

AIR DISTRIBUTION
PRODUCTS




CORE
05

ADVANCING THE SCIENCE OF AIR DISTRIBUTION

CHILLED BEAMS

Rethink what air management systems can be.
Revise your notion of functionality.
Redefine your comfort zone.TM

An abstract graphic consisting of numerous thin, overlapping, wavy lines that create a sense of motion and depth. The lines are light gray and flow from the bottom left towards the top right, with some lines curving back towards the left, creating a complex, layered effect.

Comfort, Redefined.

Since 1946, Titus has focused on technologically advanced products that create the highest degree of comfort.

We've consistently led the industry by breaking the barriers of expectation and convention when it comes to technology. We've redefined how technology drives, influences and supports air management. And by being first to market with the most innovative approaches to air distribution, we're proud to say that the marketplace has taken notice, and is counting on us to lead the way into the next decade. A challenge we're more than happy to accommodate.

Titus has raised the bar on design, proving that functional can also be beautiful. And we've redefined what it means to be energy efficient, with a collection of smart technology products that optimize the use of natural resources.

Titus has also redefined what it means to work with an air management products partner. We pride ourselves on listening and responding so that we can not only meet expectations, but also exceed them. Service has been, and will always be, our main focus at Titus. And, it's why so many of our customers keep coming back.

Welcome to your new comfort zone. It starts here.

Overview



CBAL-24 installed in a common area in the Steinbach Regional Secondary School in Steinbach, Manitoba

Titus chilled ceiling product line is comprised of both active and passive chilled beams and floor mounted displacement chilled beams. These products offer optimized performance and provide high levels of thermal comfort for the occupant. In addition to increased occupancy comfort, use of the chilled ceiling products reduce the amount of energy required to heat and cool a building.

The chilled ceiling products provide sensible cooling and heating to the space by utilizing the more efficient heat transfer capacity of water, as opposed to air. This decouples the latent and sensible loads, reducing the energy cost of sensible cooling. With passive beams and radiant products, an additional system is necessary to meet the ventilation and latent cooling needs of the space. The Titus active chilled beams integrate the supply of ventilation air creating an active diffuser. Using the ventilation air to pressurize a plenum with aerodynamically designed nozzles, high velocity jets of air are created forcing induction of room air over the water coils integral to the units. Forced induction dramatically improves the heating and cooling capacity over passive beams and radiant products. Titus active chilled beams harness the energy of the supply air to further reduce total energy consumption.

Titus offers a chilled ceiling product to meet the requirements of any design or installation. CBPE and CBPR models of passive beam accommodate both exposed and recessed mounting applications. Active chilled beams are available in 1, 2, and 4-way throw patterns. There is even a model for high sidewall applications. In addition to the variety of product solutions available, the appearance of the units can be customized through standard options, which enables seamless integration into any architectural style, traditional or contemporary.



ACTIVE CHILLED BEAMS

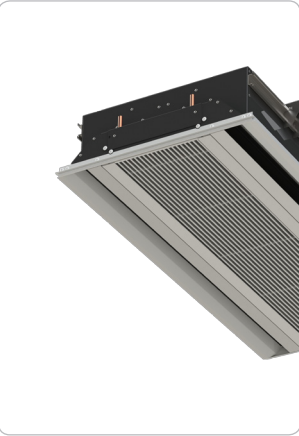
All Titus Chilled Beam products can contribute towards achieving the following credits:

- » LEED EA Credit 1: Optimize Energy Performance
- » IEQc2: Increased Ventilation
- » IEQc7.1: Thermal Comfort - Design

CBAL

LINEAR ACTIVE CHILLED BEAMS

- » Active linear chilled beam with 1-way or 2-way air distribution patterns
- » Optimized nozzle design provides high capacity and low noise levels
- » Linear design matching commercial architectural styling
- » Designed to fit in standard 12-inch and 24-inch ceiling systems
- » Optimized diffuser geometry maximizes occupant comfort



CBAL-24



CBAL-12



dual-function



healthcare



k-12 education



universities

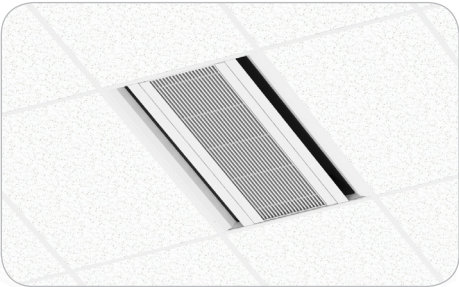


wood grains

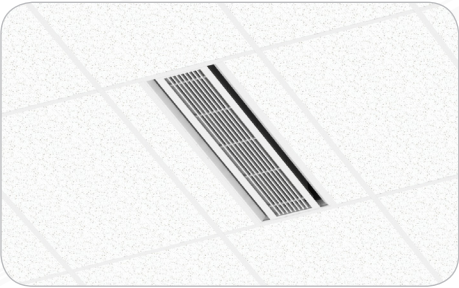


energy solutions

CBAL's are offered for both, cooling and heating, in 12-inch and 24-inch widths and lengths from 2 to 10 ft. They can be easily integrated into different grids styles within a suspended ceiling or even in drywall ceilings. The low overall height of the CBAL product line is ideal for reducing the space required for false ceiling in any application.



Rendering of CBAL-24 installed in a ceiling



Rendering of CBAL-12 installed in a ceiling

CBLE

LINEAR EXPOSED ACTIVE CHILLED BEAM

- » Exposed linear chilled beam with 1-way or 2-way air distribution patterns
- » Optimized nozzle design provides high capacity and low noise levels
- » Linear design matching commercial architectural styling
- » Integral coanda plates for ceiling independent operation
- » Optimized diffuser geometry maximizes occupant comfort



dual-function



k-12 education



universities



open ceiling



energy solutions

CBLE

CBLE's are offered for both, cooling and heating and lengths from 2 to 10 ft. The low overall height of the CBLE is ideal for open ceiling or retrofit applications with limited floor height.

CBLE STANDARD FEATURES

- 1-way or 2-way air distribution patterns
- 2 foot to 10 foot lengths, 1 foot increments
- Perforated or linear bar induced air grille
- Left hand or Right hand coil connections
- Side or top air inlet locations
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Hinged induced air grille for roomside coil access
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- Durable powder coat finish
- ½" Sweat water coil connections
- Coil air vent

OPTIONS AND ACCESSORIES

- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses

CBLV

LINEAR BEAM WITH VERTICAL COILS

- » Active linear chilled beam with 2-way air distribution patterns
- » Optimized nozzle design provides high capacity and low noise levels
- » Linear design matching commercial architectural styling
- » Designed to fit in standard 24-inch ceiling systems
- » Vertical Coil configuration
- » Optimized diffuser geometry maximizes occupant comfort



k-12 education



universities



dual-function



energy solutions

CBLV

CBLV's are offered for both, cooling and heating, and lengths from 2 to 10 ft. They can be easily integrated into different grids styles within a suspended ceiling or even in drywall ceilings.

CBLV STANDARD FEATURES

- 2-way air distribution patterns
- 2 foot to 10 foot lengths, 1 foot increments
- Perforated or linear bar induced air grille
- Left hand or right hand coil connections
- Side or top air inlet locations
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Hinged induced air grille for roomside coil access
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- Durable powder coat finish
- ½" Sweat water coil connections
- Coil air vent
- Condensate tray with drain connection for field plumbing

OPTIONS AND ACCESSORIES

- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses
- Lay-in, narrow tee and drop face border types

CBAM

MODULAR ACTIVE CHILLED BEAM

- » Active modular chilled beam with 4-way air distribution pattern
- » Optimized nozzle design provides high capacity and low noise levels
- » Modular design matching commercial architectural styling
- » Designed to fit in standard 24 inch ceiling systems
- » Optimized diffuser geometry maximizes occupant comfort



healthcare



dual-function



k-12 education



universities



wood grains



energy solutions

CBAM

CBAM's are offered for both, cooling and heating, and in 24-inch x 24-inch and 48-inch x 24-inch module sizes. They can be easily integrated into different grids styles within a suspended ceiling or even in drywall ceilings. The low overall height of the CBAM product line is ideal for reducing the space required for false ceiling in any application.

CBAM STANDARD FEATURES

- 4-way air distribution pattern
- 24-inch and 48 inch lengths
- 24-inch width
- Perforated or linear bar induced air grille
- Top coil connections
- Top or side air inlet locations
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Removable induced air grille for roomside coil access
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions

- Durable powder coat finish
- ½" Sweat water coil connections
- Coil air vent

OPTIONS AND ACCESSORIES

- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses
- Lay-in, narrow tee and drop face border types

CBAV

VERTICAL RECESSED ACTIVE CHILLED BEAM

- » Active chilled beam for use in recessed applications
- » Optimized nozzle design provides high capacity and low noise levels
- » Vertical coil with condensate pan
- » Designed to integrate with Titus slot diffusers
- » Optimized diffuser geometry maximizes occupant comfort



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energy solutions

CBAV

CBAV's are offered for both, cooling and heating, lengths from 2 to 8 ft. They can be easily integrated with many of Titus' slot diffusers. Units can have single slot diffusers installed directly to the discharge of the chilled beam, or CBAV beams can be located in specific locations above a long run of slot diffusers creating active and inactive sections.

CBAV STANDARD FEATURES

- 2 foot to 8 foot lengths
- Left hand or right hand coil connections
- Rear air inlet locations
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- ½" Sweat water coil connections
- Coil air vent
- Condensate tray with drain connection for field plumbing

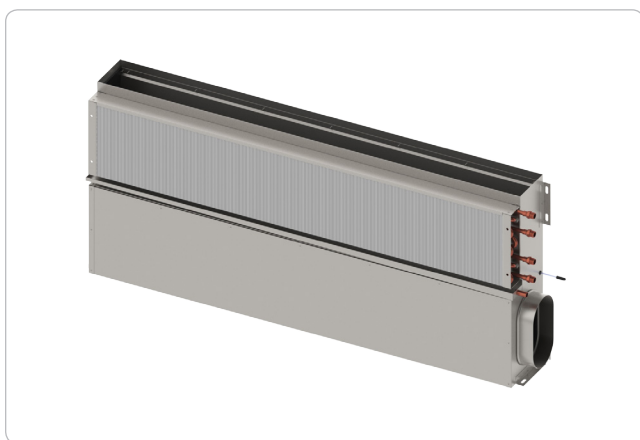
OPTIONS AND ACCESSORIES

- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses

CBAS

SILL MOUNTED CHILLED BEAM

- » Provides comfortable, effective sensible cooling to the space
- » Optimized nozzle design provides high capacity and low noise levels
- » Ideal for induction unit and unit ventilator retrofit projects
- » Quick and simple installation
- » Available in nominal lengths up to 6 feet
- » ½" Sweat or ½" MNPT coil connections



retrofit



k-12 education



universities



dual-function



energy solutions

CBAS

CBAS's are offered for both, cooling and heating, lengths from 2 to 6 ft. They can be easily integrated in retrofit projects where induction units, unit ventilator, or other under sill units are being replaced. Under sill active beams save significant energy and reduce sounds levels compared to other under sill mounted products. Additionally, the utilization of most or all of the existing piping and duct work minimizes project costs.

CBAS STANDARD FEATURES

- 2 foot to 6 foot lengths
- Left hand or right hand coil connections
- Left hand, right hand, or rear air inlet locations
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- ½" Sweat water coil connections
- Coil air vent
- Condensate tray with drain connection for field plumbing

OPTIONS AND ACCESSORIES

- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses

CBAB

BULKHEAD MOUNTED CONCEALED ACTIVE CHILLED BEAM

- » Provides comfortable, effective sensible cooling to the space
- » Optimized nozzle design provides high capacity and low noise levels
- » Ideal for single room hospitality spaces
- » Quick and simple installation
- » Available in nominal lengths up to 6 feet
- » 1/2" Sweat or 1/2" MNPT coil connections



dual-function



healthcare



hotels / motels



universities



retrofit



energy solutions

CBAB

CBAB bulkhead beams are the ideal solution for single room hospitality spaces, such as hotel, dorm, and hospital rooms. With their shallow height, ceiling heights can be maximized creating an open and inviting space. Bulkhead chilled beams are great for use in retrofit of buildings which were not originally built with HVAC systems originally installed.

CBAB STANDARD FEATURES

- 2 foot to 6 foot lengths
- Left hand or right hand coil connections
- Rear air inlet location
- Louvered supply grille
- Perforated return grille
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- 1/2" Sweat water coil connections
- Coil air vent

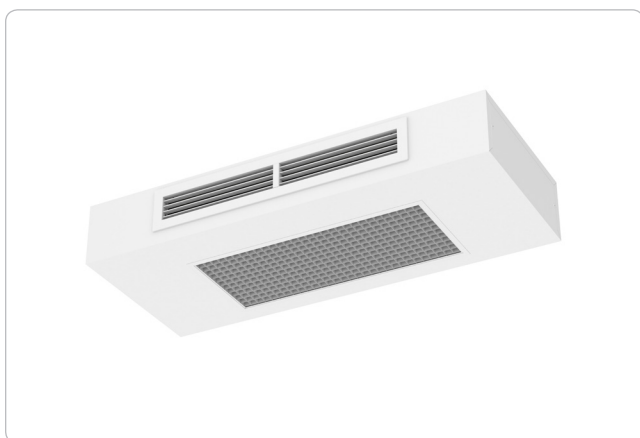
OPTIONS AND ACCESSORIES

- Linear Bar supply grille
- Linear Bar return grille
- Louvered Bar return grille
- Eggcrate Bar return grille
- 1/2" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- 1/2" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses

CBAC

BULKHEAD MOUNTED EXPOSED ACTIVE CHILLED BEAM

- » Provides comfortable, effective sensible cooling to the space
- » Optimized nozzle design provides high capacity and low noise levels
- » Durable powder coated steel cabinet with tool-less access panels
- » Quick and simple installation
- » Available in nominal lengths up to 6 feet
- » ½" Sweat or ½" MNPT coil connections



retrofit



hotels / motels



universities



dual-function



energy solutions

CBAC

CBAC bulkhead beams are the ideal solution for single room hospitality spaces, such as hotel, dorm, and hospital rooms. With their shallow height, ceiling heights can be maximized creating an open and inviting space. Exposed bulkhead chilled beams are great for use in retrofit of buildings which were not originally built with HVAC systems originally installed.

CBAC STANDARD FEATURES

- 2 foot to 6 foot nominal lengths
- Left hand or right hand coil connections
- Rear air inlet location
- Durable powder coated steel cabinet
- Louvered supply grille
- Perforated return grille
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Commissioning port with roomside access for balancing
- Mounting brackets with adjustments in two directions
- ½" Sweat water coil connections

- Coil air vent

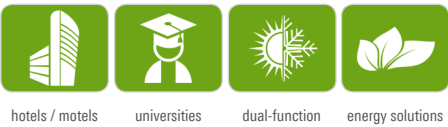
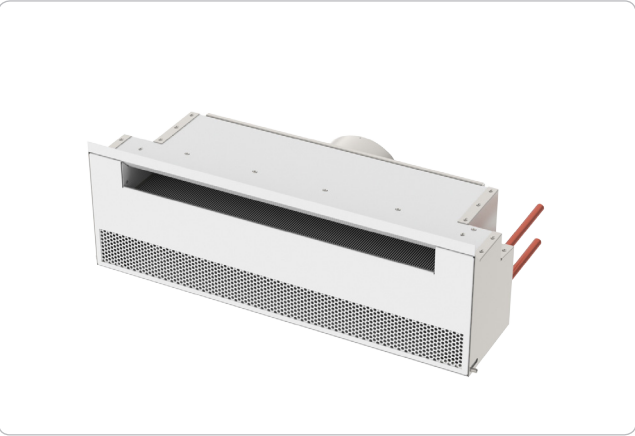
OPTIONS AND ACCESSORIES

- Linear Bar supply grille
- Linear Bar return grille
- Louvered return grille
- Eggcrate return grille
- ½" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- ½" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses

CBAW

SIDEWALL ACTIVE CHILLED BEAM

- » Provides comfortable, effective sensible cooling to the space
- » Optimized nozzle design provides high capacity and low noise levels
- » Ideal for multi-story residential and hospitality spaces
- » Quick and simple installation
- » Available in nominal lengths up to 10 feet
- » 1/2" Sweat or 1/2" MNPT coil connections



CBAW

In multi-story residential and hospitality spaces, the CBAW sidewall beams complement modern architectural styling and minimize installed space, as well as minimizing energy consumption. Superior comfort and near maintenance free operation of the CBAW product family, combined with energy efficiency are an ideal solution in such demanding applications.

CBAW STANDARD FEATURES

- 2 foot to 10 foot lengths, 1 foot increments
- 2-pipe and 4-pipe coil configurations
- Configured nozzle geometry for capacity optimization
- Commissioning port with roomside access for balancing
- 1/2" Sweat water coil connections
- Coil air vent
- Perforated grille

OPTIONS AND ACCESSORIES

- Linear bar grille
- 1/2" thick foil-faced EcoShield, anti-microbial external insulation
- Coil drain valve
- 1/2" MNPT water coil connections
- 12-inch, 18-inch or 24-inch stainless steel braided hoses



PASSIVE CHILLED BEAMS

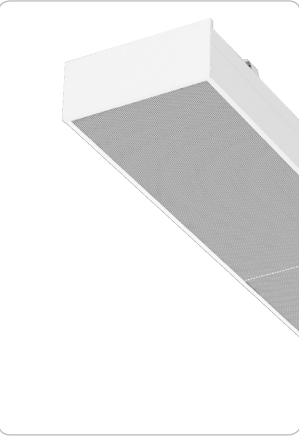
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- » LEED EA Credit 1: Optimize Energy Performance
- » IEQc2: Increased Ventilation
- » IEQc7.1: Thermal Comfort - Design

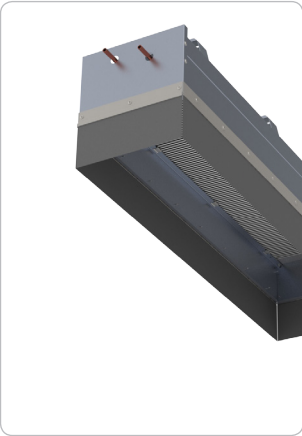
CBPE / CBPR

EXPOSED / RECESSED PASSIVE CHILLED BEAMS

- » Provides comfortable, effective sensible cooling to the space
- » Ultra quiet, natural convection driven operation
- » Perforated or Linear Bar Grille options for exposed models
- » Exposed, recessed or concealed installation
- » Quick and simple installation
- » Available in nominal lengths up to 10 feet
- » ½" Sweat or ½" MNPT coil connections



CBPE



CBPR



Comfortable, effective, ultra-quiet sensible cooling technology

Passive chilled beams are primarily used to provide sensible cooling in perimeter zones and comfortable sensible cooling within interior zones. The primary mode of heat transfer is by natural convection, with a percentage of heat transfer transmitted through radiation. During cooling, warm room air rises to the ceiling area; cool air around the coil sinks down to the occupied area as a result of the higher density. As the cool air descends in to the space, more warm air is drawn over the coil creating a convective current that drives the system.

The CBPE is ideal for exposed installations or can be integrated into lay-in ceiling systems for concealed installations. For applications with low ceilings or limited ceiling plenum height the low profile design excels at satisfying sensible cooling.

CBPR passive beams are designed for recessed installation above a false ceiling. The false ceiling could be an architectural cloud type or even a perforated panel in a conventional lay-in ceiling grid. The CBPR beams are supplied with an additional skirt below the unit's coil that is designed to further enhance the convective current through beam augmenting performance. Beams should be installed with the skirt in contact with the top side of the false ceiling.



FLOOR MOUNTED DISPLACEMENT CHILLED BEAMS

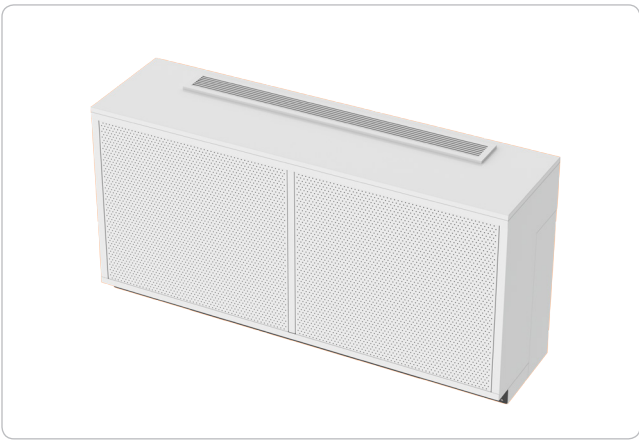
All Titus Chilled Beam products can contribute towards achieving the following credits:

- » LEED EA Credit 1: Optimize Energy Performance
- » IEQc2: Increased Ventilation
- » IEQc7.1: Thermal Comfort - Design

TAO

FLOOR MOUNTED DISPLACEMENT CHILLED BEAM

- » Perfect system for extreme climates
- » Suited for climate zones with heat loads greater than 250 Btuh per foot
- » Ideal for use in educational or healthcare facilities and/or similar environments
- » Simultaneous heating and cooling from one unit
- » Low noise levels, conforms to ANSI Standard S12.60
- » Designed to fit below windowsills
- » Multiple 5 or 6ft. units can be connected in series
- » Pencil proof grille



k-12 education



wood grains



dual-function



energy solutions

TAO

Installed along building perimeters to best handle extreme temperatures where they start – from the outside in - the TAO (Temperature Ambient Optimizer) provides superior thermal comfort in areas where high ventilation loads are needed, such as educational facilities and theaters. It combines the benefits of both chilled beam and displacement units, rolled into one system perfect for extreme climates.

Ideal for use in classrooms and theaters where air quality and sound are critical, the TAO supplies 100% outside air while meeting ANSI Standard S12.60 for acoustics in educational facilities.



CHILLED BEAM ARTICLES &
CASE STUDY



Benefits of Titus Chilled Beam Products

REDUCE COSTS. IMPROVE COMFORT. SAVE ENERGY.

BENEFITS OF CHILLED CEILING SYSTEMS

Chilled Ceiling Systems are designed to provide superior occupancy comfort. These systems require less energy to operate, and reduces maintenance cost in comparison to conventional all air systems. Tempered and dehumidified air is supplied to the space to meet ventilation requirements and handle the latent load. The majority of the sensible load is addressed with the chilled ceiling products. Decoupling the latent and sensible loads takes advantage of the superior volumetric heat capacity of water. The reduced volume of air that must be delivered to the space results in reduced air handler capacity and size, smaller duct sizes, and overall energy savings. A higher supply temperature contributes to increased occupancy comfort.

FIRST COST BENEFITS:

- Shallow unit profiles allow for reduced ceiling space requirements; they typically require 60% less vertical space than conventional all air systems
 - Reduced slab-to-slab spacing, reducing material costs per floor
 - Easily integrated into retrofit applications where space is limited
- Low volume of supply air required for active beams enables reduction of the total amount of air processed at the air-handler by an all air system up to 50%
 - Reduced air-handler size/capacity, and duct work size

COMFORT AND IAQ BENEFITS:

- Discharge temperature of active chilled beams are much closer to room temperature than conventional systems. This reduces the temperature gradient in the space, offering improved thermal comfort.
- When supplied with primary air from a dedicated outside air system (DOAS), 100% fresh air is supplied to the space
- Dry-coil sensible cooling, eliminates bacterial, fungal, or mold growth associated with fan coils and other unitary products with condensing coils
- Constant primary air volume ensures ventilation requirements are met and helps maintain relative humidity levels in the space

ENERGY EFFICIENCY AND OPERATIONAL BENEFITS:

- Utilizing the heat transfer capacity of water also takes advantage of the superior operational efficiency of pumps as compared to fans.
 - A 1" diameter pipe can deliver the same cooling/heating capacity as an 18" x 18" duct
 - Reduction of fan energy by a factor of 7 to deliver the same cooling to the space
- Higher supply water temperatures compared to conventional systems allow for use of water side economizers
 - Increased opportunities for free-cooling
- Significant reduction in maintenance costs and labor as compared to conventional all air systems
 - No moving parts - no blowers, motors, damper actuators to replace
 - Dry-coil operation - does not require regular cleaning and disinfecting of condensate pans
 - Recommended cleaning of coils once every 4 to 5 years, more frequently in hospitality rooms where linens are frequently changed (i.e. hospital patient rooms and hotel rooms)

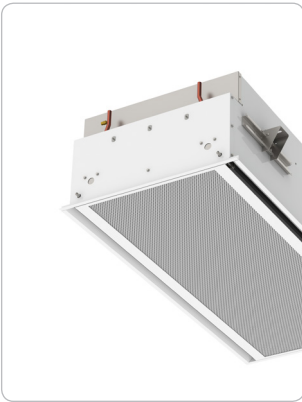
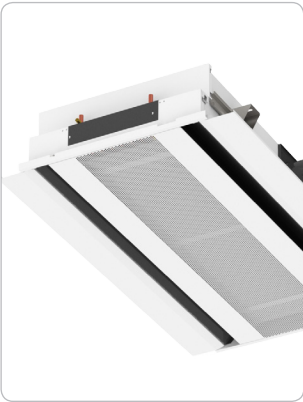


The Case for Chilled Beams in School

IMPROVING HEALTH + FRESHER AIR = BETTER PERFORMANCE

We all know the importance of comfort in schools and comfort’s relationship with student performance. While temperature gets the lion’s share of attention, equally important are noise, humidity, and ventilation. Efforts to update standards to address noise, humidity, and ventilation have made it harder for traditional HVAC equipment to establish and maintain comfortable learning environments in schools.

Enter chilled beams.



In a chilled-beam system, zone-based hydronic heating and/or cooling devices complement the primary air ventilation system, enabling the optimization of all heating, cooling, and ventilation functions. Chilled beams are quiet, can reduce energy consumption and maintenance, and take up less ceiling-cavity space while contributing to conditions that increase occupant performance.

NOISE

Think back to when you were a kid in math class. There probably were a number of distractions: a class clown, paper airplanes, someone passing notes.

One disruption that does not get the attention it deserves is unnatural or excessive background noise, which studies have shown can significantly hinder student performance. Conventional HVAC systems rarely meet prescribed background-noise-level requirements. ANSI/ASA S12.60, Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, requires a maximum background-noise level of 35 dBA (about NC 27)—difficult, if not near impossible, to attain with traditional classroom HVAC equipment. Chilled beams do not rely on internal motors or blowers to recirculate and recondition room air and, thus, can be utilized to maintain HVAC background-noise levels in accordance with ANSI/ASA S12.60.

HUMIDITY AND VENTILATION

HVAC systems that modulate supply airflow rate during occupied operation often do not maintain outdoor airflow rate within the requirements of ANSI/ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality. Additionally, with all air systems, minimum ventilation airflow rate establishes minimum supply airflow rate. During off-peak operation, this airflow rate exceeds what is required for cooling, necessitating the reheating of supply air before it enters a space.

Active chilled beams served by a dedicated outdoor-air system (DOAS) utilize ducted variable-temperature outdoor air to induce room air through an integral hydronic heat-transfer coil. Classroom cooling/heating demand is met by modulation of the rate of water flow through the coil while the rate of airflow remains constant. The coil's effect on space conditioning allows ducted-airflow temperature to be reset seasonally, resulting in significant reheat energy savings.

Active beams can be located either within a ceiling grid or floor-mounted adjacent to an outside wall. When active beams are floor-mounted, ventilation air can be delivered to a classroom in a displacement-ventilation manner. This method of delivery can reduce classroom carbon-dioxide levels and the resultant risk of the spread of respiratory diseases by more than 50 percent.

ADDITIONAL BENEFITS

Not only do chilled beams benefit students by being quieter and more adept at adjusting to fluctuating humidity and heat conditions, they benefit schools by reducing costs. While most conventional HVAC systems depend on the delivery of large volumes of air to condition classrooms, chilled-beam systems reduce ducted-air requirements by up to 60 percent by relying on their integral heat-transfer coils to offset the majority of space sensible-cooling and heating requirements. And because water is more efficient for space cooling and heating than air, chilled beams use considerably less energy overall than do other options.

In DOAS, chilled beams reduce classroom ducted airflow to the rates required for space ventilation and latent cooling, which allows for a constant volume of ventilation air. Also, they can contribute to the achievement of LEED certification through Energy and Atmosphere Credit 1, Optimize Energy Performance, and Indoor Environmental Quality Prerequisite 1, Minimum Indoor Air Quality Performance.



Introducing the TAO – Temperature Ambient Optimizer

FLOOR MOUNTED DISPLACEMENT CHILLED BEAM

Titus, TAO Temperature Ambient Optimizer, targets educational facilities in climate zones with heat loads > 200 BTUH per foot. The unit can help find the path to a balanced and healthy system by providing the right proportion of heating or cooling to the perimeter wall to take care of the majority of the room load, while maintaining the necessary displacement ventilation, humidity control, and temperature level of the room within the desirable acoustic levels that are expected to be in classrooms or theaters.



- Allows the supply of 100% outside air
- Operates at near-minimum ventilation rate for the classroom
- Conforms to ANSI Standard S12.60 sound levels, acceptable to education facilities
- Reduces energy consumption
- Features customizable cabinets in a variety of wood finishes and colors

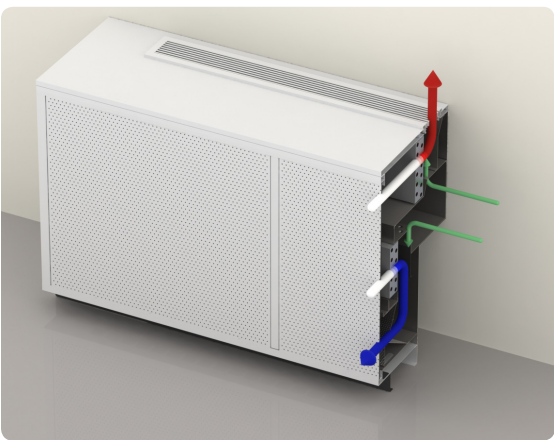
According to BOMA, energy averages 60% of a building's total operating costs. With oil and electricity prices on the rise, it is no surprise that there is an increased focus on renewable energy, green products, and LEED certified buildings, resulting in a greater demand for a product that combines comfort, indoor air quality, and energy efficiency. The TAO, a combination chilled beam/displacement unit and radiator, is the perfect solution to help address these issues.

The TAO is an excellent choice for schools and theaters where air quality is a concern. The required ventilation air for the classrooms is already pretreated before it is brought into the unit. With the TAO unit, part of the supply air is discharged into the space, with low air velocity, as close to the floor as possible. This provides a very low and slow moving pool of fresh air spreading over the entire floor. The convection from the occupants and other heat sources causes the fresh air to rise and create very comfortable conditions in the occupied zone.

By redirecting a portion of the treated supply air at very low velocity towards the cold, outside wall or window, it neutralizes the heat load and creates a thermal curtain. This reduces the convection and radiation from the cold wall or window, providing a more uniform temperature distribution and comfortable environment.

Since there are no blowers and motors operating within the TAO unit, the sound levels are further reduced and the overall energy consumption of the system can be improved.

This revolutionary product takes advantage of all LEED certification requirements to obtain energy credits. In addition, the stricter ASHRAE Standards of thermal comfort (Std. 55), energy savings and perimeter heating (Std.90.1) can be easily achieved with the addition of this product.



DESCRIPTION OF OPERATION

TAO – A hybrid unit that takes advantage of the displacement, chilled beams and radiation principles.

The unit does not have any moving parts; instead it has two sets of coils and two sets of nozzles to neutralize the two major loads within the zone.

The units are provided with a constant volume flow of conditioned outside air between 55 to 66°F supply air temperature. This primary supply air pressurizes the induction plenum of the TAO terminal unit and major portion of it will flow through the primary set of nozzles located in the lower part of the unit and displaced into the room. As the conditioned air leaves the nozzle it will also induce room air through the water coil to heat or cool the return air. Here it is reconditioned, mixed with primary air, and delivered to the room, at a discharge temperature of 64 to 72°F, providing the necessary ventilation/ air displacement for a very comfortable occupied zone.

The other portion of the primary supply air is discharged through a secondary set of nozzles directed towards the outside wall/window to neutralize the perimeter load. The secondary set of nozzles induces room air through the secondary coil



to increase the temperature of the supply air during the heating mode. The hot air will rise along the perimeter walls and windows to neutralize the thermal load by creating a warm air curtain.

Comfort (temperature and air movement) is met by optimizing the air path where the two major loads are located. At the same time the unit meets minimum ventilation requirements.

Classroom latent loads as high as 200 BTUH per linear foot of exposure can be satisfied while operating with chilled water temperatures high enough to avoid condensation on the integral terminal cooling coil. Higher latent loads may require that some degree of condensation be employed as a means of removing moisture from the recirculated room air. Although the units are furnished with a condensate pan, Titus suggests that all latent loads are handled by the primary air.

This revolutionary new product is specifically designed for the high ventilation loads that are normally required in all the educational facilities, theaters and long hallways with perimeter walls or windows.

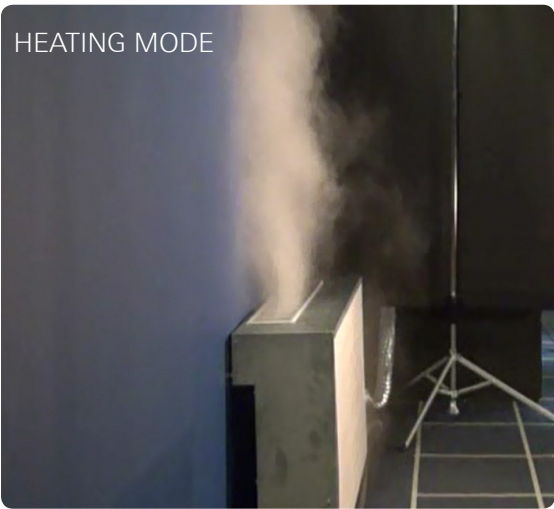
- TAO takes advantage of the new, non-condensing, low temperature, high-efficiency boilers that operates at 140 deg. F instead of 180 degrees, thus reducing energy consumption
- Allows for the reduction of the fresh air guidelines per ASHRAE 62.1, making its air exchange effectiveness the highest among all HVAC systems and ensures the correct quantity of outdoor air is provided to the space
- Achieves high indoor air quality by using the displacement ventilation strategy so there is no mixing of contaminants which keeps the CO2 levels in the classroom at minimum
- Helps meet fan power limitations prescribed by ASHRAE 90.1

- Provides individual zone control and satisfies both heating and cooling loads in one single unit with no moving parts
- Available to take full advantage of cooling-water side economizer offering energy savings when mechanical cooling is not needed

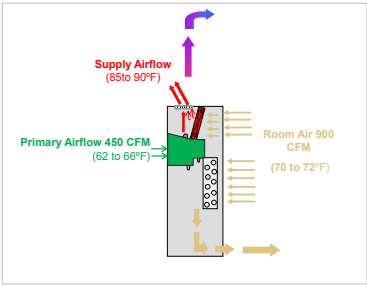
Opportunities for the contractor who understand DOAS

- Easier to coordinate
- Higher labor productivity
- Takes advantage of prefabrication and modularization

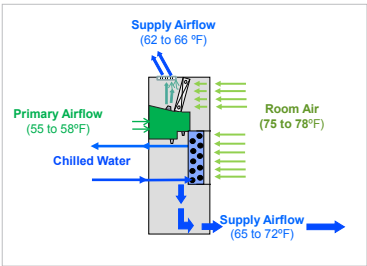
Two unit sizes can be chosen and very well suited to fit under the windowsill adjacent to the perimeter wall. Customized cabinets in a variety of aesthetically-pleasing wood finishes and colors.



Primary air continues to be delivered cooler temperature than the ambient air in the classroom. It is discharged through induction nozzles inducing room air through the integral heat transfer coil. This air is cooled in accordance with space thermostat demands prior to mixing with the primary air. The resultant air delivery to the space is a displacement type mixture of primary and recirculated air at 62 to 68°F.



Primary air is delivered through the induction nozzles. The velocity of the nozzles induces room air through the integral heat transfer coil which is then cooled in accordance with space thermostat demands prior to mixing with the primary air. The use of room air induction and reconditioning allows the use of 100% outside air as the primary air source. The space thermostat regulates the amount of induced air reconditioning in accordance with the room cooling requirements, resulting in a constant volume, variable temperature (61 to 68°F) discharge to the classroom.



CASE STUDY

Amber Trails Community School

Winnipeg, Manitoba

- Client - Seven Oaks School Division
- Representative Office - BPL Sales
- Architect - Prairie Architects
- Engineers - Wolfrom Engineering Ltd
- Contractor - Bockstael Construction Ltd
- ME Contractor - Thor Plumbing & Heating
- LEED Certification - LEED Gold Candidate



ABOUT THE PROJECT

Students at Amber Trails Community School in Winnipeg, Manitoba, are being taught by a new teacher – the building itself. Prairie Architects and the Seven Oaks School division designed the school to serve as a teaching tool for its students, one that highlights the impact facilities have on their communities. The new school is intended to challenge the existing standards about school design and to create exciting new visions for education based on a welcoming entrance, family home-like scale, natural daylight, atelier spaces, transparency courtyards, flexibility, and a fusion of inside and outside environments. The abundance of fresh air, sustainable design elements and natural light not only teach the students about sustainability but also help them study by providing a healthy learning environment. On top of housing K-8 students, the 78,000 square foot facility also serves as a neighborhood daycare and public library.

THE TITUS SOLUTION

HVAC SYSTEM BOLSTERS SUSTAINABILITY

To match its sustainable design, the building uses chilled beam products as its primary source of air distribution. The beams feature the aerodynamic properties of Titus’ ceiling diffusers and benefit from the use of using hydronic coils and induced air, reducing energy consumption associated with removing sensible thermal loads.



CBAL-24



After being discharged through nozzles located along the beams, the primary air is supplied to the beam's mixing chamber. The nozzles inject this air into the mixing chamber at velocities capable of inducing room air through one or two coils and where it mixes with the primary supply air. This air mixture is then discharged through the ceiling slot diffusers into the space, providing high cooling outputs with low amounts of primary air. The reduced volume of air leads to smaller (and less expensive) air handlers and ducts and less energy consumption.

The supplied air from the air handling unit is tempered and dehumidified to handle the latent load. The remaining loads in the space are addressed via the chilled beam's heat exchanger. Applications with low latent cooling loads could potentially use 100 percent outdoor air, allowing for a dedicated outdoor air system with energy recovery that would further reduce total system energy consumption.

The chilled beams used for this project can be used for both heating and cooling and are offered in multiple sizes – 12-inch and 24-inch widths and 2ft to 10ft lengths. They can be easily integrated into different grids styles within a suspended ceiling or even in drywall ceilings. The low overall height of these chilled beams make them ideal for reducing space required for false ceilings.

Additional air distribution products helped to complete an impressive school for the community. Chilled beams provide a great alternative to conventional overhead heating and cooling.

THE CHILLED BEAM ADVANTAGE IN SCHOOLS

Studies have shown that excessive noise levels can adversely affect student performance. Conventional HVAC systems typically used in schools today (fan-powered VAV, fan coils, unit ventilators), rarely meet prescribed background noise level requirements - ANSI standard S12.60 for classroom acoustics requires a maximum background noise level of 35 dBA (about NC-27) – this is difficult, if not near impossible to attain with traditional equipment.

Furthermore, student performance is affected by space humidity and ventilation levels. HVAC systems whose primary airflow rate is modulated while the classroom is occupied often do not comply with the requirements of ASHRAE 62.1. Ventilation airflow rates are difficult to maintain at part load conditions with modulating the primary airflow rates. Chilled beams are systems where zoned based hydronic-heating and/or cooling devices compliment the conditioning of the primary air ventilation system, allowing for optimization of all heating, cooling and ventilation functions and providing opportunities for savings in energy, ceiling cavity space and maintenance as well as increased occupant performance.

Most conventional HVAC systems depend on the delivery of large volumes of air to condition the classroom. Chilled beam systems typically reduce





ducted air requirements by as much as 60% by relying on their integral heat transfer coils to offset most of the space sensible cooling and heating requirements. Since water is more efficient for space cooling and heating than air, chilled beams use considerably less overall energy than the other options available, such as VAV, VRF, and fan coil units.

Since chilled beams allow classroom ducted airflow rates to be reduced to that which is required for space ventilation and latent cooling, they are ideal for use with 100% (DOAS) outside air systems. This allows the beams to provide a constant volume of ventilation air to the classroom at all times. Chilled beams also contribute toward achieving LEED certification.

THE END RESULT

The new school, which opened its doors in January 2015 is designed to meet the requirements for LEED Gold Certification and now has a total occupancy of 775 students and staff. With dedicated spaces allotted for day care, early childhood education, play areas and a public library, Amber Trails Community School is a vital piece of a Winnipeg community's puzzle. Thanks to a sustainable design and energy efficient HVAC system, the multipurpose space serves as a daily reminder to students, teachers and the overall community about how buildings can have a positive impact on communities beyond their intended uses.

More Information

Additional information on our chilled beam products and their best applications can be found on the URLs listed below:

<https://www.titus-hvac.com/architects/>

<http://healthcare.titus-hvac.com/>

<https://www.titus-hvac.com/critical/>

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AIR DISTRIBUTION PRODUCTS



ADVANCING THE SCIENCE OF AIR DISTRIBUTION

605 Shiloh Rd.
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(ofc): 972.212.4800
(fax): 972.212.4884
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