

# Chilled Beams

What are they? How do they benefit my system? Why is certification important?



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## Learning Objectives

- **Chilled beams types**
- **How an active chilled beam works**
- **Why a chilled beam might be beneficial**
- **Rating/testing of chilled beams**
- **Certification of chilled beams**

# Chilled Beams Types

## ➤ **Active Chilled Beams**

- An air induction and diffusion device which introduces conditioned air for the purposes of temperature and/or humidity control. Primary Air is delivered through a series of Nozzles, which induces and conditions Secondary Air through a unit mounted coil.

# Chilled Beams Types

## ➤ Passive Chilled Beams

- A cooled element or coil, fixed in, above or under a ceiling that sensibly cools through natural convection using buoyancy driven air flow.

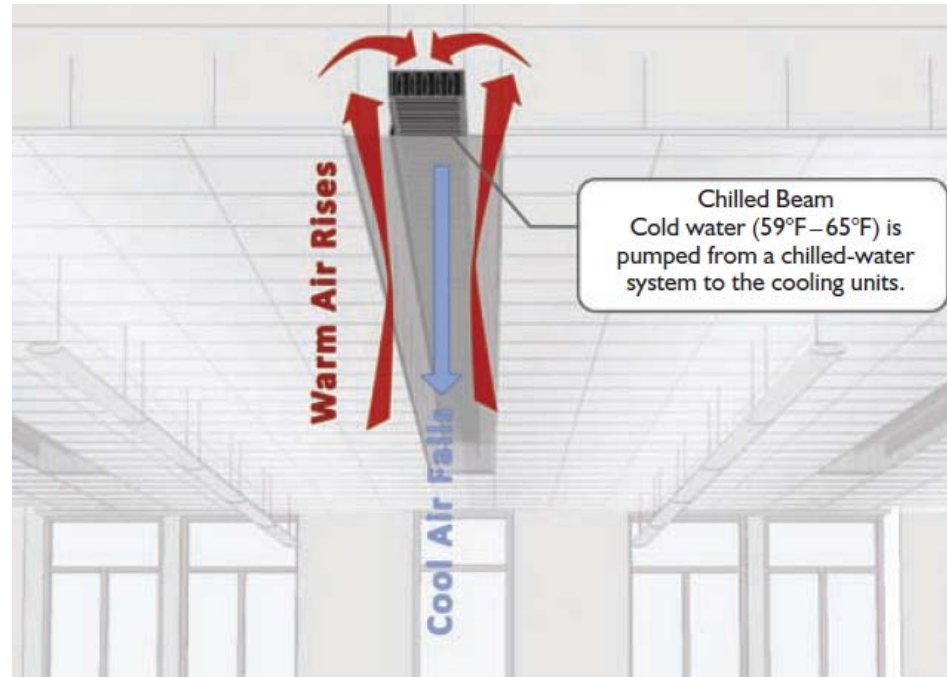


Photo source: ASHRAE Journal Article: Cooling With Less Air Using Underfloor Air Distribution and Chilled Beams

## Chilled Beams Types

### ➤ Multi-service Chilled Beam

- A chilled beam that incorporates space services other than cooling such as lighting. This type of chilled beam is usually customized to meet specific project requirements.

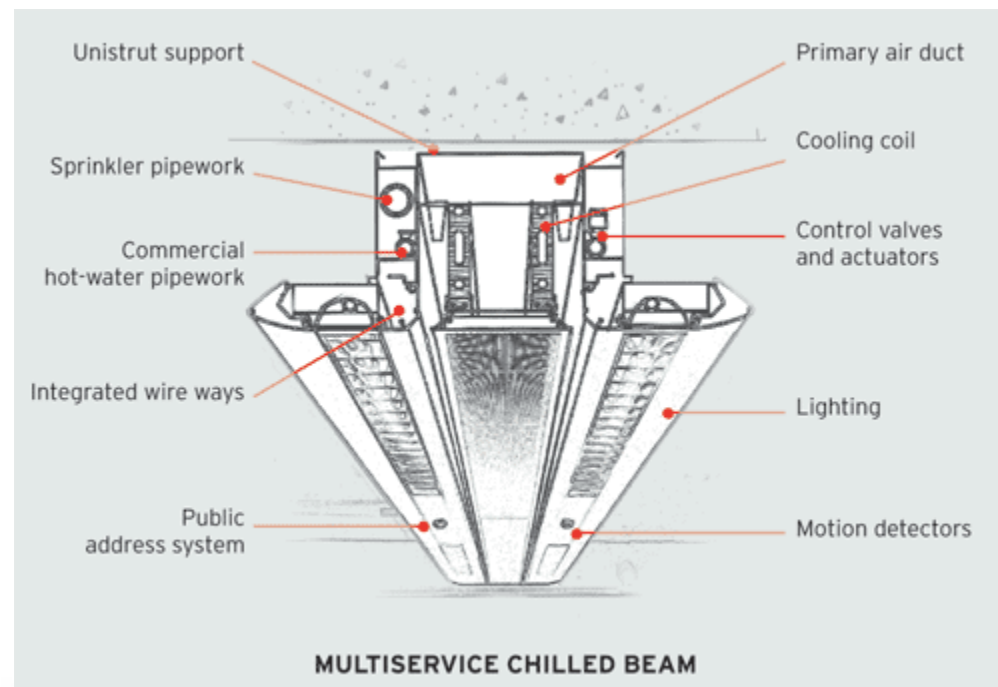


Image from: [http://continuingeducation.construction.com/article\\_print.php?L=5&C=463](http://continuingeducation.construction.com/article_print.php?L=5&C=463)

## Chilled Beams Types

### ➤ Room Air Induction Unit

- A type of Active Chilled Beam that requires at least 1.5 in. H<sub>2</sub>O of inlet static pressure to operate.

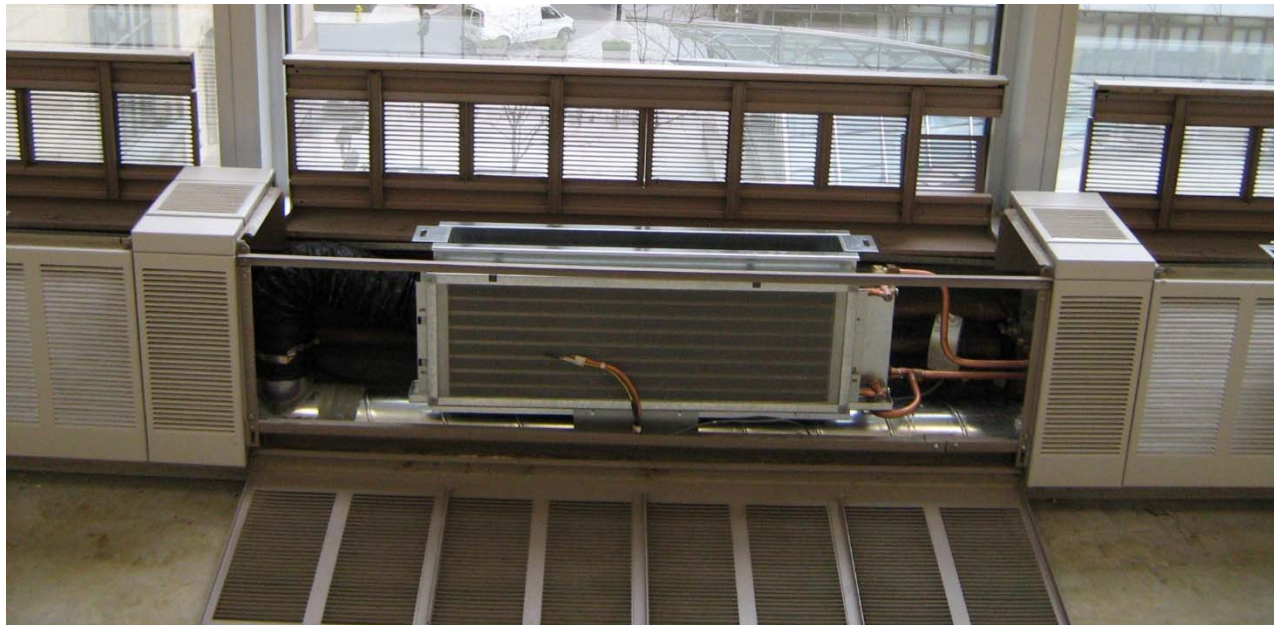


Image credit: [http://www.ebaircontrol.com/image/img\\_24.jpg](http://www.ebaircontrol.com/image/img_24.jpg)

## How Does an Active Chilled Beam (ACB) Work?

- Typically ceiling-mounted induction diffusers that deliver cooling or heating via water circulated through a coil mounted in the induced air path.
- Water is cooled to approximately 57° F to 62° F and is pumped to the chilled beam units.
  - Adjustments to water temperatures, supply air rate and temperature, and static pressure may all contribute gains in efficiency and, ultimately, lower energy consumption.

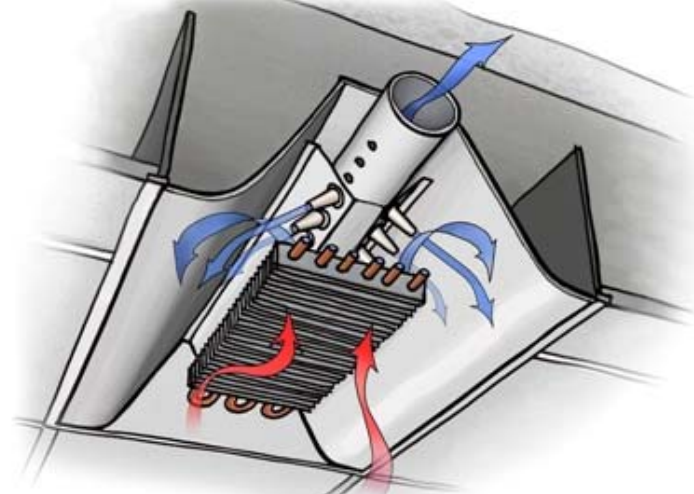


Image credit: [http://ahrinet.org/site/S\\_127/295/Modules/AHRI/Articles](http://ahrinet.org/site/S_127/295/Modules/AHRI/Articles)

## How Does an Active Chilled Beam (ACB) Work?

- Utilize supply air plenums and induction nozzles which makes heat transfer more effective.
  - Mixture of primary air and conditioned room air is slightly warmer than all air systems resulting in higher airflow rates.
  - Attention should be given to proper room air distribution and its effect on localized velocities and temperatures within the occupied zone.

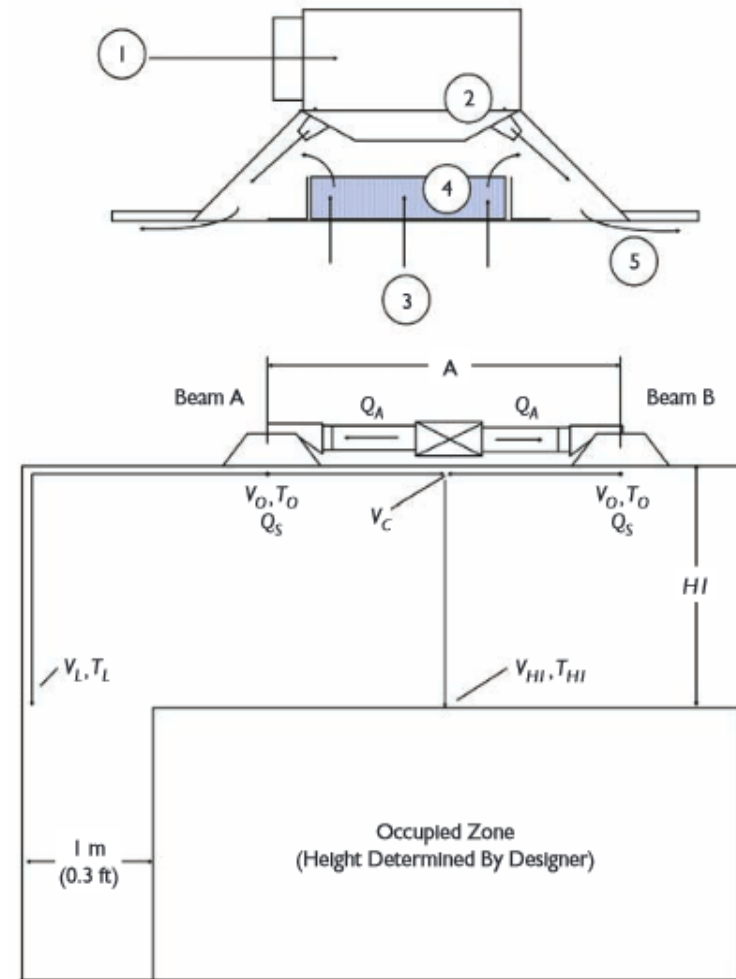


Image credit: ASHRAE Journal  
Designing Chilled Beams for  
Thermal Comfort



## Why Use an Active Chilled Beam (ACB)?

- They may help to lower building operating costs
- They provide quiet operation
- They have no electrical power requirements
- They may help overcome tight floor-to-floor space requirements

## Why Use an Active Chilled Beam (ACB)?

- Potential applications for active chilled beams include universities, historic buildings, government buildings, laboratories, open-plan office buildings, meeting rooms, libraries, and hospitals.

Building Types and Percentage of Total Building types Using Chilled Beams (2012 to 2014*)	
Educational	68%
Commercial	10%
Government	7%
Community	5%
Medical	4%
Civil	2%
Military	2%
Residential	1%
Industrial	1%

\*2014 data was annualized based on 11 months of data from Reed Insight Data

Source: Reed Construction Data

## How Do You Verify a Chilled Beam's Performance?

- **RP-1629, “Testing and Modeling Energy Performance of Active *Chilled Beam* Systems”.**
  - Currently underway to verify the performance of chilled beams and provide guidance for simulation tools
  - Research sponsored by ASHRAE TC 5.3
    - Tuesday, January 27, 2015 from 1:00 PM–3:30 PM in Monroe

## How Do You Verify a Chilled Beam's Performance?

- **ASHRAE RP-1383 will yield a developed module for radiative/convective systems for simulation. The results of this project, once available, will be analyzed for application to active chilled beam systems and inclusion in this study.**
  - An active study sponsored by TC 6.5
    - Monday, January 26, 2015 from 2:15 PM–4:15 PM in LaSalle 1

## How Do You Verify a Chilled Beam's Performance?

- **EN 15116 , Ventilation in buildings — Chilled beams — Testing and rating of active chilled beams**
  - Most current edition is from 2008
- **Nordtest VVS 078, Ceiling cooling systems: Cooling capacity**
  - Most current edition is from 1999
- **Recently approved ASHRAE Standard 200, Methods of Testing Chilled Beams**
  - Anticipated publication in February 2015

## Basic differences between the standards

	EN 15116	ASHRAE 200	VVS 078
Thermal Testing	✓	✓	✓
Air throw Testing		✓	
Induction Ratio		✓	
Acoustical Testing		✓	

## AHRI's New Active Chilled Beam Certification Program

- In early 2015, AHRI launched the ACB certification program
- The program uses ASHRAE Standard 200 as the method of test
- AHRI Standards 1240 (I-P) and 1241 (SI) provide performance metrics and rating conditions
  - Available for free on the AHRI website, [www.ahrinet.org](http://www.ahrinet.org)

## Why Choose AHRI-Certified Products

- **Foremost globally recognized HVACR & water heating certification program**
- **Voluntary program**
- **Qualification is lengthy and rigorous**
- **400+ participants across all program**
  - Including 58 International Licensees from 16 countries
- **2,500 independent laboratory tests annually**
- **Accredited by Standards Council of Canada (SCC)**



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## Why You Can Trust AHRI

- **AHRI contracts with a third-party lab to conduct all tests**
- **Products are randomly selected for testing**
- **Operation Manuals dictate strict procedure for administration of the certification program**
- **AHRI Directory is recognized by government agencies**
  - EPA (Environmental Protection Agency)
  - DOE (U.S. Department of Energy)
  - FTC (Federal Trade Commission)
  - NRCan (Natural Resources Canada)
  - CEC (California Energy Commission)

## Qualification Process

### ➤ **Application Submittals**

- Application is separately applied to each Certification Program
- Ratings provided for all models (Certify All)

### ➤ **Testing**

- 20% Basic Model Groups are tested
- Conducted by a 3<sup>rd</sup> party lab (not AHRI)

## Third-party Verification

- **Manufacturer performance ratings verified by a third-party laboratory**
- **Holds manufacturers accountable**
- **Provides consumers with confidence in performance of the product**

## Rated

- Conforms to standard
- Subject to rigorous and continuous testing
- Manufacturers' performance ratings independently measured
- Third-party verified
- All products within program scope certified
- Provides marketplace clarity

## AHRI-Certified<sup>®</sup>

- Conforms to standard
- Subject to rigorous and continuous testing
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- Third-party verified
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## AHRI Standards 1240 (I-P) and 1241 (SI)

### ➤ **Written by members of the AHRI Chilled Beams Product Section**

- Air System Components
- Carrier Corporation
- Halton Group Americas
- Mestek, Inc.
- Metal Industries, Inc.
- Price Industries, Inc.
- Swegon
- Trane
- Trox USA, Inc.

## AHRI Standard 1240 – Important Terms

- **Primary Air** - Air delivered through the Nozzle(s) of an Active Chilled Beam
- **Secondary Air** - Air induced through coil of an Active Chilled Beam
- **Nozzle** - An air flow opening in the Plenum which discharges a jet of Primary Air via the Air-induction Process.

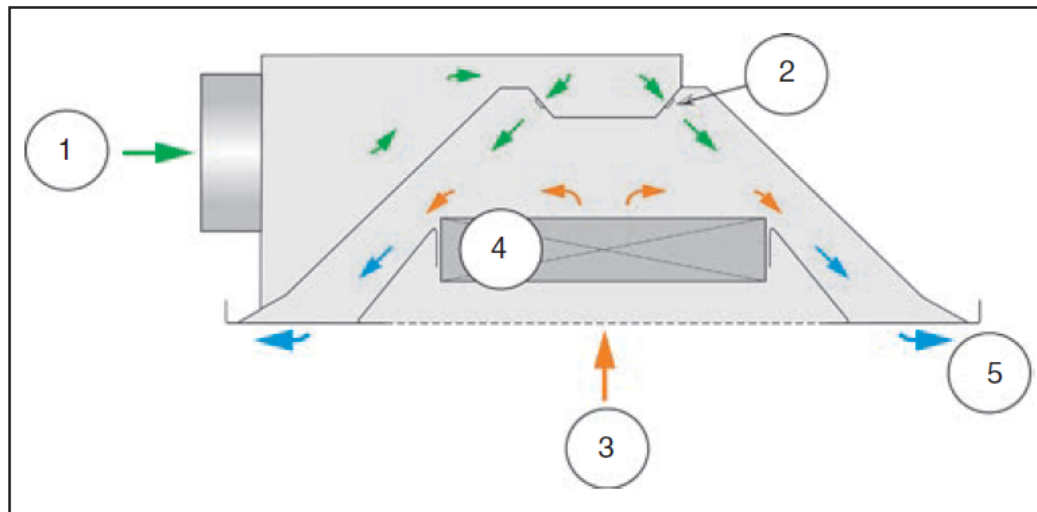


Photo source: ASHRAE Journal Article Efficient Space Humidity Control With Active Chilled Beam Systems

## AHRI Standard 1240 – Important Terms

- **Plenum** - An air compartment under positive pressure, and consisting of inlet(s) and Nozzle(s) for Primary Air. Also referred to as a Plenum chamber
- **Induction Ratio** - The ratio of the volumetric flow rate of Secondary Air to Primary Air

# AHRI Standard 1240 – Standard Ratings

## ➤ **Primary Air**

- flow rate, cfm (Standard Air)
- temperature, - Isothermal to Reference Air Temperature
- pressure drop, 0.5 inches H<sub>2</sub>O

## ➤ **Water coil**

- capacity, reported, Btu/h
- Entering water temperature, cooling: 57°F
- Leaving water temperature, reported value °F
- Water flow rate, gpm, adjusted to achieve mean water temperature differential of 14.5°F relative to reference air temperature
- Water pressure drop, reported, inches H<sub>2</sub>O



## AHRI Standard 1240 – Standard Ratings

- **Supply Air throw distance, 100 fpm**
  - Supply Air at isothermal conditions relative to the test room to be determined using ANSI/ASHRAE Standard 70.
  - Air volume to be at manufacturer supplied value for primary air.
- **Sound generation (combined radiated and discharge sound) by Octave Bands 2 to 7.**
  - Air volume to be at manufacturer's supplied value for primary air.
- **Induced air flow rate, cfm**

## ACB Certification Program

- **Certify all within 3 years of program launch for products sold within the intended market**
- **Exclusions**
  - Active Chilled Beam units employing volatile-refrigerant coils
  - Active Chilled Beam units employing steam coils
  - Passive chilled beam units
  - Multi-service active chilled beams

## ACB Certification Program – Certified Data

### ➤ **Water**

- Flow Rate, L/s [gpm], adjusted to achieve mean water temperature differential of 8.0°C [14.4 °F] relative to reference air temperature
- Pressure Drop, kPa [inches w.c.]
- Coil Capacity, W, [Btu/h]

### ➤ **Primary Air Flow Rate, L/s [cfm]**

### ➤ **Sound Generation (combined radiated and discharge sound) by octave bands 2 to 7**

## ACB Certification Program – Certified Data

- **Induced air flow rate, L/s [cfm], calculated in accordance with ASHRAE 200**
- **All data is at the following conditions:**
  - Standard Air Condition for cooling capacity test:
    - Primary Air Temperature, 24 °C [75°F] Isothermal to reference air temperature
    - Primary Air Pressure Drop, 125 Pa [0.5 inches w.c.]
    - Entering Water Temperature, : 14.0°C [57.2°F]
    - Leaving Water Temperature, °C [°F]

## Conclusion

- Chilled Beams may be the right solution for your project.
- There will soon be an ASHRAE Method of Testing available.
- AHRI has launched a certification program to verify the performance of chilled beams.
- Once manufacturers have completed the application process for the certification program, certified data will be available on [ahridirectory.org](http://ahridirectory.org)

# Questions?



**AHRI**

AIR-CONDITIONING, HEATING,  
& REFRIGERATION INSTITUTE

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