NuClimate

zehnder
always the
best climate

Robert Button
National Sales Manager NuClimate Product Line

INDUCTION & CHILLED
BEAM TECHNOLOGY

Made in America for the American Market

Overview

General Knowledge

How Induction works

Operation, History & Evolution

Sensible only Designs

Fully Condensing Designs

Challenges

System Design

Installations

Benefits

Software & Support Documentation

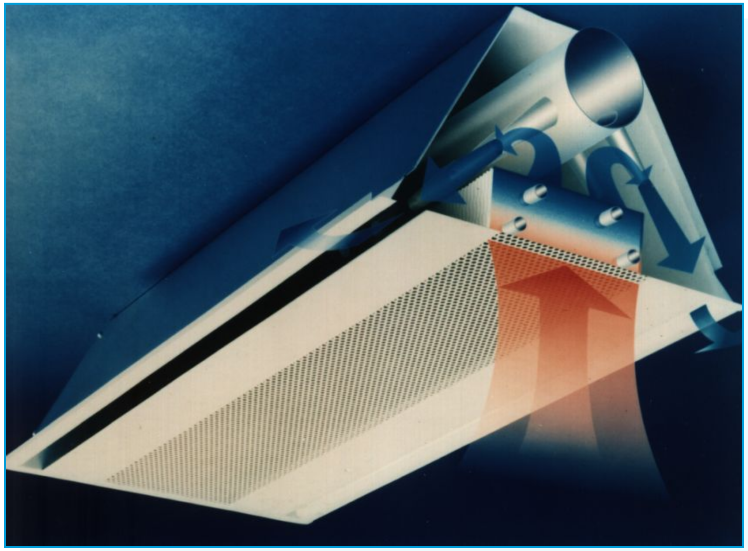
Evolution

Rebirth in Europe in 1990's

Europe is a Hydronic heating market – 78DB/67WB in Cooling mode

Europe designs based on <u>low</u> cooling load requirements

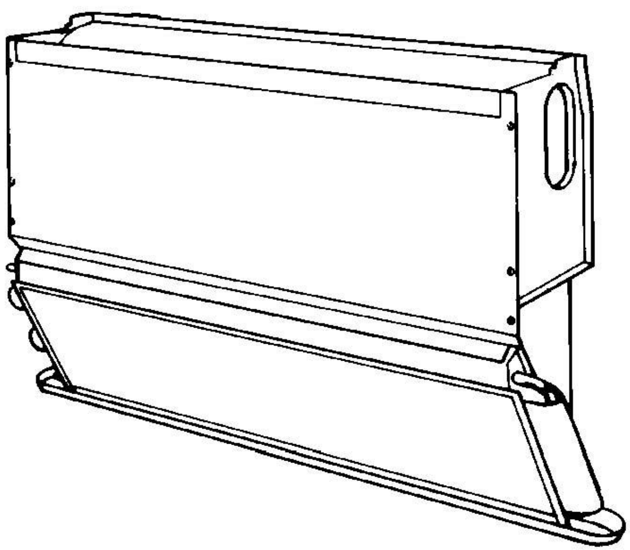
Similar spaces in Europe are less square feet than in the US

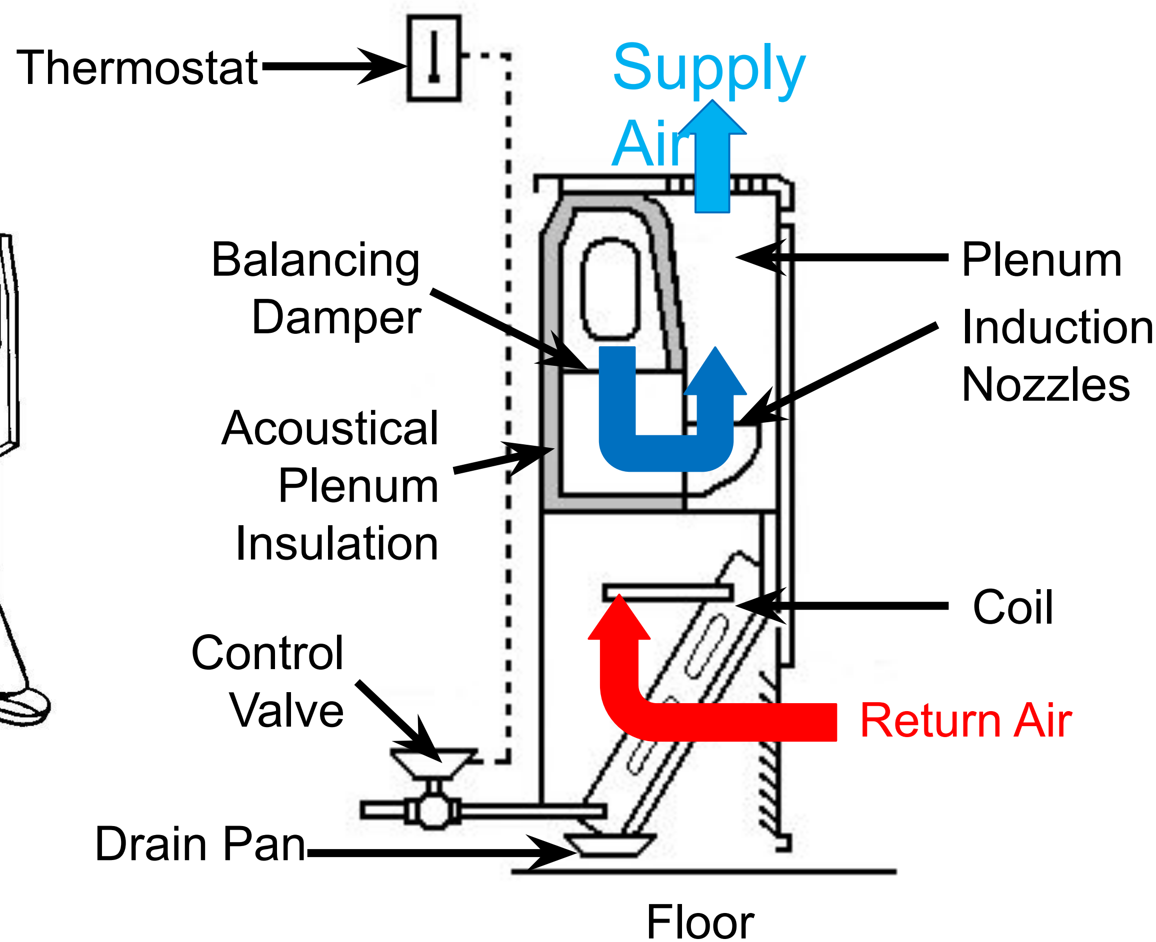


History

Began with Carrier 36S Series Induction Unit

Units require higher static pressure to work, up to 2”



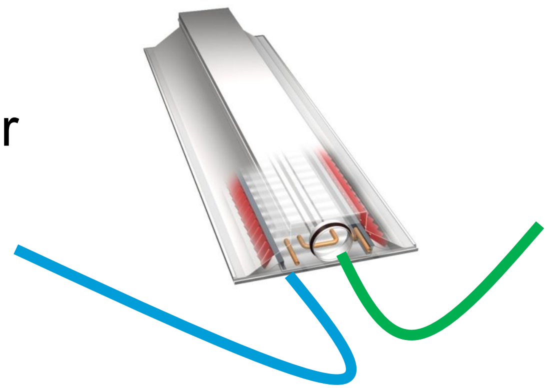


Operation

***Sensible Only Chilled Beams** (no drain pans)*

58 to 62°F Chilled water

120 to 180°F Hot water

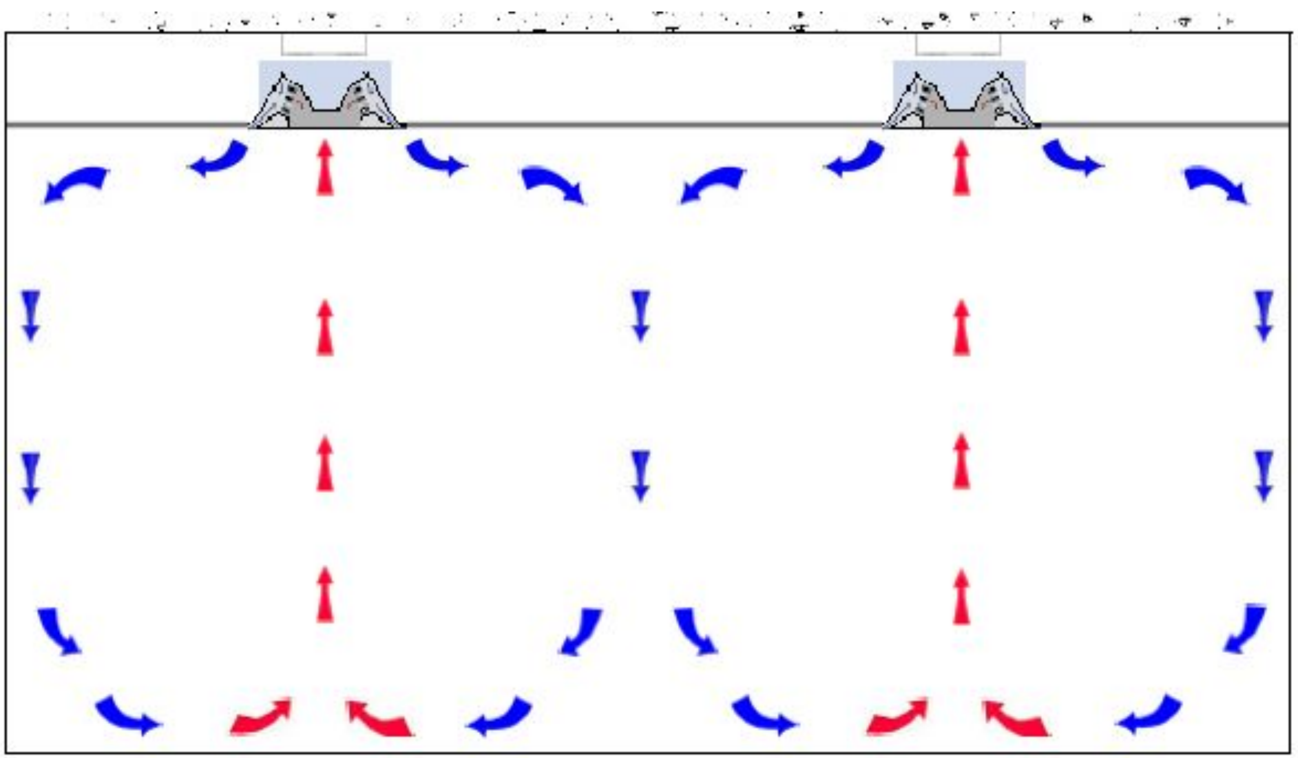


Primary Ventilation Air:

41 to 48 grains

50-70°F EAT

0.2”-0.8” Inlet Pressure

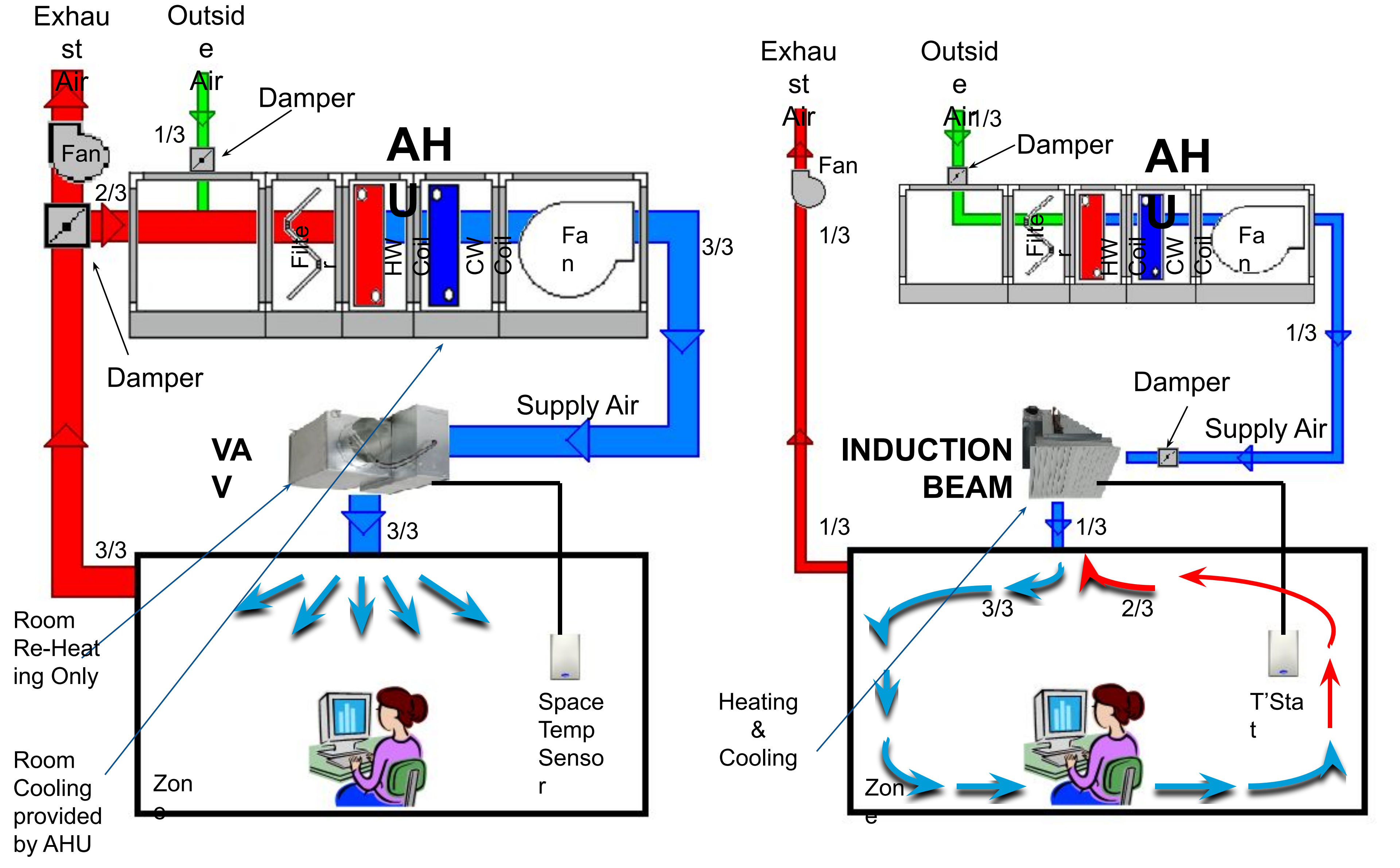


Room Conditions
75DB/50RH

50% RH design or lower helps reduce the condensation risk

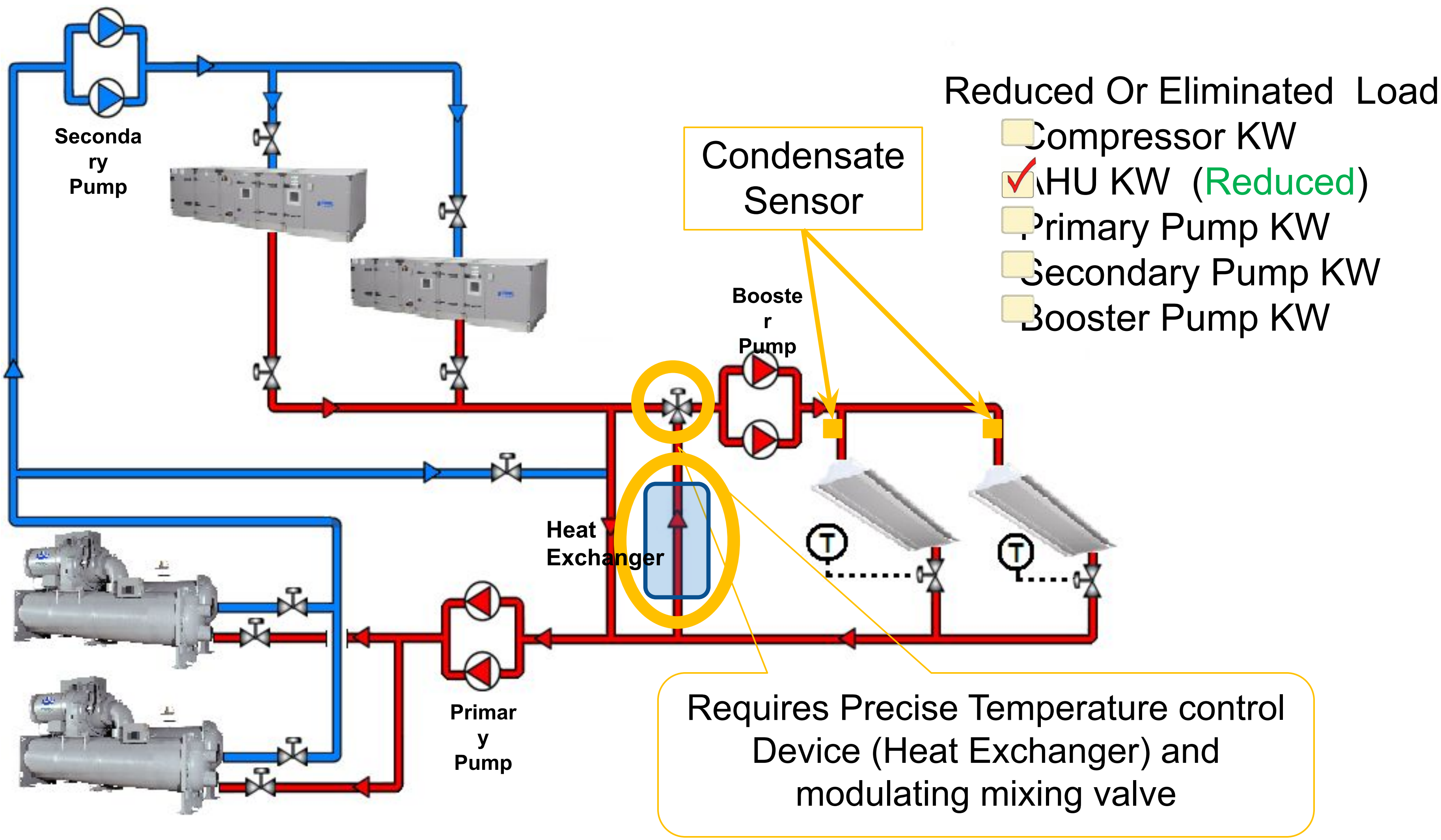
Fan Energy Savings!

Traditional VAV vs. Induction/Chilled Beam



System Design

Primary – Secondary Loop System. Sensible Only Chilled Beams

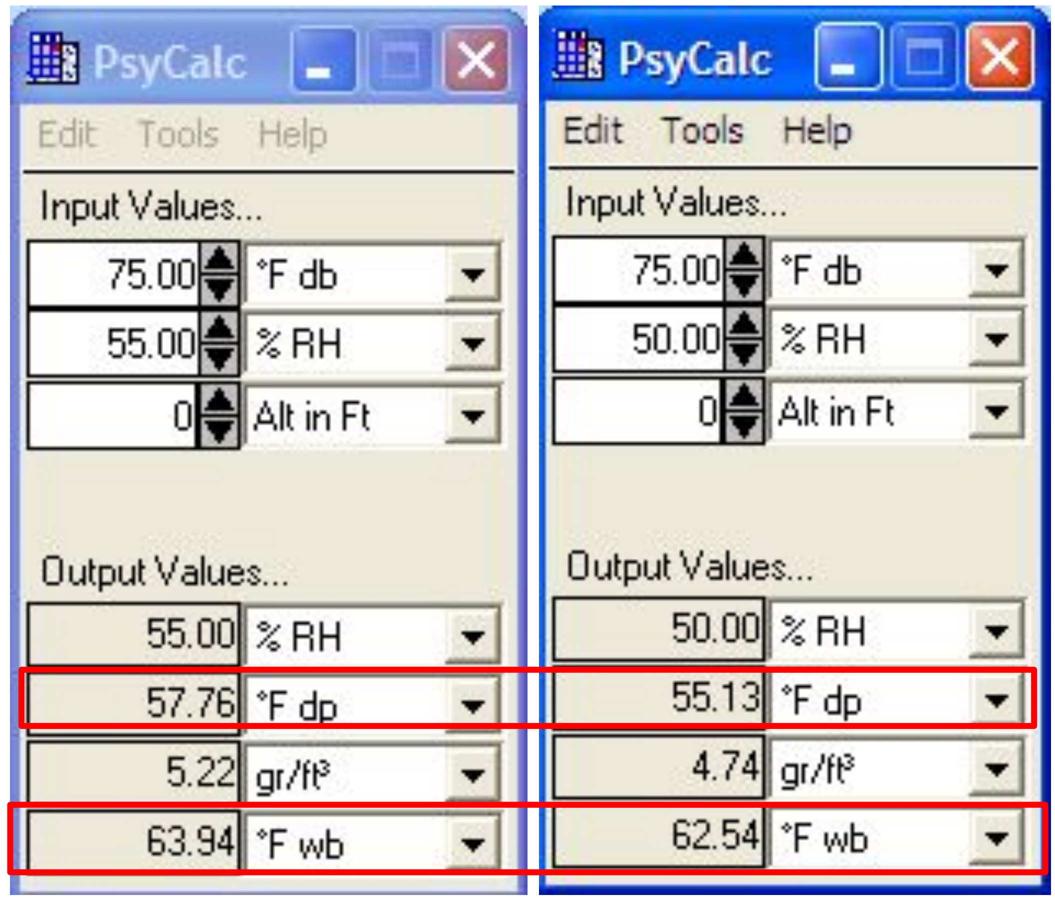


Most building are designed for 75db/62wb/50%RH or 75db/61wb/45%RH

TRADITIONAL

Building Design Conditions

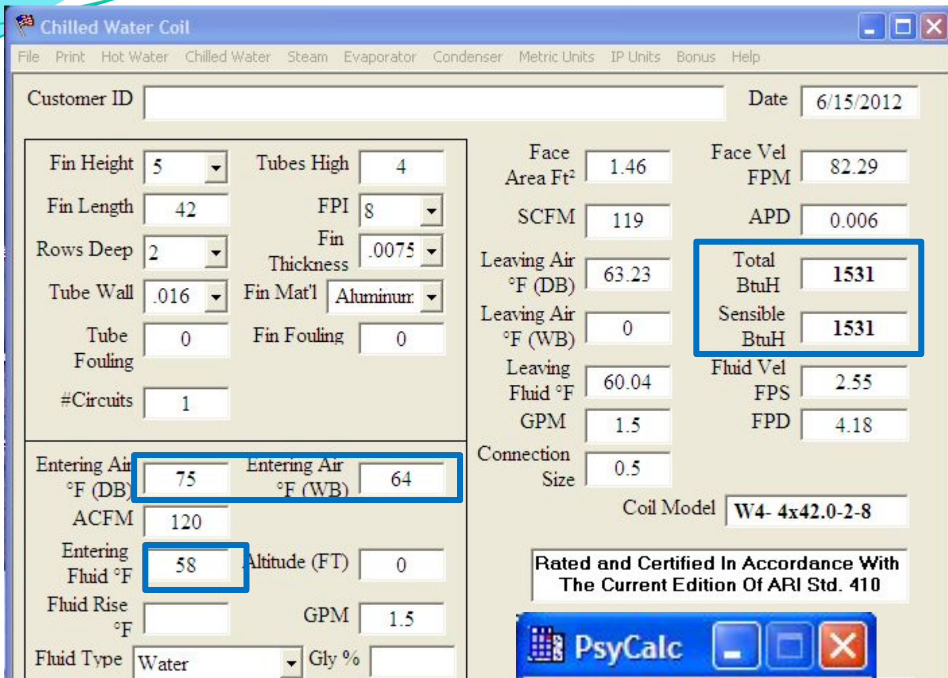
	Condition # 1	Condition # 2
Building Design Temp	75º F	75º F
Relative Humidity	55 %	50 %

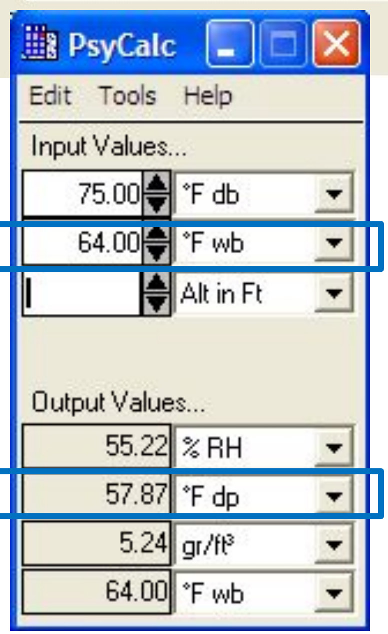


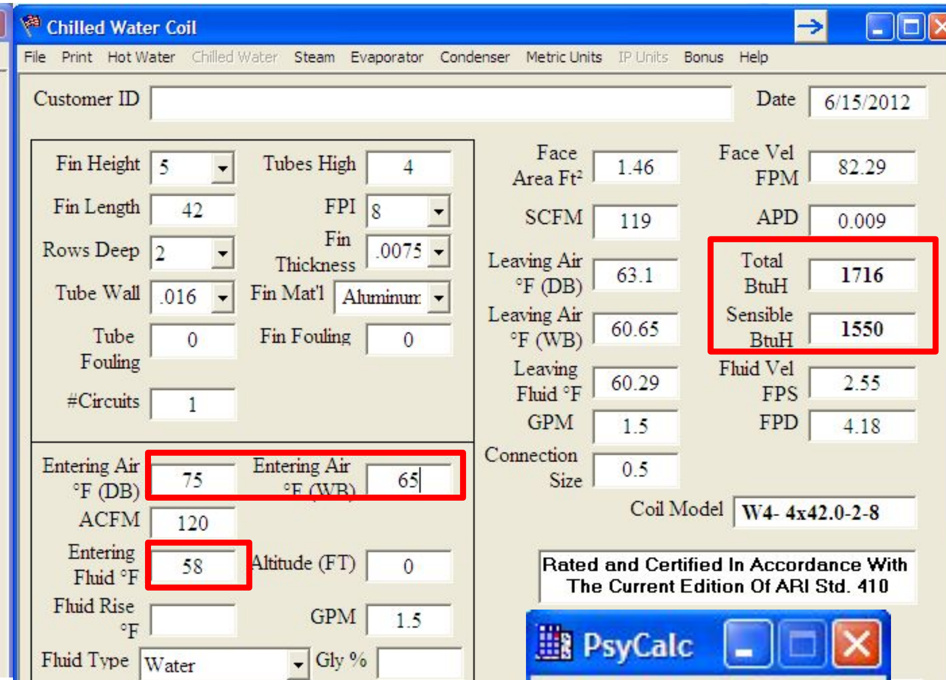
Dew Points

Wet Bulb Temp

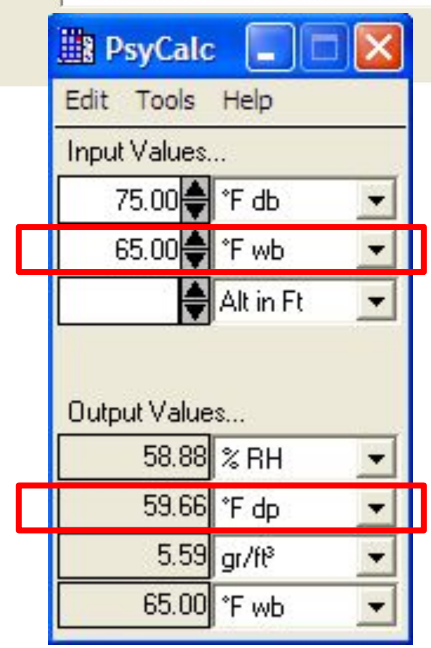
TRADITIONAL CHILLED BEAM LIMITATIONS







Wet Bulb Temp



Dew Points

Chilled Water Coil Rating - Program Version 2.0

Date: 01-14-2013
Customer ID:
CoilModel: W4- 4x42.0-2-8

Coil Construction:

Fin Height: 5"	Rows Deep: 2	
Fin Length: 42"	FPI: 8	
Fin Thickness: .0075"	Fin Material: Aluminum	Fin Type: Sine Wave
Tube Wall: .016"	Tube Material: Copper	Tube O.D.: 1/2"
# Circuits: 1	Connection Size: 0.5"	Face Area: 1.46 ft²

1,531 BTUH

Rating Conditions:

1.5 GPM

Entering DB: 75° f	Entering WB: 64° f	
CFM: 120	Altitude: 0 ft	SCFM: 119
Fluid Temp In: 58° f	GPM: 1.5	
Fluid: Water	% Glycol:	

Performance:

Total btuh: 1,531	Sensible btuh: 1,531	
Leaving DB: 63.2° f	Leaving WB: .° f	
Face Velocity: 82 fpm	Air Press. Drop: .01"	
Fluid Temp Out: 60.° f	Fluid Velocity: 2.6 fps	Fluid Pressure Drop: 4.2'

*** Rated and Certified In Accordance With The Current Edition Of ARI Std. 410 ***

Challenges in USA

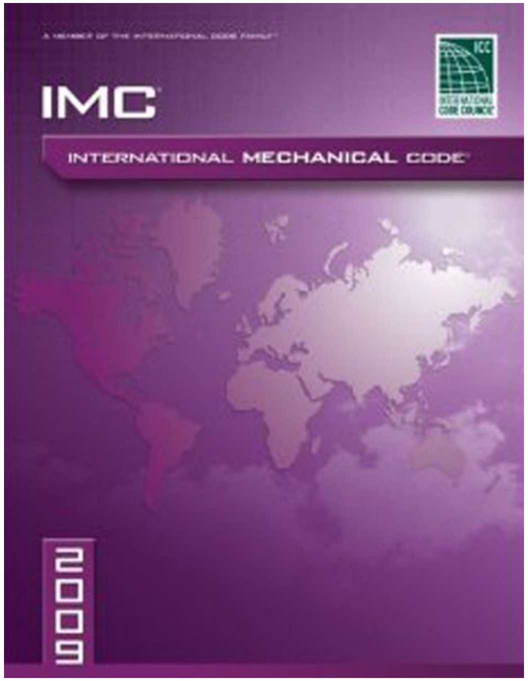
- Higher Sensible and Latent Load Densities
- Higher Outside Air Latent Loads
- Code compliant drain pans required. (Sen. only exception)
- Spaces maintained to 75DB/64WB/55RH or Lower
- Requires tight control of space to avoid condensation
- Must apply necessary protection – dew point control, condensation sensors, mixing valves, booster pumps, piping loops, controls.

Challenges & Requirements to Control Liability

Requirements in US Market

Requires drain pan to eliminate liability concerns.

307.2 Evaporators and cooling coils. Condensate drain systems shall be provided for equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 307.2.1 through 307.2.4



Challenges & Requirements

Requirements (cont..)

"…cast iron, galvanized steel, copper, cross-linked polyethylene, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing…size shall be not less than ¾-inch…"

"An auxiliary drain pan…"

"A separate overflow drain line shall be connected to the drain pan provided with the equipment."

"An auxiliary drain pan without a separate drain…"

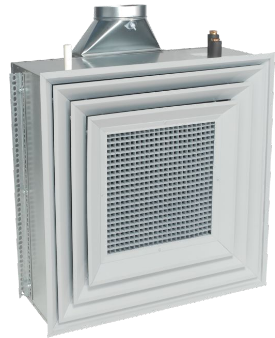
"A water level detection device conforming to UL 508…The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary…"

307.2.2 Drain pipe materials and sizes. Components of the condensate disposal system shall be cast iron, galvanized steel, copper, cross-linked polyethylene, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation. Condensate waste and drain line size shall be not less than $^3/_4$-inch (19 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an approved method. All horizontal sections of drain piping shall be installed in uniform alignment at a uniform slope.

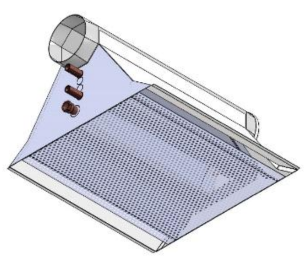
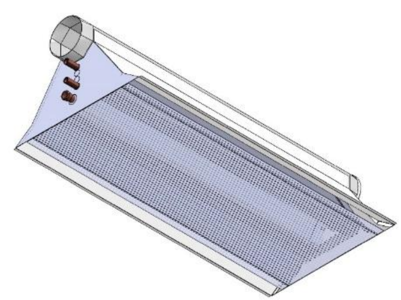
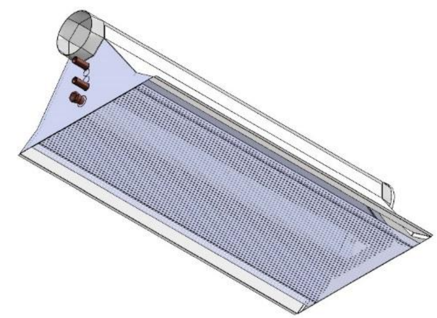
307.2.3 Auxiliary and secondary drain systems. In addition to the requirements of Section 307.2.1, a secondary drain or auxiliary drain pan shall be required for each cooling or evaporator coil or fuel-fired appliance that produces condensate, where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. One of the following methods shall be used:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1.5 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Metallic pans shall have a minimum thickness of not less than 0.0276-inch (0.7 mm) galvanized sheet metal. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
4. A water level detection device conforming to UL 508 shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary

Sensible & Latent Induction Beams w/Drain Pans
Fan Coils w/out Fans?

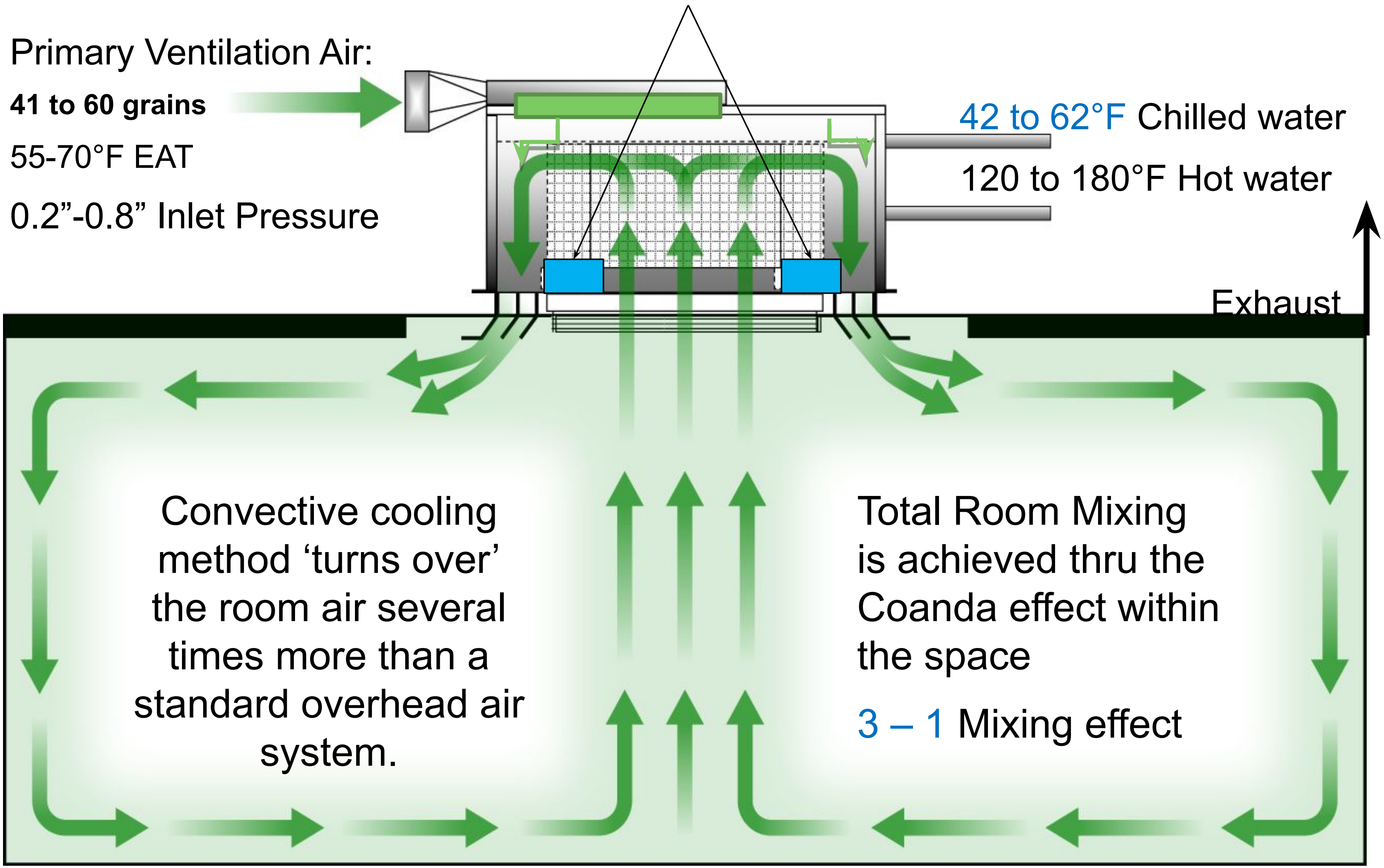


- Higher Capacity
- Provides Sensible and Latent Cooling
- Occupant Comfort – No drafts
- Noise Levels NC14 to NC 35
- Independently tested by ETL Intertek
- All Drain Pans meeting IBC requirements
- No Filters Required
- AHRI Certified Coils

Solution

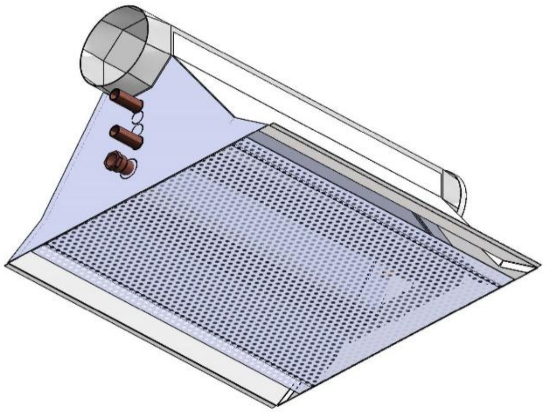
Induction Beam with Drain Pans



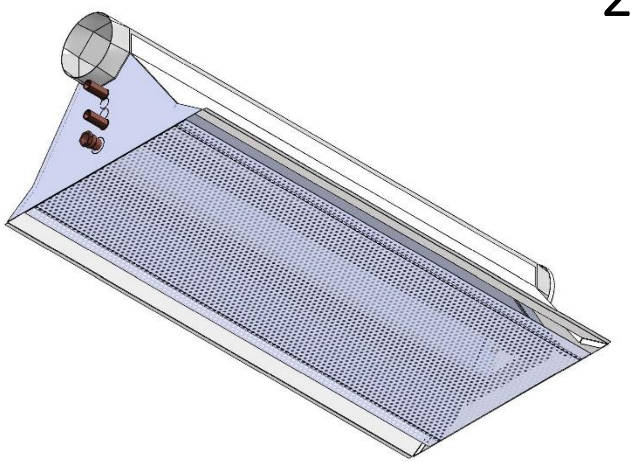
INDUCTION BEAMS WITH DRAIN PANS

1-Way, 2-Way Blow & All Way - Induction Rates from 3 to 1 thru 7 – 1

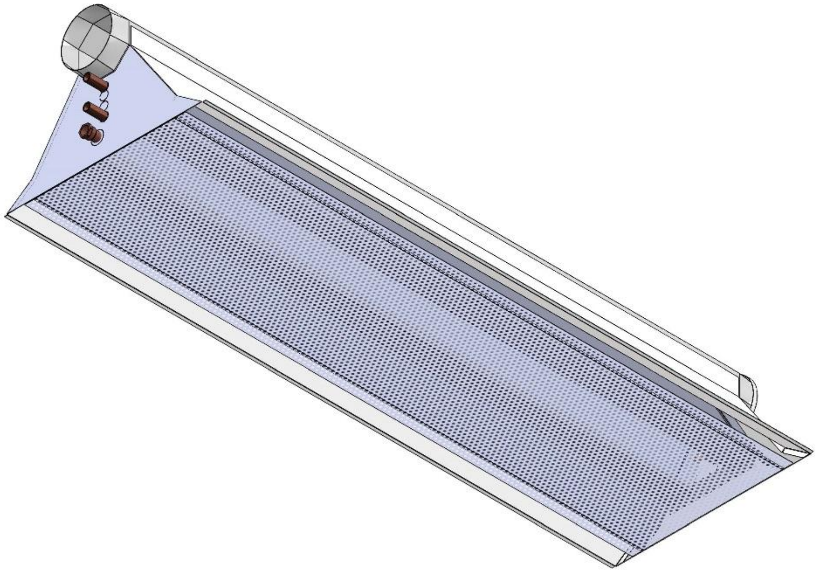
0.2”-0.8” Inlet Pressure



24” X 24”



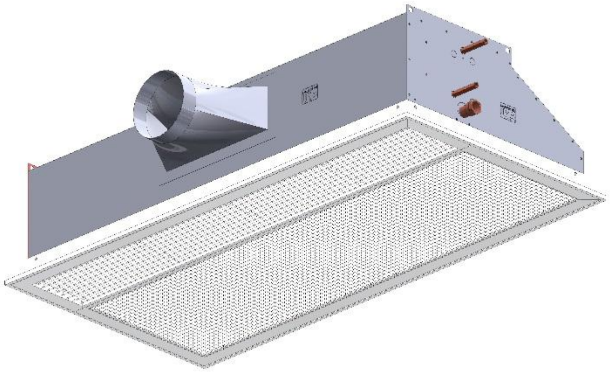
48” X 24”



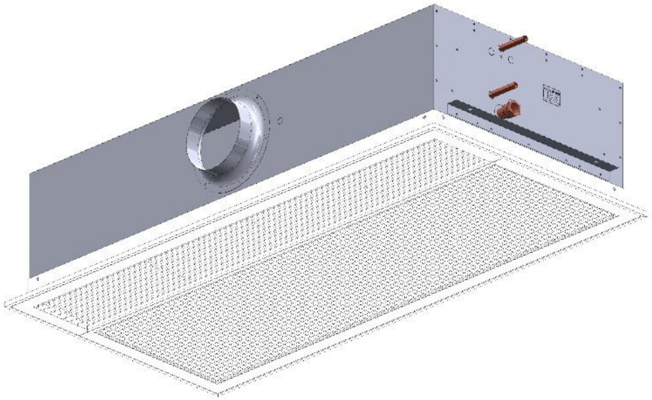
72” X 24”

L-295-W
Rev

INDUCTION BEAMS WITH DRAIN PANS



24” X 48”



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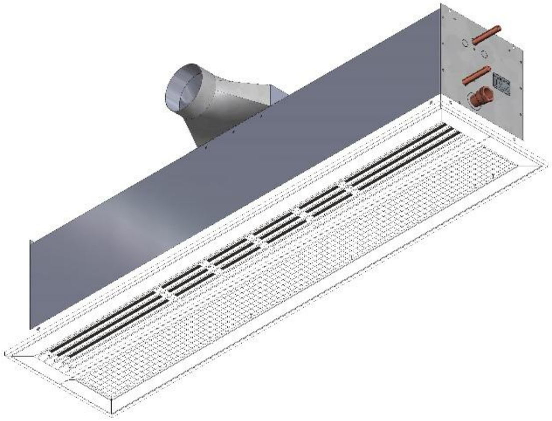
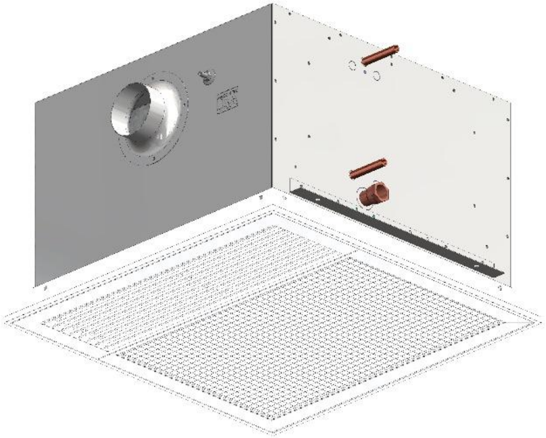
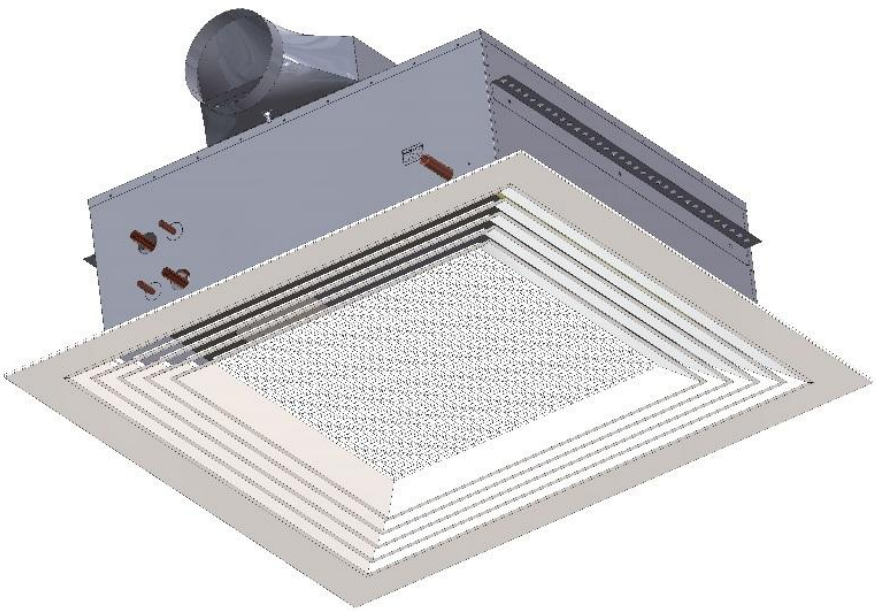


12” X 48”



24” X 24”

INDUCTION BEAMS WITH DRAIN PANS



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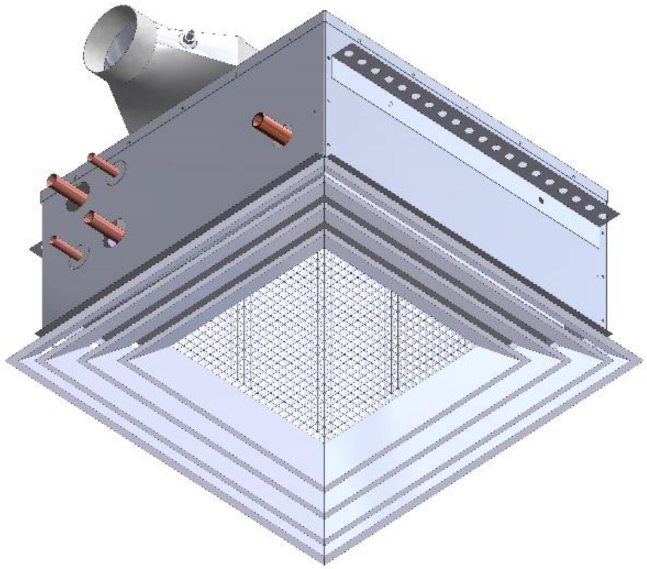


24” X 24”

Soffit / Bulkhead Induction Unit

Chilled Water Coil Rating - Program Version 2.0

Date: 01-14-2013
Customer ID:
CoilModel: W4- 4x42.0-2-8

Coil Construction:

Fin Height: 5"	Rows Deep: 2	
Fin Length: 42"	FPI: 8	
Fin Thickness: .0075"	Fin Material: Aluminum	Fin Type: Sine Wave
Tube Wall: .016"	Tube Material: Copper	Tube O.D.: 1/2"
# Circuits: 1	Connection Size: 0.5"	Face Area: 1.46 ft²

1,531 BTUH

Rating Conditions:

1.5 GPM

Entering DB: 75° f	Entering WB: 64° f	
CFM: 120	Altitude: 0 ft	SCFM: 119
Fluid Temp In: 58° f	GPM: 1.5	
Fluid: Water	% Glycol:	

Performance:

Total btuh: 1,531	Sensible btuh: 1,531	
Leaving DB: 63.2° f	Leaving WB: .° f	
Face Velocity: 82 fpm	Air Press. Drop: .01"	
Fluid Temp Out: 60.° f	Fluid Velocity: 2.6 fps	Fluid Pressure Drop: 4.2'

*** Rated and Certified In Accordance With The Current Edition Of ARI Std. 410 ***

Chilled Water Coil Rating - Program Version 2.0

At 42°@ 1.5 GPM
4,965 BTUH vs 1,531 BTUH
324% more capacity (same coil)

Date: 01-14-2013
Customer ID:
CoilModel: W4- 4x42.0-2-8

Coil Construction:

Fin Height: 5"	Rows Deep: 2	
Fin Length: 42"	FPI: 8	
Fin Thickness: .0075"	Fin Material: Aluminum	Fin Type: Sine Wave
Tube Wall: .016"	Tube Material: Copper	Tube O.D.: 1/2"
# Circuits: 1	Connection Size: 0.5"	Face Area: 1.46 ft²

Rating Conditions:

1.5 GPM

Entering DB: 75° f	Entering WB: 64° f	
CFM: 120	Altitude: 0 ft	SCFM: 119
Fluid Temp In: 42° f	GPM: 1.5	
Fluid: Water	% Glycol:	

6.6F Delta T

Performance:

4,965 BTUH

Total btuh: 4,965	Sensible btuh: 3,030	
Leaving DB: 51.7° f	Leaving WB: 49.7° f	
Face Velocity: 82 fpm	Air Press. Drop: .01"	
Fluid Temp Out: 48.6° f	Fluid Velocity: 2.6 fps	Fluid Pressure Drop: 4.4'

*** Rated and Certified In Accordance With The Current Edition Of ARI Std. 410 ***

Chilled Water Coil Rating - Program Version 2.0

Date: 01-14-2013
Customer ID:
CoilModel: W4- 4x42.0-2-8

At .5 GPM or 1/3 the total flow we still Produce 3,490 BTUH vs 1,531 BTUH or 228% Greater Capacity

Coil Construction:

Fin Height: 5"	Rows Deep: 2	
Fin Length: 42"	FPI: 8	
Fin Thickness: .0075"	Fin Material: Aluminum	Fin Type: Sine Wave
Tube Wall: .016"	Tube Material: Copper	Tube O.D.: 1/2"
# Circuits: 1	Connection Size: 0.5"	Face Area: 1.46 ft²

Rating Conditions:

.5 GPM

Entering DB: 75° f	Entering WB: 64° f	
CFM: 120	Altitude: 0 ft	SCFM: 119
Fluid Temp In: 42° f	GPM: .5	
Fluid: Water	% Glycol:	

3,490 BTUH

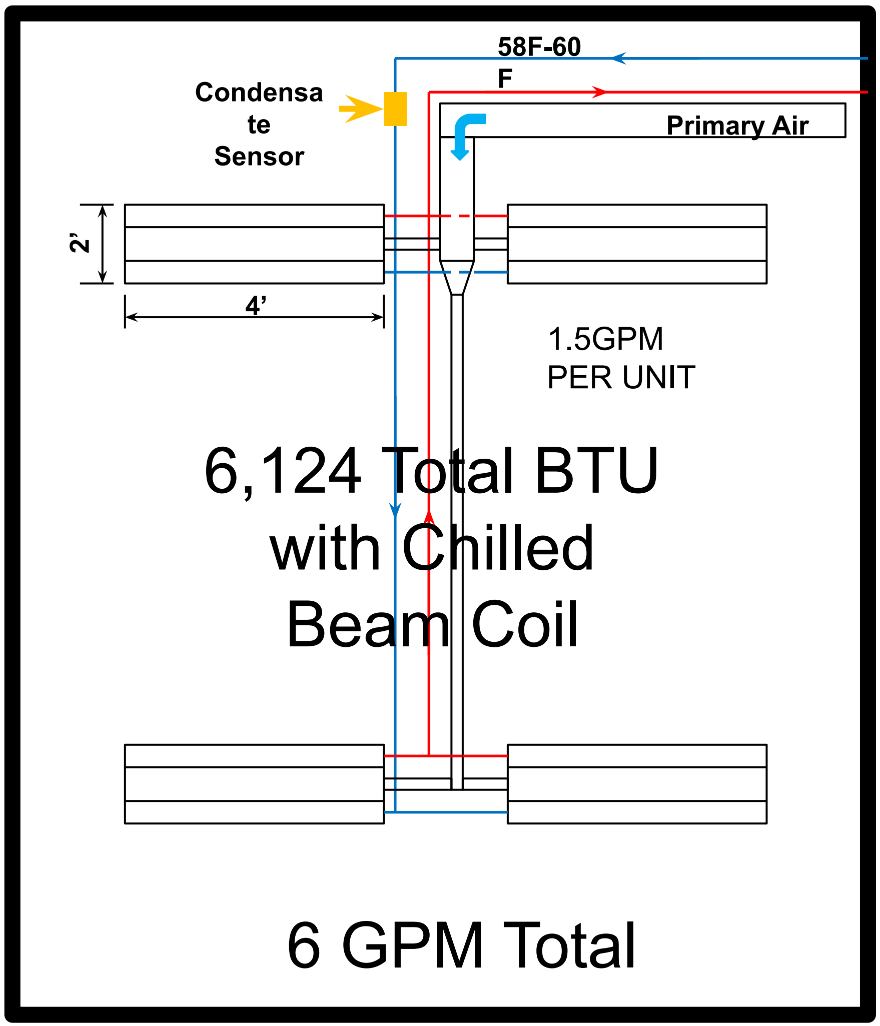
13.9 DEGREE DELTA T

Performance:

Total btuh: 3,490	Sensible btuh: 2,365	
Leaving DB: 56.8° f	Leaving WB: 54.4° f	
Face Velocity: 82 fpm	Air Press. Drop: .01"	
Fluid Temp Out: 55.9° f	Fluid Velocity: .9 fps	Fluid Pressure Drop: .5'

Applications

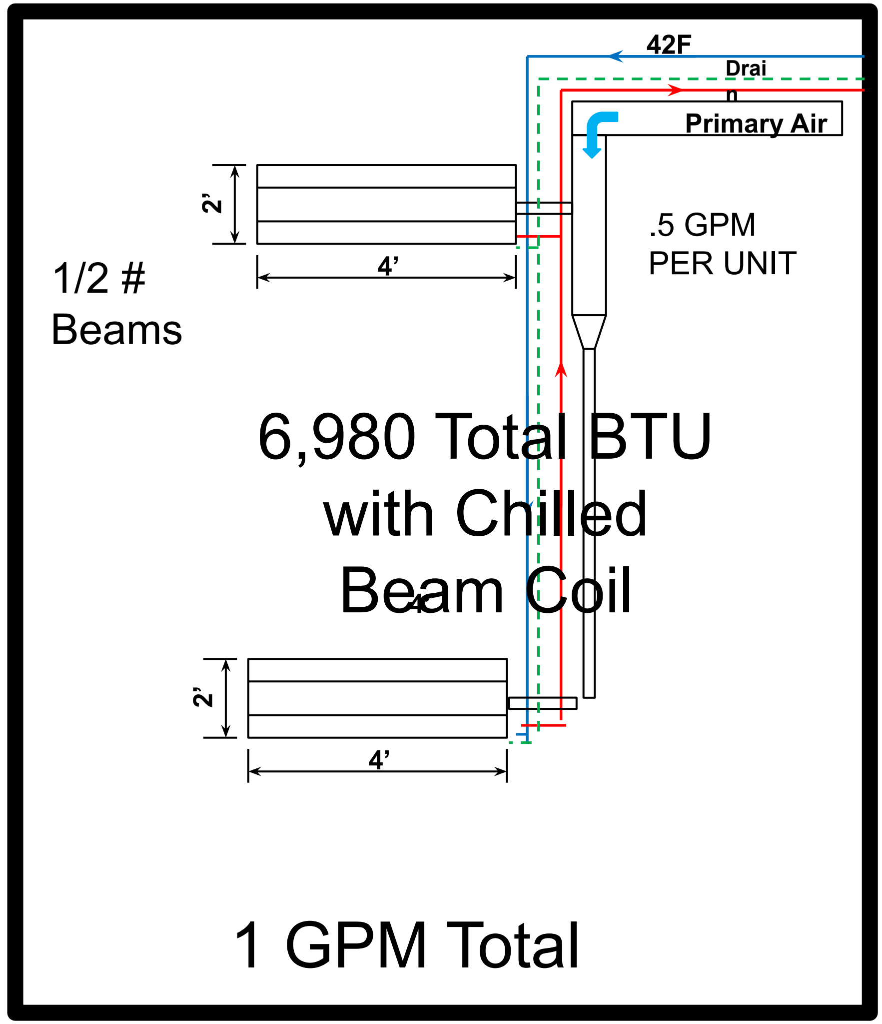
Zone Layout – Chilled Beam



Example: Typical Open Office Floor Plan

Applications

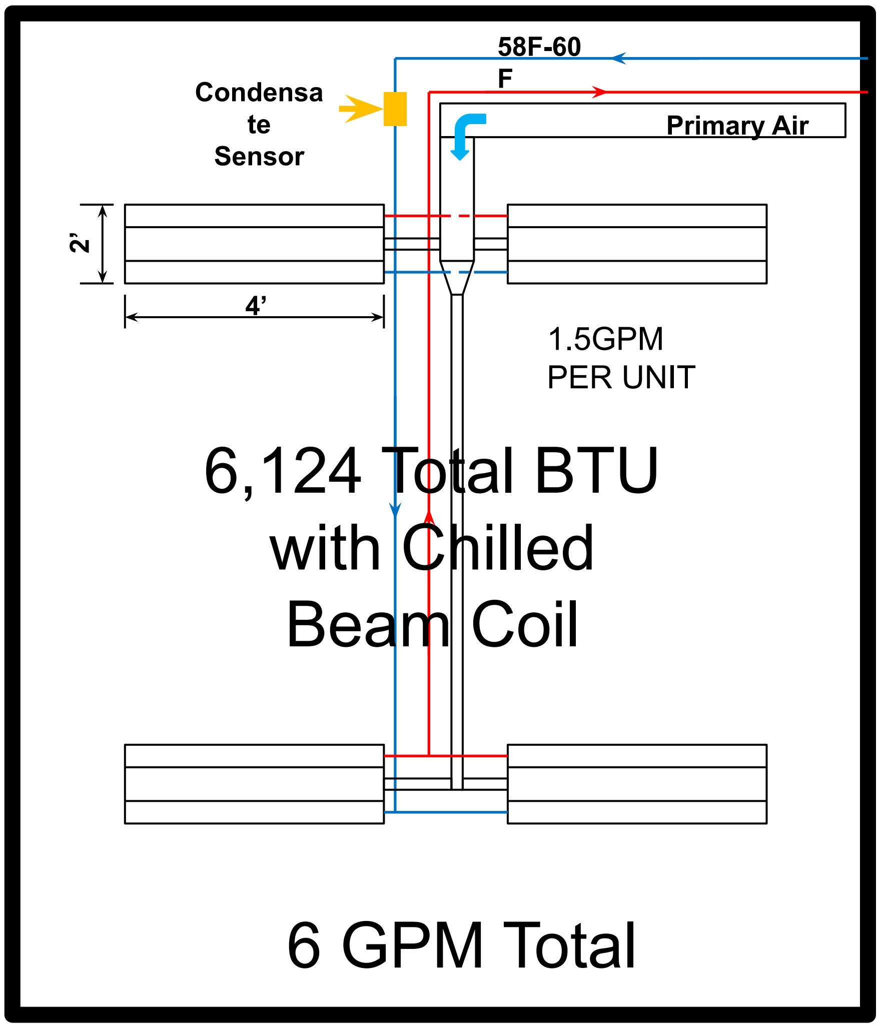
Zone Layout – Induction Beam



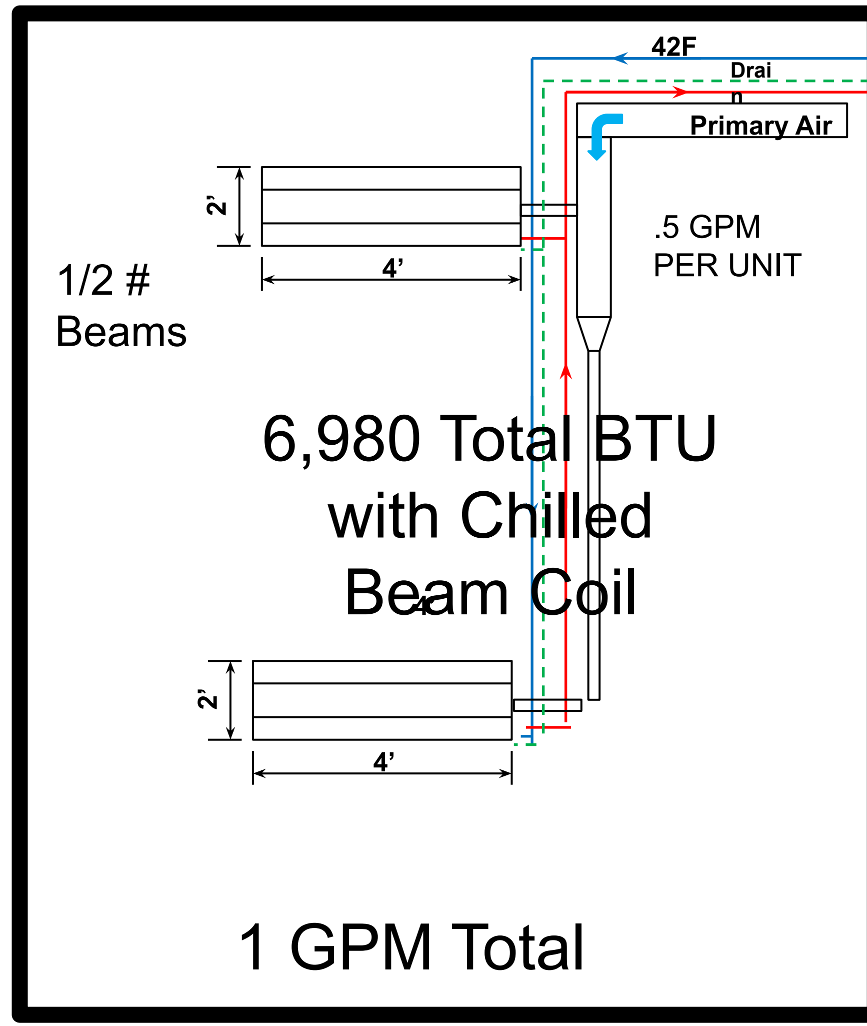
Example: Typical Open Office Floor Plan

Applications

Zone Layout – Chilled Beam



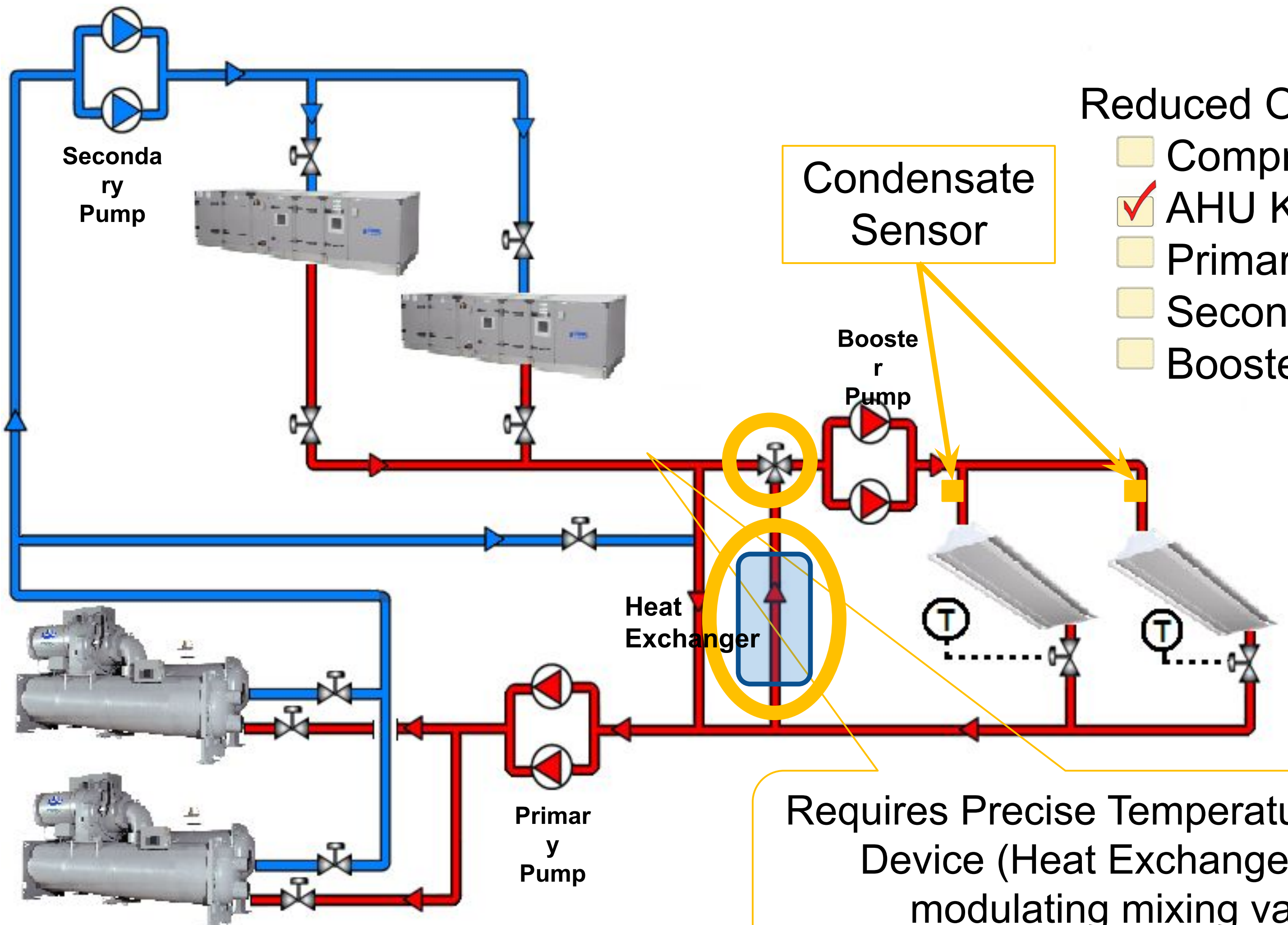
Zone Layout – Induction Beam



Example: Typical Open Office Floor Plan

System Design

Primary – Secondary Loop System With Traditional Chilled Beams



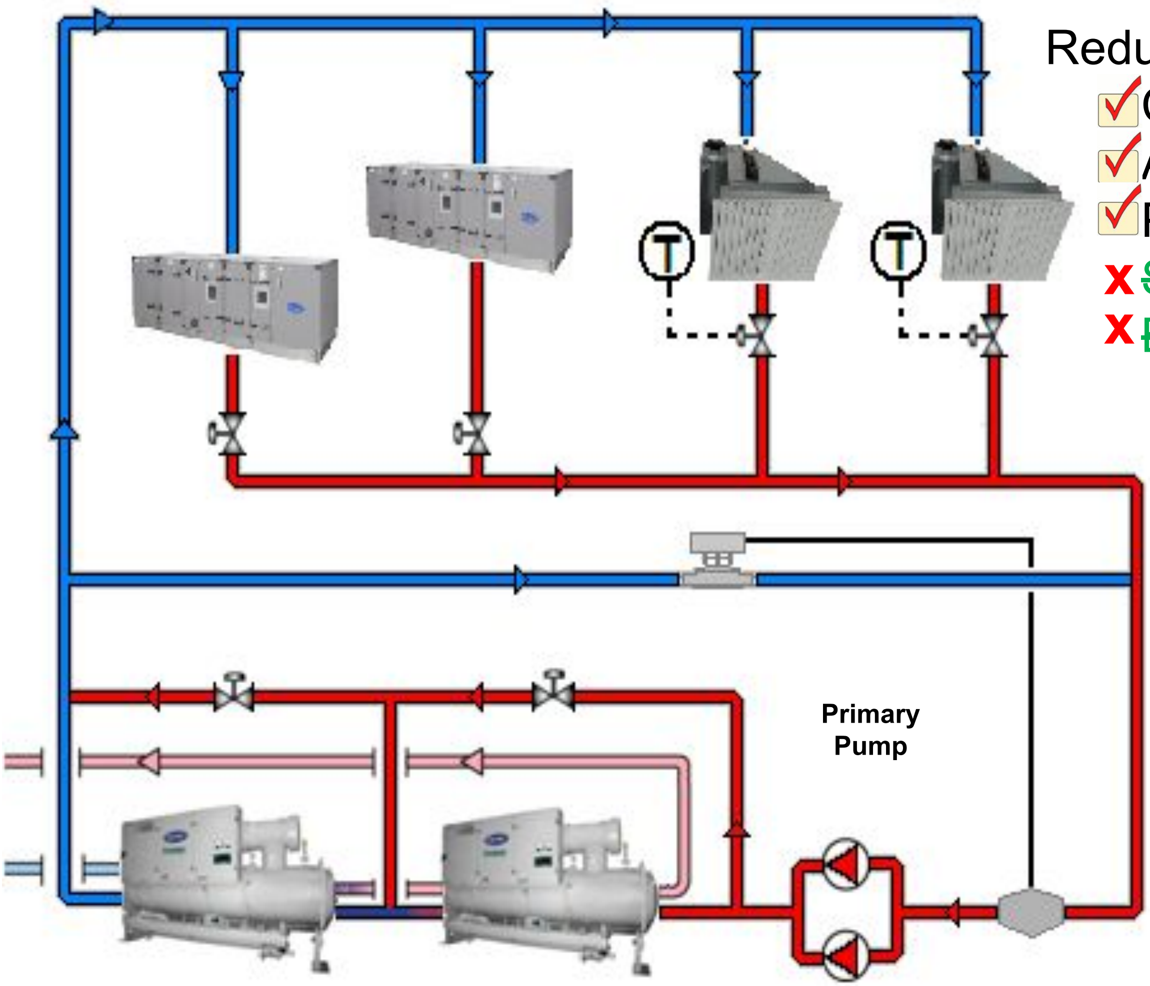
Reduced Or Eliminated Load
- ☐ Compressor KW
- ☑ AHU KW (Reduced)
- ☐ Primary Pump KW
- ☐ Secondary Pump KW
- ☐ Booster Pump KW

Requires Precise Temperature control Device (Heat Exchanger) and modulating mixing valve

Most building are designed for 75db/62wb/50%RH or 75db/61wb/45%RH

System Design

Primary Variable Loop System With Induction Beams



Reduced Or Eliminated Load

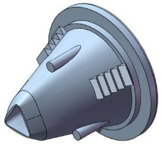
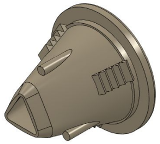
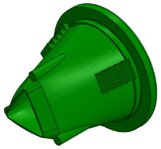
- ✓ Compressor KW (Reduced)
- ✓ AHU KW (Reduced)
- ✓ Primary Pump KW (Reduced)
- x ~~Secondary Pump KW~~
- x ~~Booster Pump KW~~

Most building are designed for 75db/64wb/55%RH or 75db/62wb/50%RH

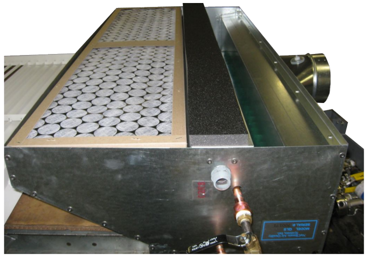
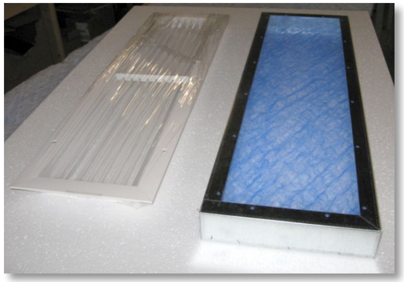
Applications

- Educational
- Office
- University
- Health Care
- Laboratories
- Government
- Nursing Homes
- Public Library
- Police Stations
- Fire Stations
- Court House

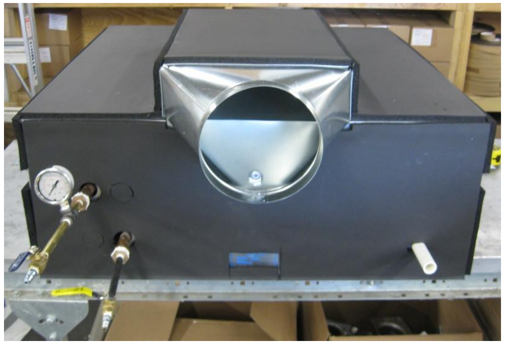
PRODUCT FEATURES

Nozzle Options 24  31  38 

Filter Options
- Throwaway
- Washable
- Special


Other Special Features like
- Varity Of Grille Style & Finish
- Exterior Insulation
- SS Drain Pan
- Copper Connection Drain Pan




SENSIBLE ONLY CHILLED BEAM SYSTEMS (no drain pans)

When does it make sense?

- When energy efficiency is a driving factor, not first cost.
- When a dedicated chiller can produce 58°water or higher.
- When cooling requirements are low enough that minimum ventilation from the outside air can meet the sensible and latent space loads.
- When infiltration and other latent space loads can easily be controlled by the Air Handler.
- When ceiling space is very limited and running condensate lines is not possible.
- When facility staff is capable of handling more complex DOAS unit and controls.

SUMMARY

INDUCTION BEAM SYSTEMS WITH DRAIN PANS
1940's to present day

- Proven sustainability & flexibility of Induction Technology.
- 50 + Year Hydronic Systems. Carrier 36S IU's (1940-Present)
- Lower first cost / greater capacity / less equipment & controls
- Central plants producing 45°water
- Single cold water loop, as few as ½ the # of terminal units.
- Often cooling requirements are greater than the capacity of sensible only Chilled beams at "minimum ventilation".
- Design days or above: Hybrid IB system can have up to a 250% increase in cooling capacity. Capacity "at the ready".
- Densely populated spaces with high latent loads: Schools, labs, dorms, universities & hospitals.
- Standard 100% O.A. AHU's with simple controls vs Custom DOAS

Q & A

Thank You