extruded sections with a profile designed to optimize heat transfer by radiation as well as promote heat transfer by natural convection as surrounding air falls though openings between profiles. The sail shall feature a frame with integrated hanger brackets and shall be constructed of steel or aluminum.
C. The panel face shall be painted with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Manufacturer shall provide water pressure drop data as well as heat output data derived from tests in accordance with DIN 14037 (heating) and DIN 14240 (cooling).
D. Chilled sail capacity shall be tested and certified by manufacturer in accordance with DIN 14037 (heating) and DIN 14240 (cooling) to meet the performance listed on the schedule. Should any performance rating, chilled water supply temperature, water pressure drop, etc. deviate from the schedule, manufacturer shall submit updated capacity as described in Section 1.3, as well as computational fluid dynamic modeling demonstrating that any changes do not impact the air distribution in a room that would cause a detriment to the PMV and ADPI rating from the design conditions. Manufacturer shall have factory testing facility available to perform performance test of units in accordance with said standard, as required. Upon request, up to 1% of units for the project can be tested in accordance with the standard. Request will be made with order and prior to shipment of chilled sails. Engineer will have the option of witnessing this test.
E. Water connections shall be shipped sealed to limit the introduction of dust and dirt during shipping and construction.
F. Accessories:
1. Manufacturer shall supply upon request 12”/18” stainless steel braided hose with isolation ball valves as required.
Chilled Sails

2.3 Source Quality Control
A. Identification: Label each chilled sail with appropriate tag number.
B. Verification of Performance:
   1. Rate chilled sail in accordance with DIN 14037 (heating) and DIN 14240 (cooling).

Part 3 – EXECUTION
3.1 Pre-Design Services
A. Bid shall include the costs to complete final selections and coordination with the Engineer at the Engineers office. Allow for a minimum of three (3) days.

3.2 Installation – General
A. Install chilled sails level and plumb. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
B. Complete installation and startup checks according to manufacturer’s written instructions and perform the following:
   1. Verify controls and control enclosures are accessible.
   2. Verify control connections are complete to control valves as needed.
   3. Verify controls respond to inputs as specified.

3.3 Connections
A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicated general arrangement of piping, fittings, and specialties
B. Install piping adjacent to chilled sails to allow for service and maintenance.
C. In addition to Division 23 Section “Hydronic Piping”, connect coils to supply with shut-off valve, strainer, control valve, and union or flange, and to return with balancing valve and union or flange.
D. Connect wiring according to Division 26 Section “Low-Voltage Electrical Power Conductors and Cables”.
E. Tighten electrical connectors and terminals according to Division 26.

3.4 Field Quality Control
A. Perform the following field tests and inspections and prepare test reports:
   1. After installing chilled sails and after controls have been energized, test for compliance with requirements.
   2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report any findings in writing.
C. Remove and replace malfunctioning units and retest as specified above.

3.5 Cleaning and Protection
A. Clean all visible surfaces of equipment; touch up as required.
B. Protect all units before, during and after installation. Damaged materials due to improper protection shall be cause for rejection.

3.6 Construction Phase Services
A. Installer shall visit the chilled sails factory, or factory-authorized representative, prior to the arrival of the product on site, to become familiar with the sails. Manufacturer shall include the cost of such a visit for one (1) installer in the bid.
B. Manufacturer or factory-authorized representative shall visit the site regularly during the installation process to ensure proper means and methods are being employed. Bid shall include the cost of a minimum of two (2) such visits.
C. Manufacturer or factory-authorized representative shall provide start-up and training services to owners/staff to adjust, operate, and maintain chilled sails. Refer to Division 01 Section “Demonstration and Training”. A minimum of eight (8) hours of such services shall be included in the bid.