System Components with Emphasis on Packaged Rooftop Application and Installation

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President
Jacco & Assoc.

Agenda

Define and relate in practical terms the following components:

- System Effect & Fans
- Cooling & Heating Options
- Temperature Control Options
- Filtration Options
- Cabinet Options
- Psychrometrics of Motor Heat
- Best Installation Practices

Agenda

- Variable Air Volume
- Single Zone Variable Air Volume
- Low Dewpoint DX Systems
- High Efficiency with TurboCor Compressors
- Aaon Capabilities

Question for You

- Is a DX Package Rooftop as Efficient as a Chilled Water system?

Questions for You

- What Constant are all Systems Designed Around?
  - Height & Width
  - Length

Fans or Compressors? (CV)

5%	of the unit's operation requires one hundred-percent mechanical cooling capacity,
20%	of the unit's operation is in heating mode,
30%	of the unit's operation is in an "unoccupied" mode that requires ten-percent mechanical cooling capacity
45%	of the time the machine is at a part load requiring an average fifty-percent mechanical cooling capacity.
100%	

Fan and Compressor Power Consumption

Peak Cooling Mode	Btu/hr	Watt	Horsepower
Compressor Input Power	69,130	20,260	27.2
Backward Curved Plenum Fan Power	23,465	6,876	9.2
Heating Mode	**Btu/hr**	**Watt**	**Horsepower**
Compressor Input Power	0	0	0
Backward Curved Plenum Fan Power	23,465	6,876	9.2
Unoccupied Mode	**Btu/hr**	**Watt**	**Horsepower**
Compressor Input Power	6,913	2,026	2.7
Backward Curved Plenum Fan Power	23,465	6,876	9.2
Part Load	**Btu/hr**	**Watt**	**Horsepower**
Compressor Input Power	34,565	10,130	13.6
Backward Curved Plenum Fan Power	23,465	6,876	9.2

Weighted Average Operating Fan and Compressor Power Consumption

Part Load	Btu/hr	Watt	Horsepower
Compressor Input Power	**21,085**	6,179	8.3
Backward Curved Plenum Fan Power	**23,465**	6,876	9.2

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Fan System Effect

- Fan *System Effects* occur because of the difference in inlet and outlet conditions under laboratory test conditions and the inlet and outlet conditions as the fan is installed in the system.

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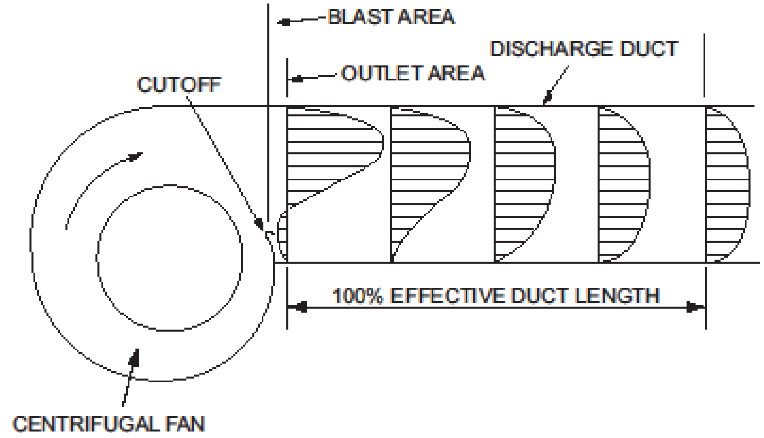
Fan System Effect

- System Effect is Velocity Dependent
  - Total Pressure = Static Pressure + Velocity Pressure
  - Static Regain
- You CAN NOT Measure System Effect
- You CAN Calculate System Effect
  - System Effect Factor
  - Loss Coefficient

Centrifugal Fan Outlet Conditions



To calculate 100% duct length, assume a minimum of 2½ duct diameters for 2500 fpm or less. Add 1 duct diameter for each additional 1000 fpm.

EXAMPLE: 5000 fpm = 5 equivalent duct diameters. If the duct is rectangular with side dimensions *a* and *b*, the equivalent duct diameter is equal to $(4ab/\pi)^{0.5}$.

	No Duct	12% Effective Duct	25% Effective Duct	50% Effective Duct	100% Effective Duct
Pressure Recovery	0%	50%	80%	90%	100%
Blast Area / *Outlet Area*	System Effect Curve				
0.4	P	R-S	U	W	—
0.5	P	R-S	U	W	—
0.6	R-S	S-T	U-V	W-X	—
0.7	S	U	W-X	—	—
0.8	T-U	V-W	X	—	—
0.9	V-W	W-X	—	—	—
1.0	—	—	—	—	—

Determine *SEF* by using Figure 7.1

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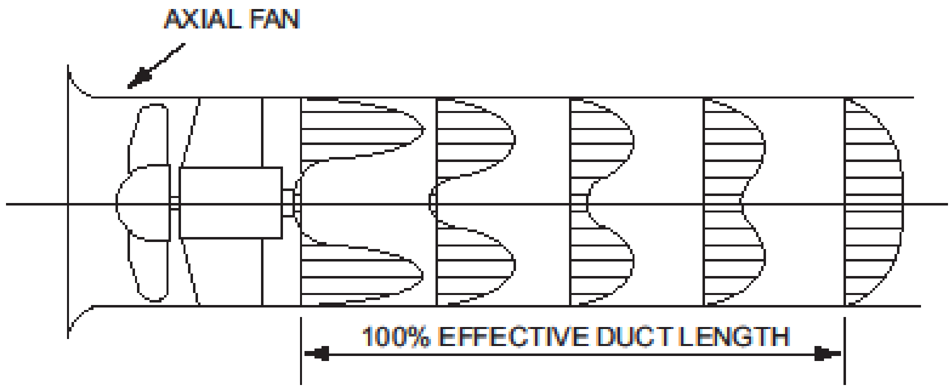
SWSI Fans

- Exhaust Fans
- Regeneration Fans
- System Effect Applies

DWDI Fans

- Supply & Return Fans
- <u>System Effect Applies</u>

Axial Fan Outlet Conditions



To calculate 100% duct length, assume a minimum of 2½ duct diameters for 12.7 m/s (2500 fpm) or less. Add 1 duct diameter for each additional 5.08 m/s (1000 fpm).

EXAMPLE: 25.4 m/s (5000 fpm) = 5 equivalent duct diameters

	No Duct	12% Effective Duct	25% Effective Duct	50 % Effective Duct	100% Effective Duct
Tubeaxial Fan	---	---	---	---	---
Vaneaxial Fan	U	V	W	---	---

Determine *SEF* by using Figure 7.1

Figure 8.2 - System Effect Curves for Outlet Ducts - Axial Fans

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Vane Axial Fans

- High Static
- High Volume
- Very High Efficiency
- Supply & Return Fans
- System Effect Applies

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Outlet Requirements per AMCA

- If the outlet velocity is less than 2,500 fpm: 100 percent-effective duct length = 2.5 x Duct diameter
- If the outlet velocity is more than 2,500 fpm: 100 percent-effective duct length = fpm/1000 x Duct diameter

Unducted Discharge Losses

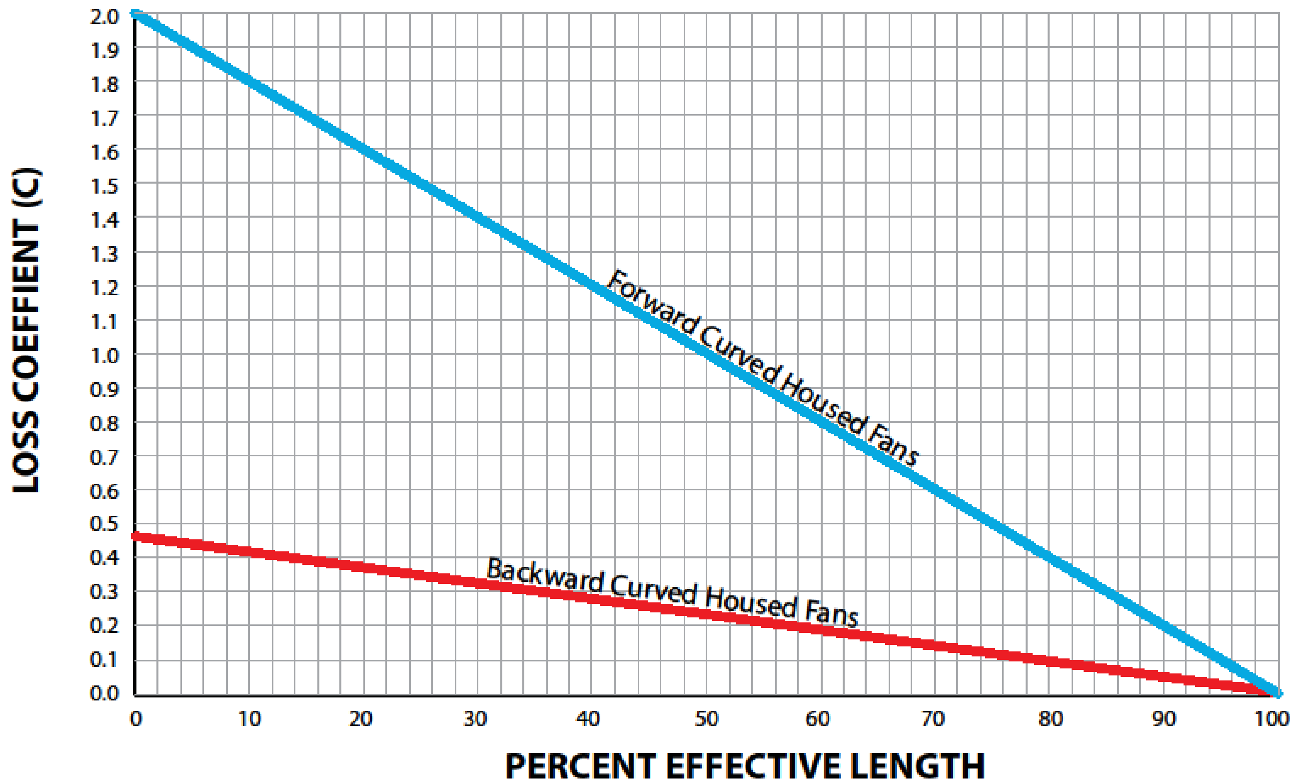

Fig. 32: House Fan Unducted Discharge Losses

Centrifugal Fan Inlet Conditions

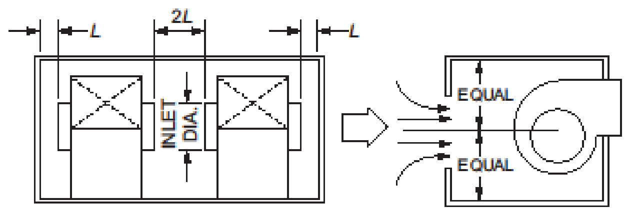

Figure 9.11A - Fans and Plenum

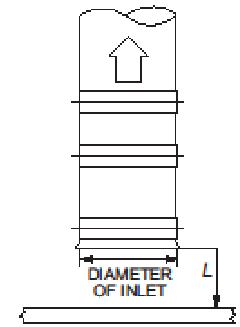

Figure 9.11B - Axial Fan Near Wall

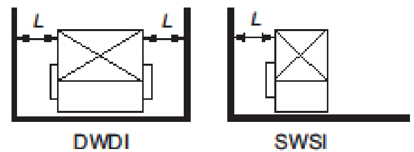

Figure 9.11C - Centrifugal Fan Near Wall(s)

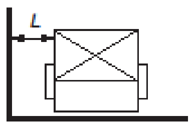

Figure 9.11D - DWDI Fan Near Wall on One Side

L - DISTANCE INLET TO WALL	For Figures 9.11A, B & C SYSTEM EFFECT CURVES	For Figures 9.11D SYSTEM EFFECT CURVES
0.75 x DIA. OF INLET	V-W	X
0.50 x DIA. OF INLET	U	V-W
0.40 x DIA. OF INLET	T	V-W
0.30 x DIA. OF INLET	S	U

Determine SEF by calculating inlet velocity and using Figure 7.1

Inlet Conditions

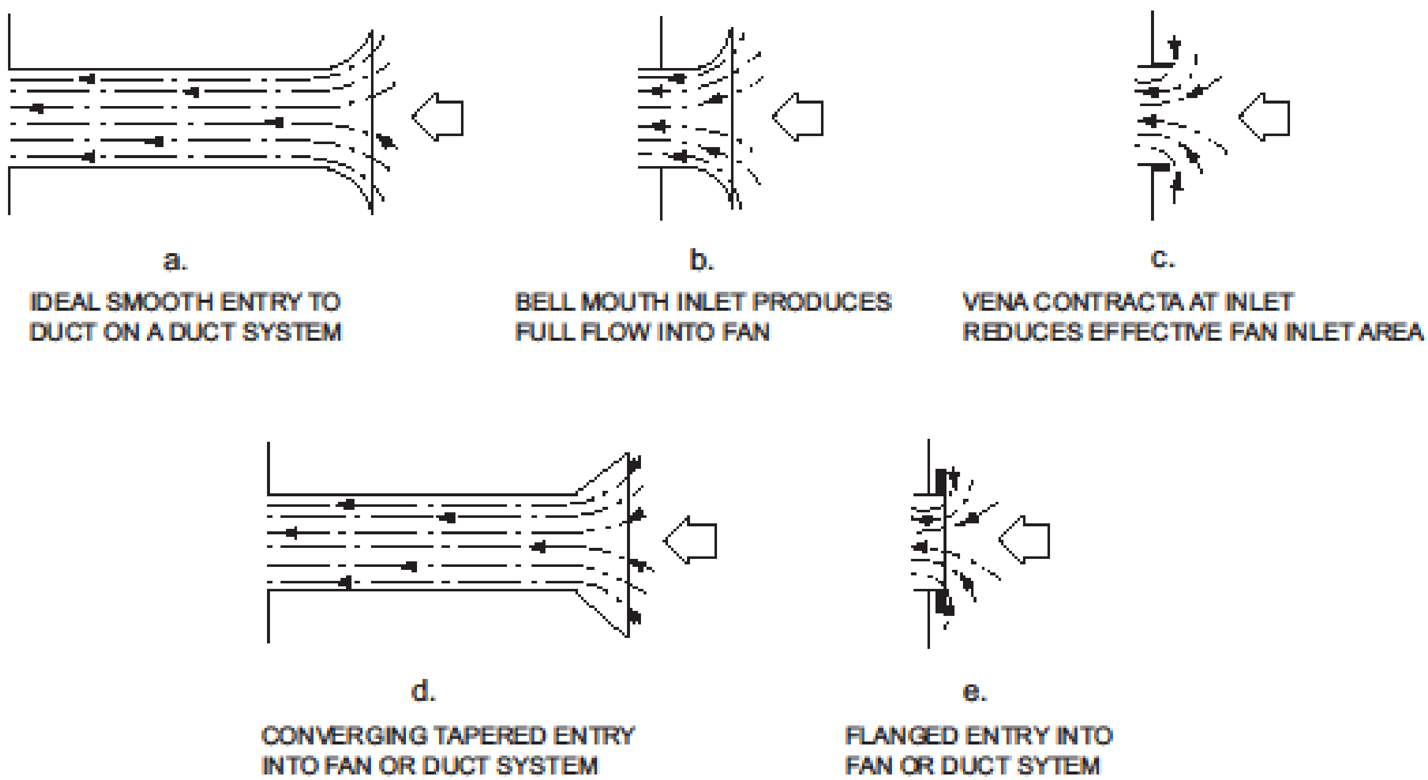

Figure 9.1 Typical Inlet Connections for Centrifugal and Axial Fans

Inlet Requirements per AMCA

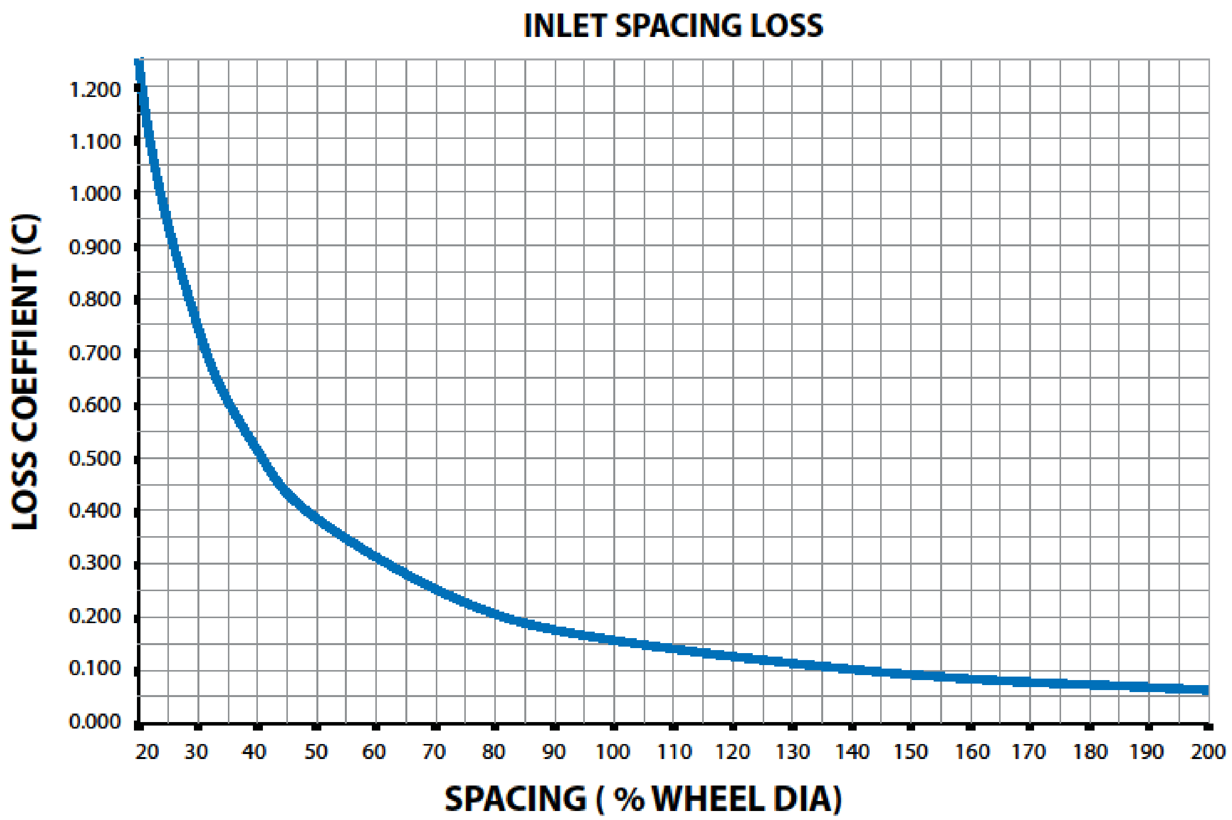

Fig. 27: Inlet Spacing Loss Coefficient

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System Effect for Accessories

- Factory Supplied Accessories that have a System Effect.
  - Bearing and supports in fan inlet
  - Drive guards obstructing fan inlet
  - Belt tube in axial fan inlet or outlet
  - Inlet box
  - Inlet box dampers
  - Variable inlet vane (VIV)
  - Discharge dampers

Belts & Sheaves

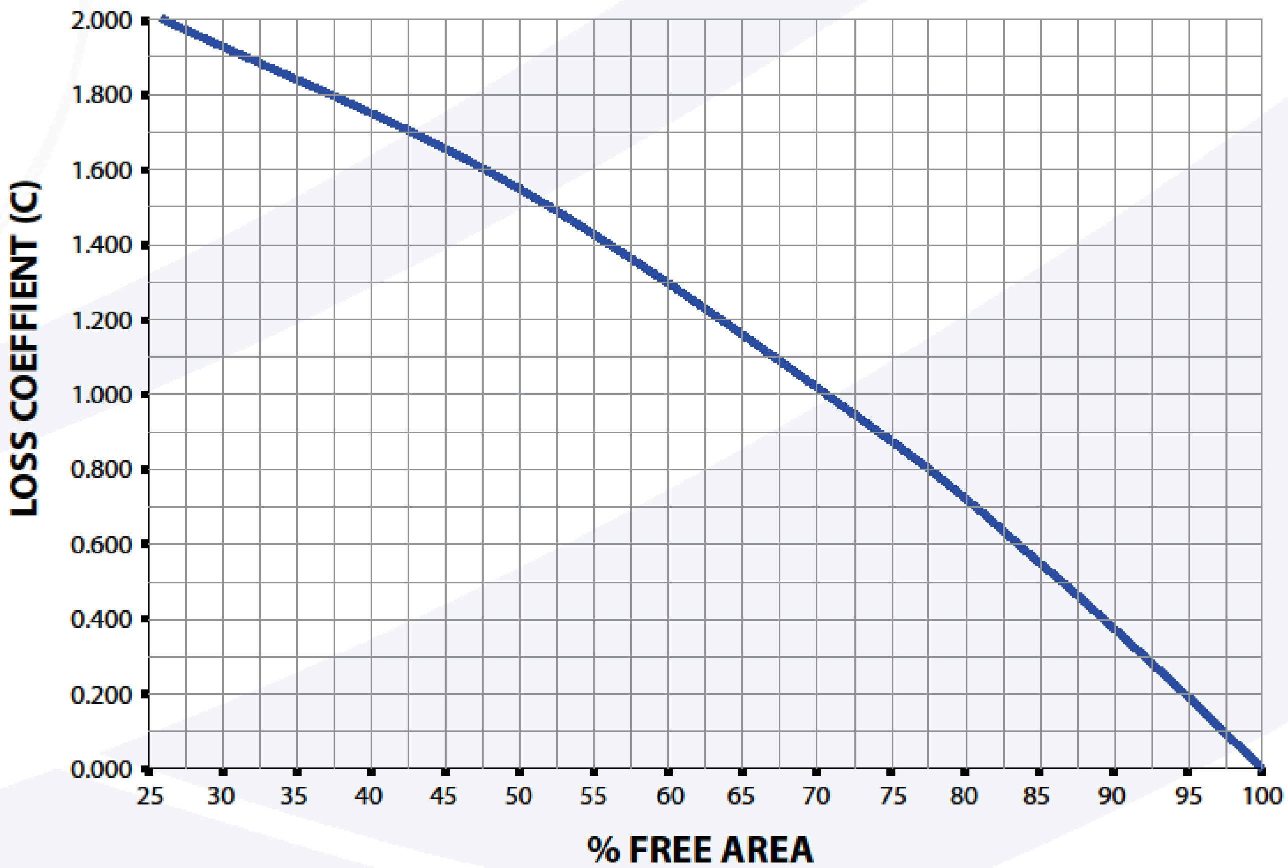

Fig. 29: Inlet Free Area Reduction Loss

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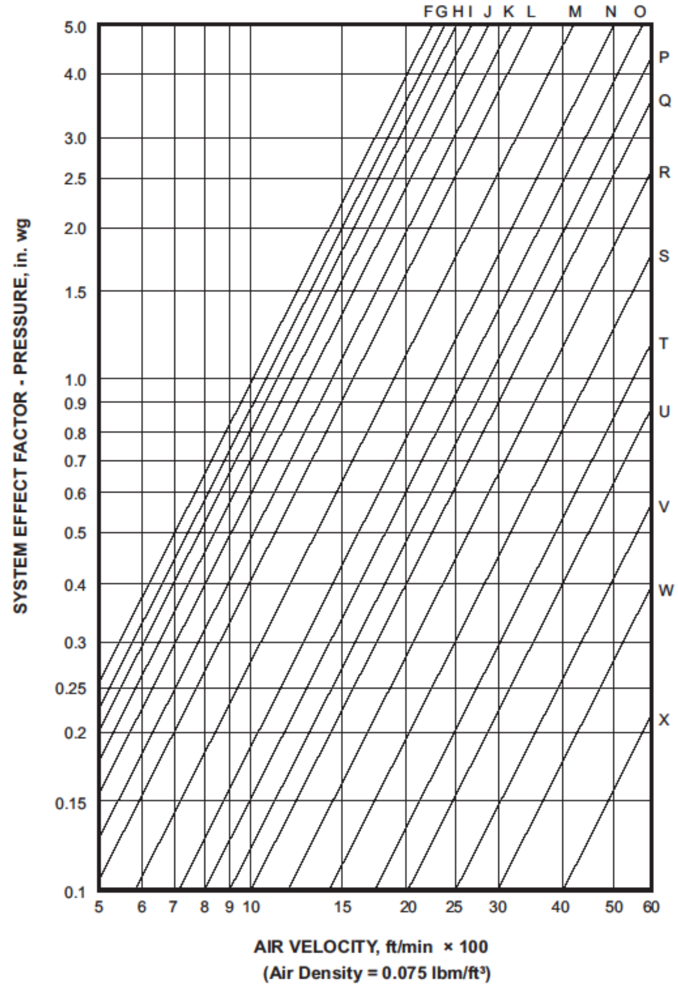
19 Fan System Effect Curves



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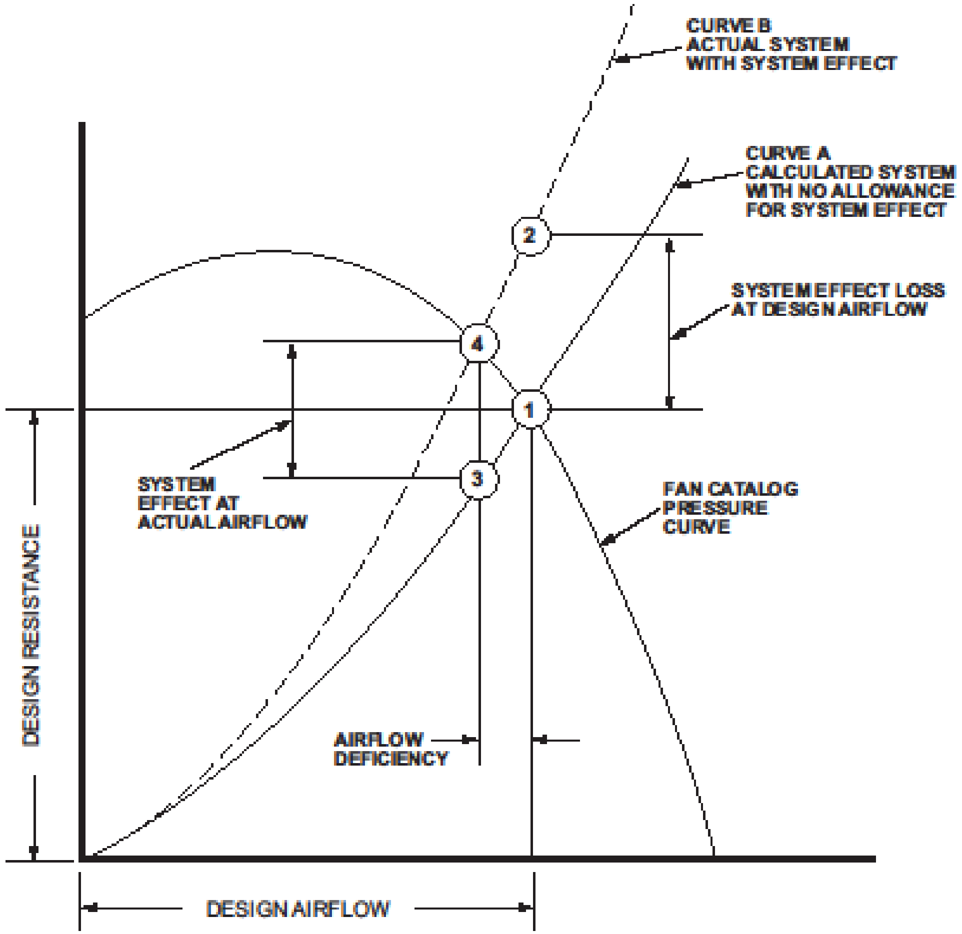
Overcome Fan System Effect



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Plenum Fans

- Typically BI or AF
- Supply, Return & Exhaust Fans
- Previous System Effect <u>Does Not</u> Apply

Plenum Fan Inlet Conditions

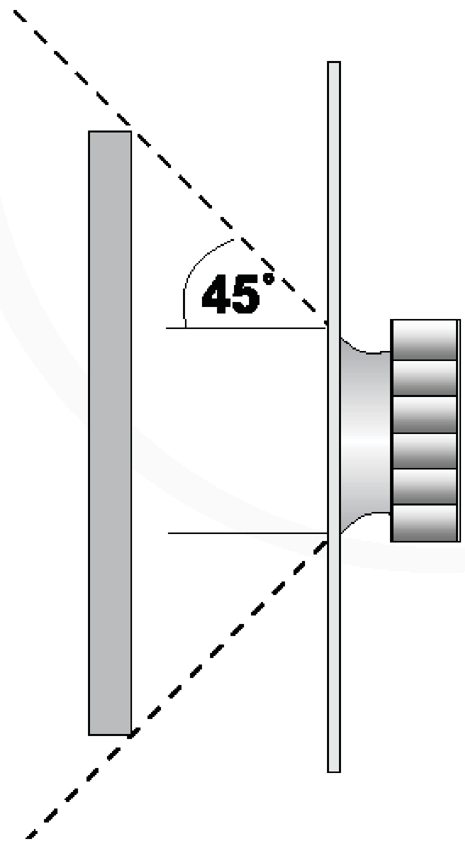

Fig. 28: Airstream Approach Angle

Plenum Fan Outlet Conditions

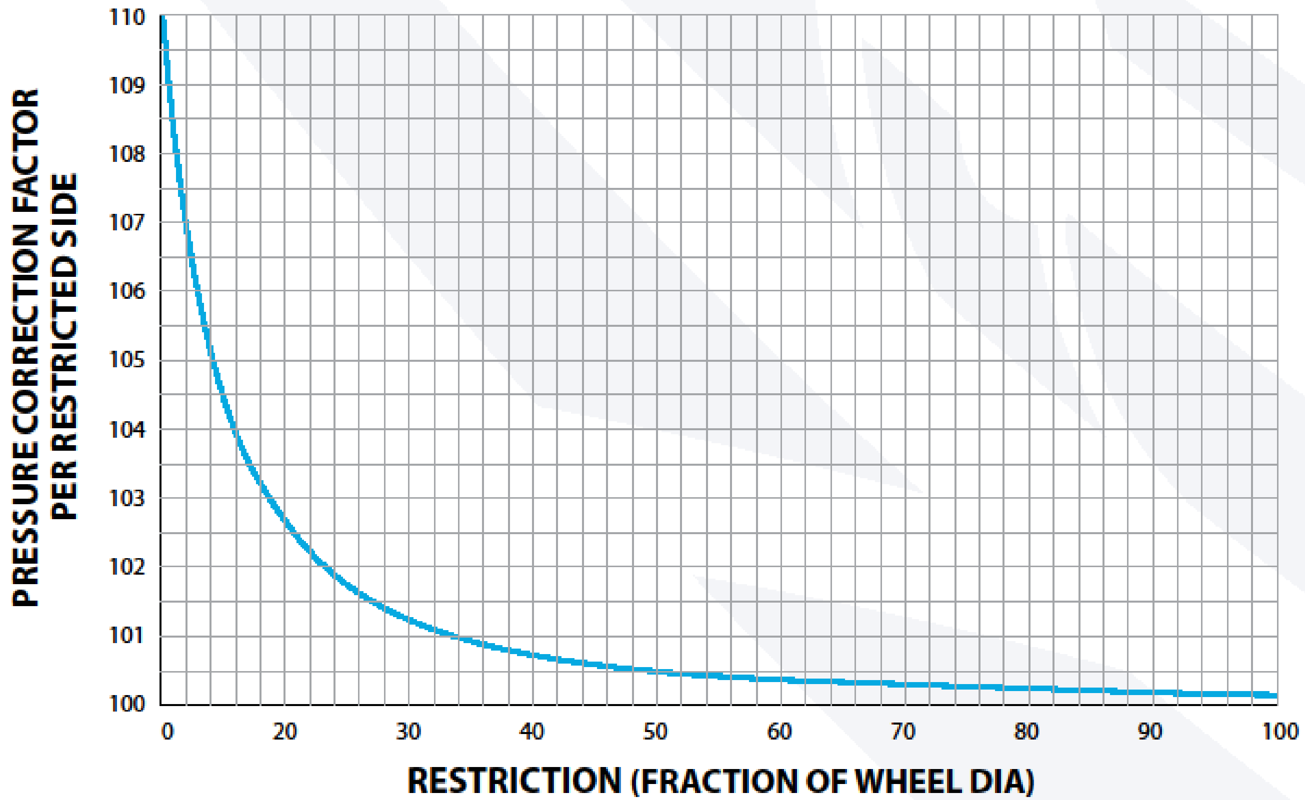

Fig. 35: Plenum Fan cfm Correction for Side Restriction

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Plenum Fans

- Virtually NO System Effect

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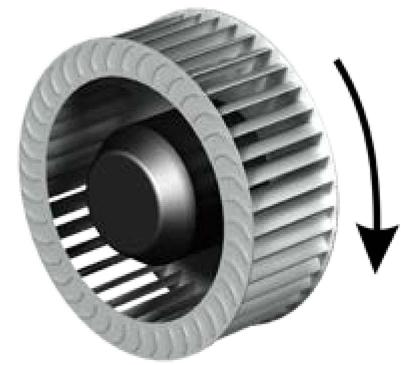
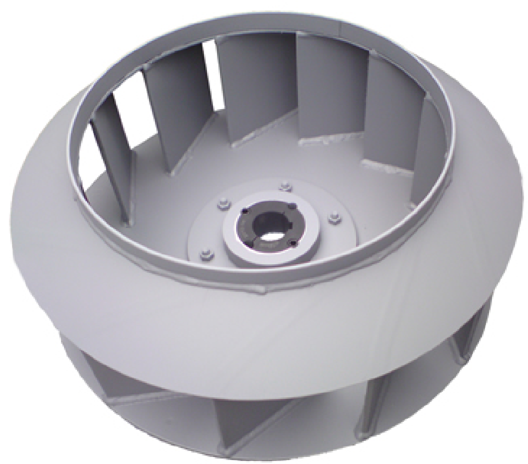
Fans

- FC – Low Static, Low Efficiency
- BI – High Static, High Efficient
- AF – High Static, High Efficient
- Class I, II & III





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Class I, II & III

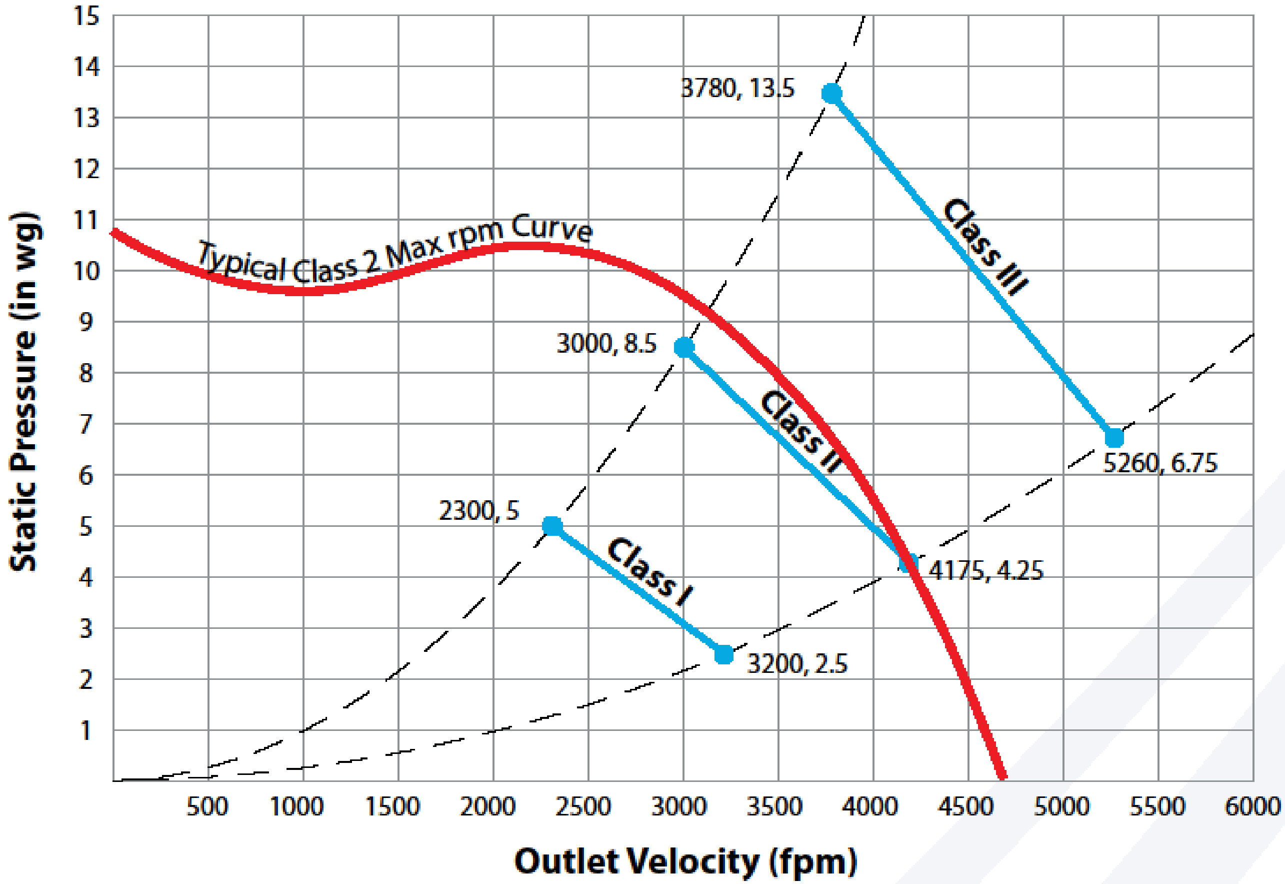

Fig. 17: AMCA Fan Class

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Belt Loss

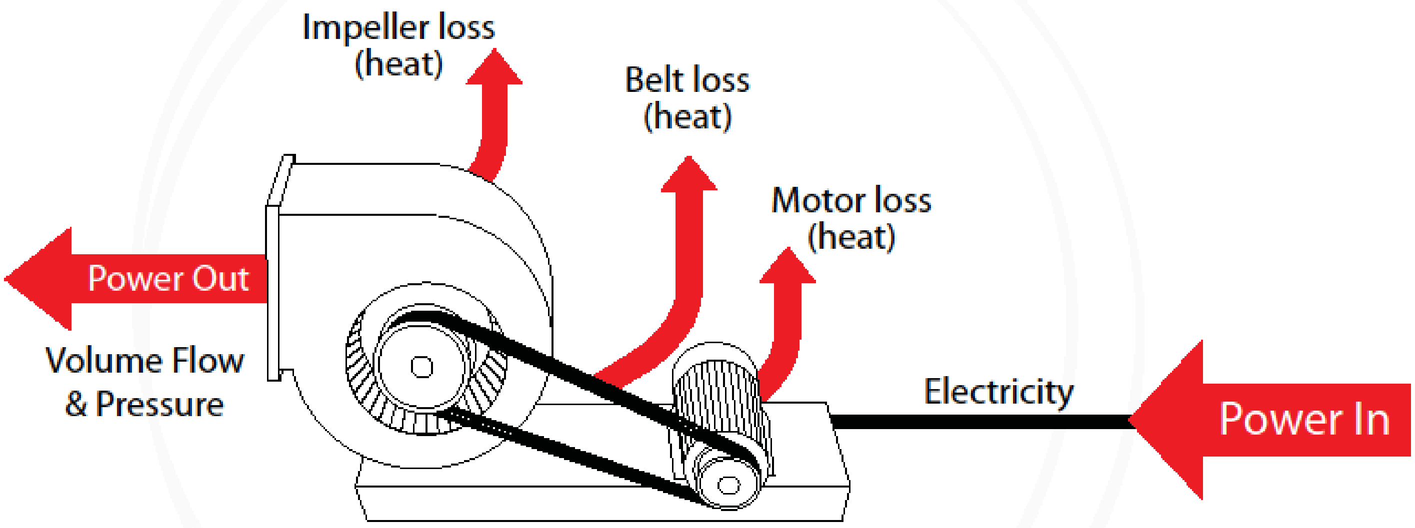

Fig. 36: Belt Driven Fan System

No Belt Loss

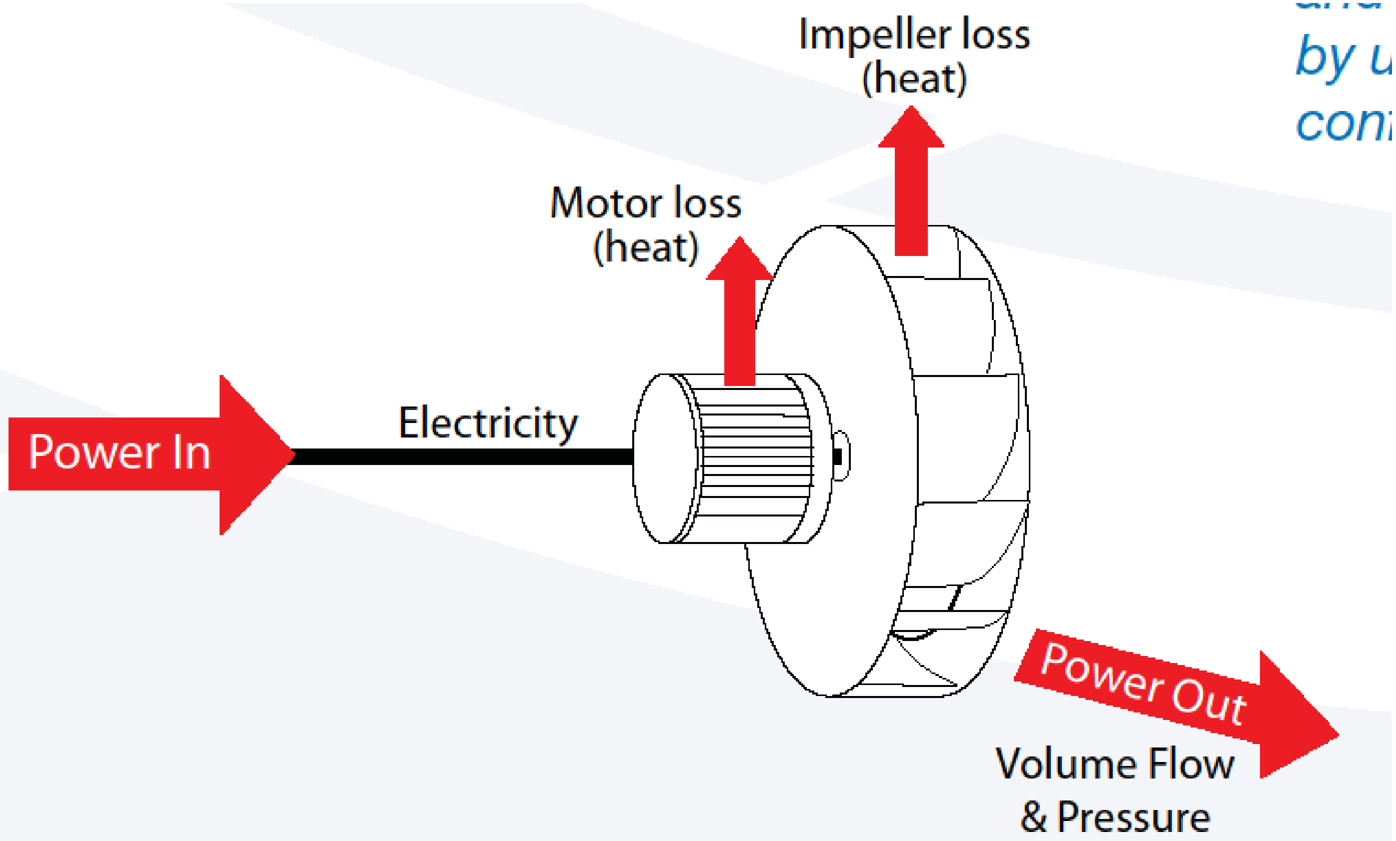

Fig. 37: Direct Drive Fan System

Direct vs. Belt Driven Fans

- New Belts
  - Peak Efficiency 90-95%
- Worn Belts
  - 85-90% Efficient

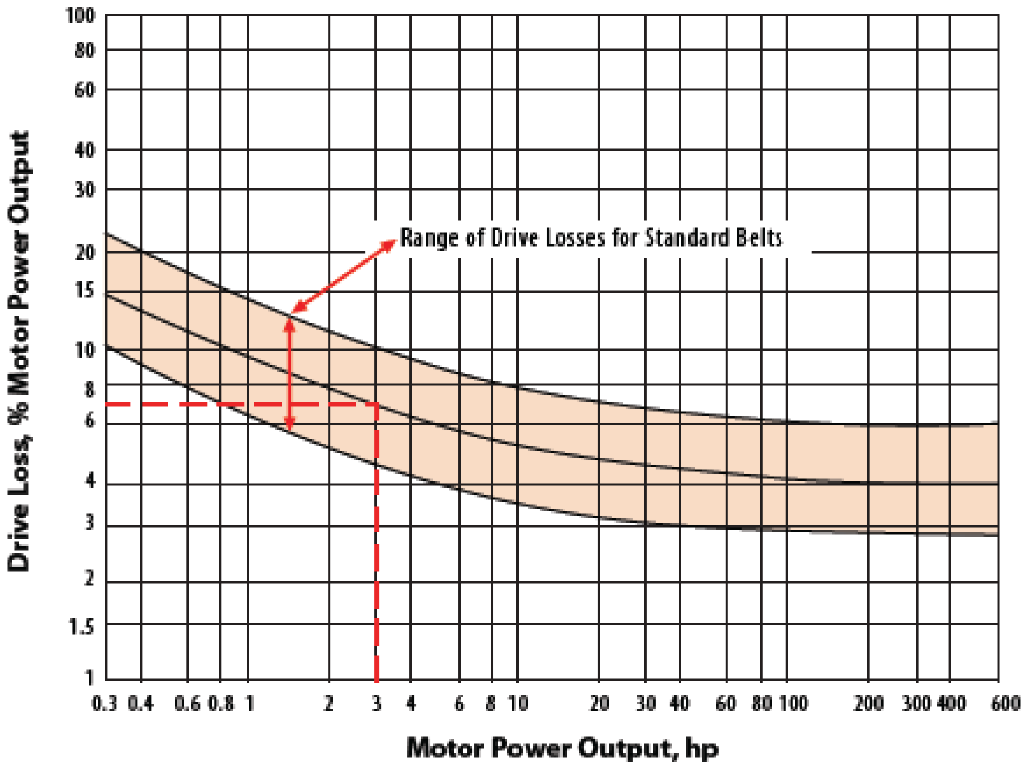

Figure 1: Average Belt Drive Losses vs. Motor Power Output
(AMCA publication 203-90)

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What Fan Would You Choose?

Calculated Application Efficiency

	Motor Efficiency		Belt Efficiency		Fan Efficiency		System Effects		Total System Efficiency
Belt-Driven, Housed, Forward Curved Total Efficiency =	(0.90)	•	(0.87)	•	(0.60)	•	(0.70)	=	**33%**
Belt-Driven, Housed, Backward Curved Total Efficiency =	(0.90)	•	(0.87)	•	(0.75)	•	(0.80)	=	**47%**
Direct Drive, Unhoused Backward Curved, Total Efficiency =	(0.90)	•	(1.00)	•	(0.70)	•	(1.00)	=	**63%**

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Filtration Options

- MERV 7 or 8 Pre-filters
- MERV 13, 14 or 15 Final Filters
  - 4" or 12"
- Hospital Final Filters
- Clogged Filter Switch
- Magnehelic Gauge

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Filter Loading

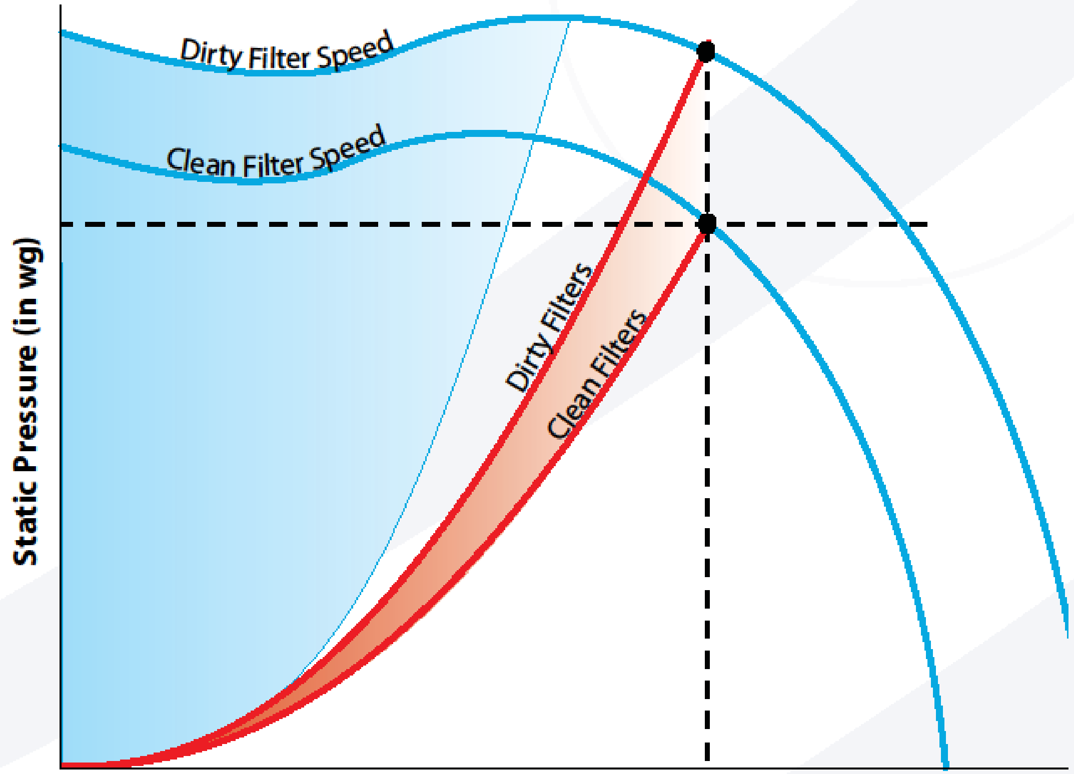
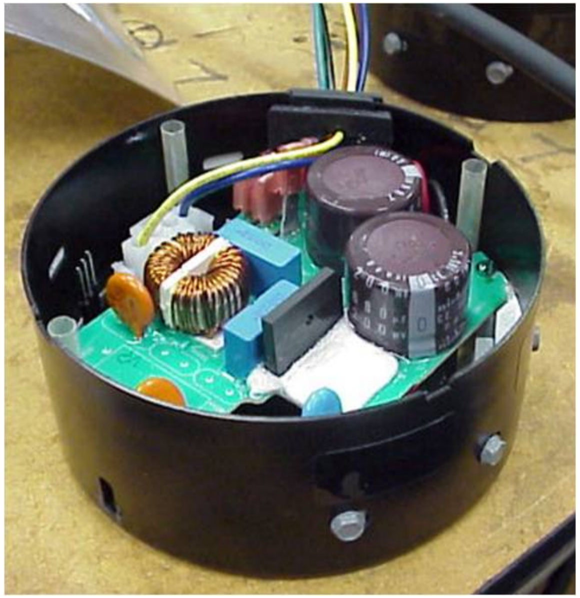
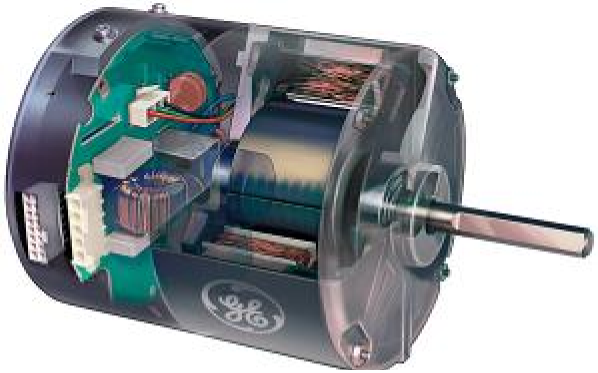


Fig. 23: VAV System with Filter Loading

ECM Motors & VFD’s





ECM Motors & VFD’s

- ECM = AC to DC Speed Control
- VFD = AC to DC to AC Speed Control
- Soft Start
- Balancing Tool
- Energy Savings

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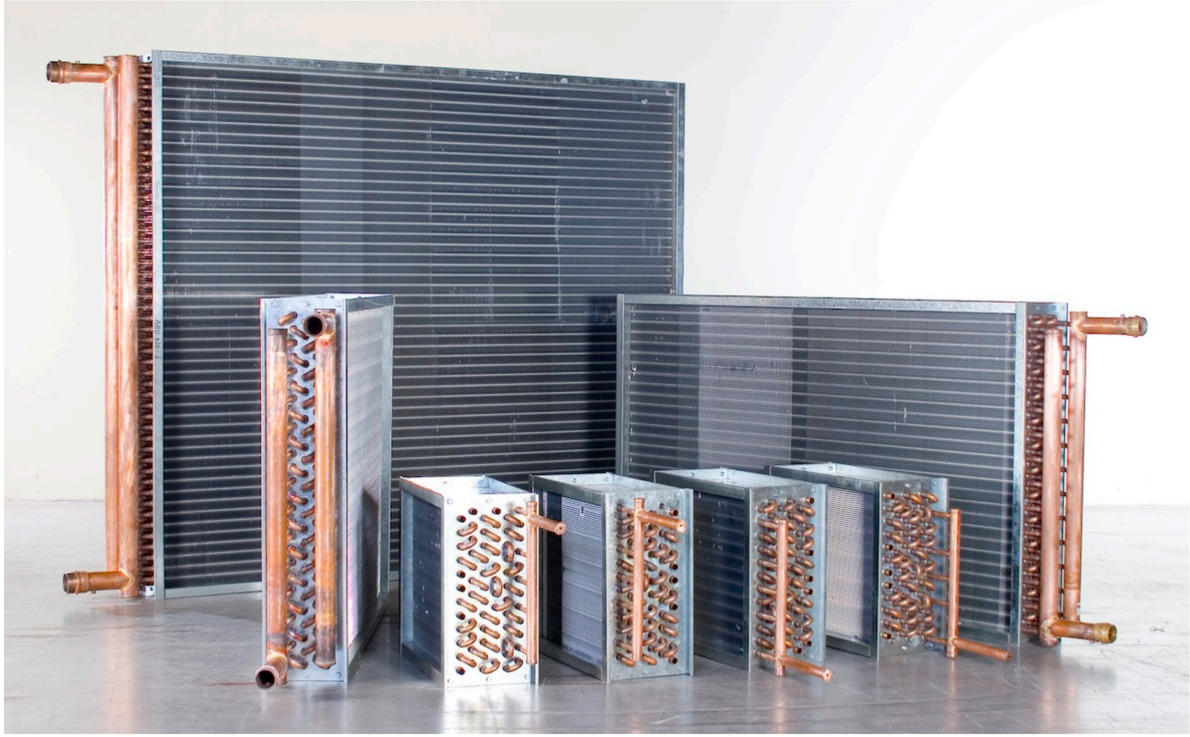
Cooling Options

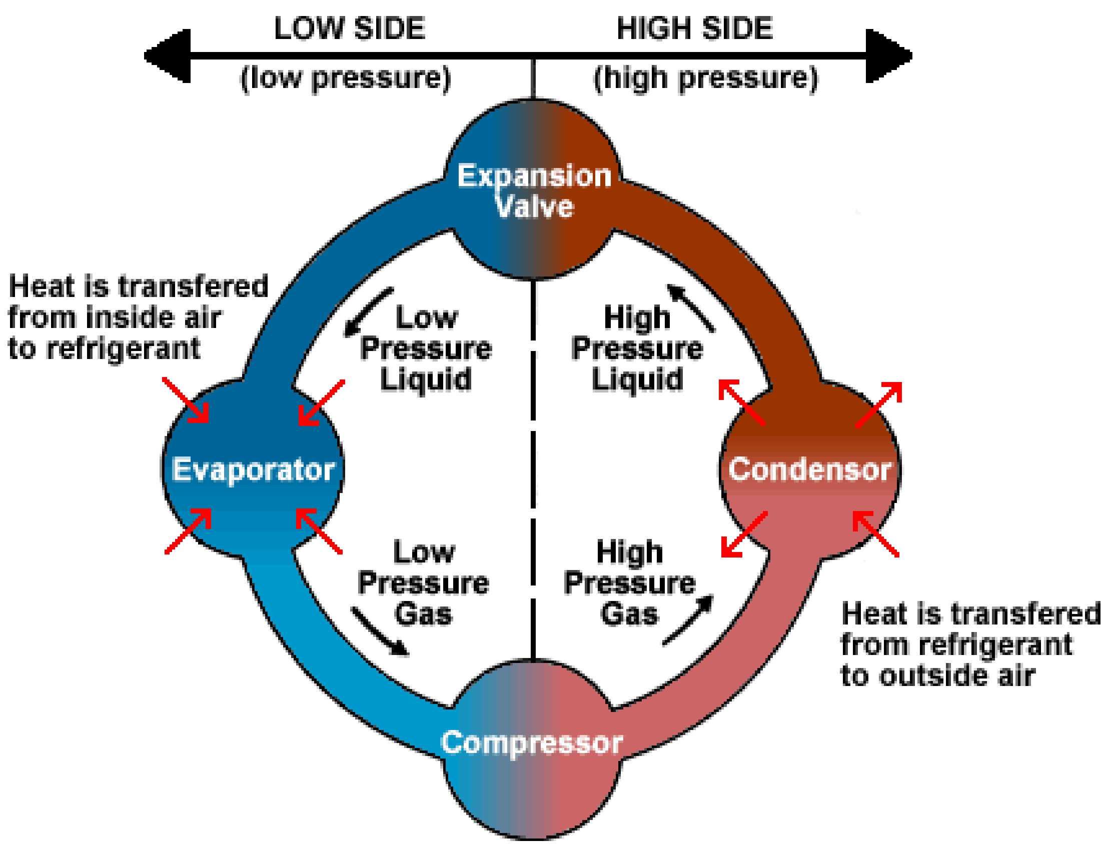
- Chilled Water
- Direct Expansion

Chilled Water Coils

- Multiple Coil Options



Direct Expansion



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Direct Expansion

- Air Source & Water Source
- Multiple Coil Options
- Expansion Devices
  - Thermal Expansion Valve
  - Electronic Expansion Valve

High Capacity DX Coils

- Increased Efficiency
- Increased Dehumidification

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Micro Channel Condenser Coils

- Reduced Refrigerant Amounts By 40%
- Think Car Radiator

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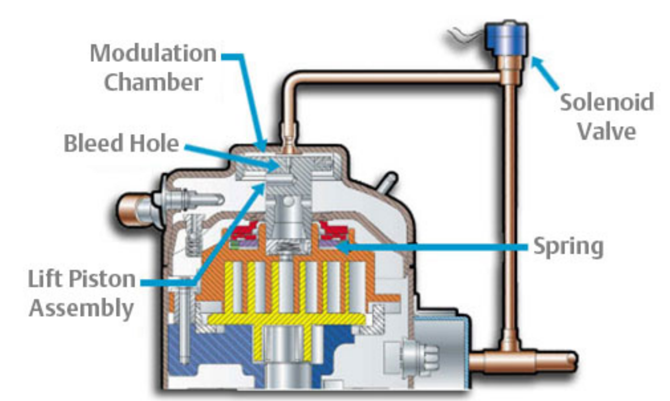
Compressors

- Single Stage Compressors
- Multiple Staging with Multiple Compressors
- Modulating Compressors
  - Scroll – Digital & VFD
  - Screw - VFD
  - Centrifugal - Magnetic
- Or Hot Gas Bypass



Digital Scroll Compressor

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Head Pressure Control

- Variable Speed Condenser Fan Provides Energy Savings by Optimizing TXV Operation
  - Variable Speed Compressors
  - Fluctuating Ambient Conditions
- Similar to Cooling Tower with VFD's

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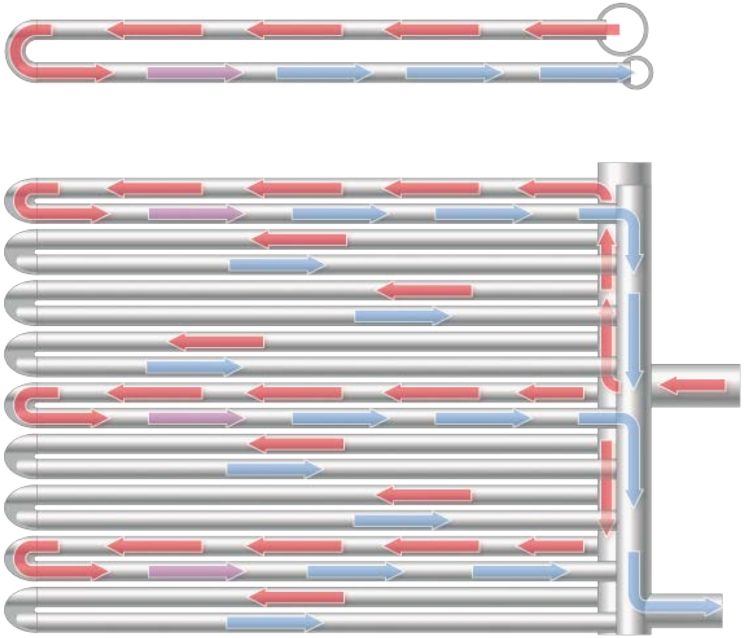
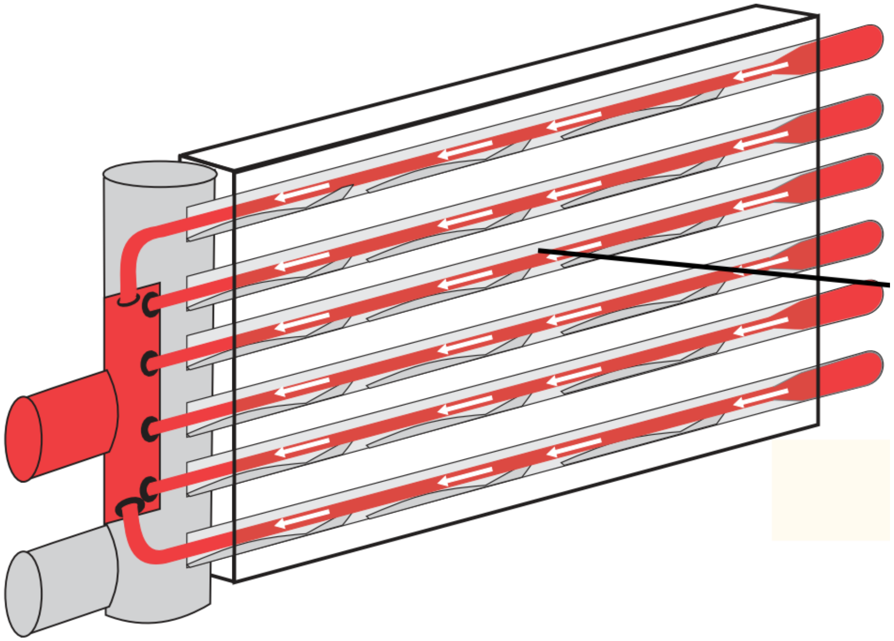
Heating Options

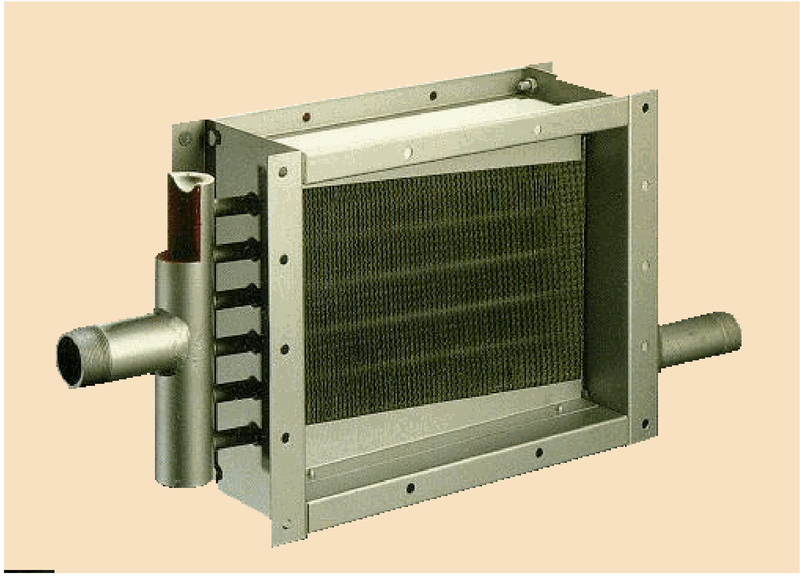
- Steam Heat
- Hot Water Heat
- Electric Heat
- Gas Heat
- Heat Pump & Hybrid Heat

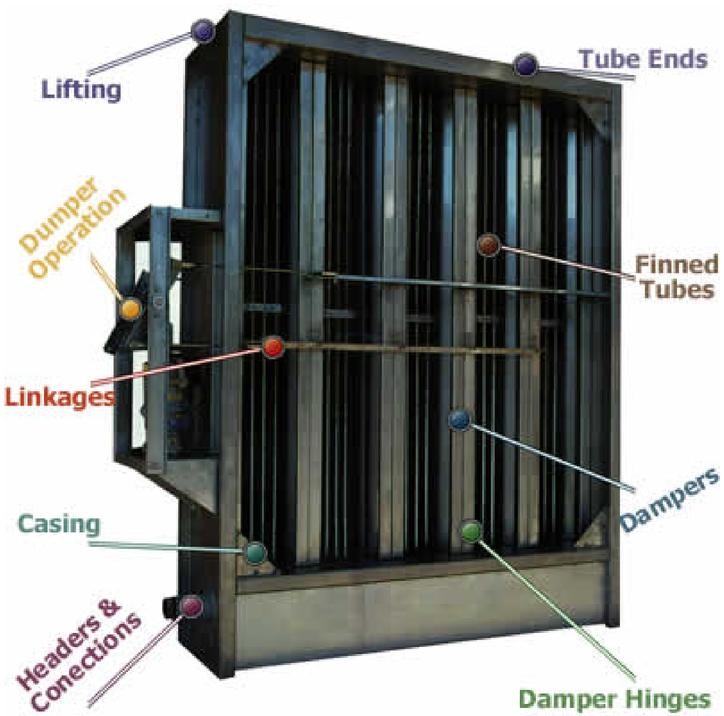
Steam Heat





Steam Heat

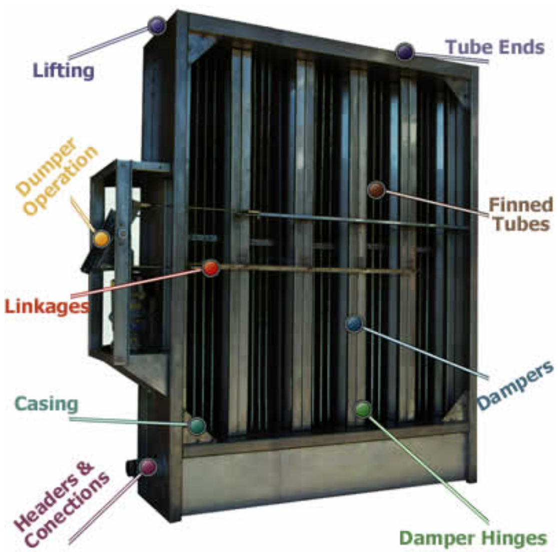



Lifting
Tube Ends
Dumper Operation
Finned Tubes
Linkages
Dampers
Casing
Headers & Conections
Damper Hinges

Steam Heat

- Single Coil for Normal Heating
- Single Coil for 100% OA
- Two Coils for 100% OA (PH & RH)
- F&BP for 100% OA
  - Internal, External & Integral F&BP

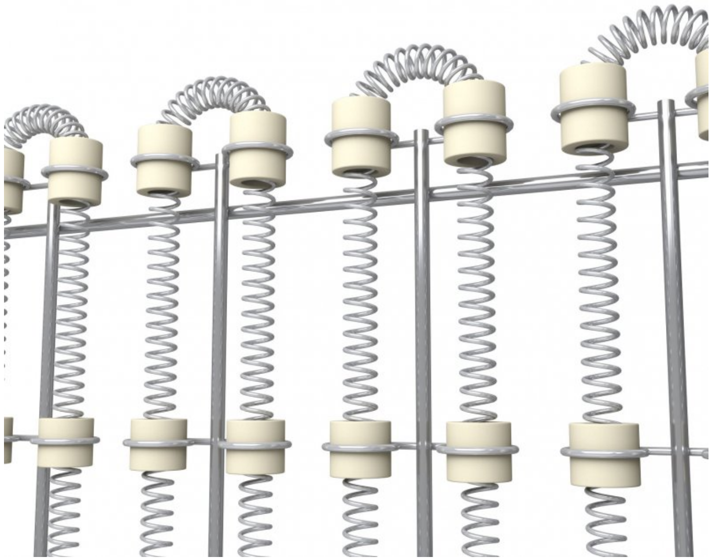
Hot Water Heat



Hot Water Heat

- Single Coil for Normal Heating
- Single Coil for 100% OA
- Two Coils for 100% OA
- F&BP for 100% OA
  - Internal, External & Integral F&BP

Electric Heat



Electric Heat

- Open Wire & Fin Tubular Element
- Multiple Stages with Contactors
- Modulating with SCR Controls

Gas Heat

- Staging
- Modulating

Gas Heat

- 1 Stage
  - 40 Degree TR = 40 Degree Minimum TR
- 2 Stage
  - 40 Degree TR = 20 Degree Minimum TR
- 4 Stage
  - 40 Degree TR = 10 Degree Minimum TR

Gas Heat

- 3:1 Modulation
  - 90 Degree TR = 30 Degree Minimum TR
- 5:1 Modulation
  - 90 Degree TR = 18 Degree Minimum TR
- 10:1 Modulation
  - 90 Degree TR = 9 Degree Minimum TR
- 20:1 Modulation
  - 90 Degree TR = 4.5 Degree Minimum TR

Hybrid Heat

- Primary Air Source Heat Pump
- Primary Water Source Heat Pump
- Secondary Gas, HW, Steam or Electric

Hybrid Heat for 100% OA

- Infinite TR
- 3:1 Modulation
  - 90 Degree TR = 1 Degree Minimum TR
- 5:1 Modulation
  - 90 Degree TR = 1 Degree Minimum TR
- 10:1 Modulation
  - 90 Degree TR = 1 Degree Minimum TR

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Temperature Controls

- Factory Analog
- Factory Digital
  - BACnet or LON Compatibility
- Factory Mounted DDC by Others
- Field Mounted DDC by Others
  - Isolation Relays
- <u>We Want to Review the Sequence!!!</u>

Long Life Cabinet

- 2500 Hour Salt Spray Paint
  - Tested per ASTM B 117-95
- 2” Double Wall Panels w/ R-13 Foam Insulation
- Thermal Break
- Galvanized or Stainless Steel Construction
- Stainless Steel Piano Hinges and Corrosion Resistant Lockable Handles
- Sloped Stainless Steel Drain Pan

2,500 Hour Salt Spray Test

- ASTM B 117-95 Testing Procedure
- 5% Salt Spray & Fog Atmosphere
- Stopped At First Visible Sign Of Deterioration
- Custom Color by Architect!!

Others

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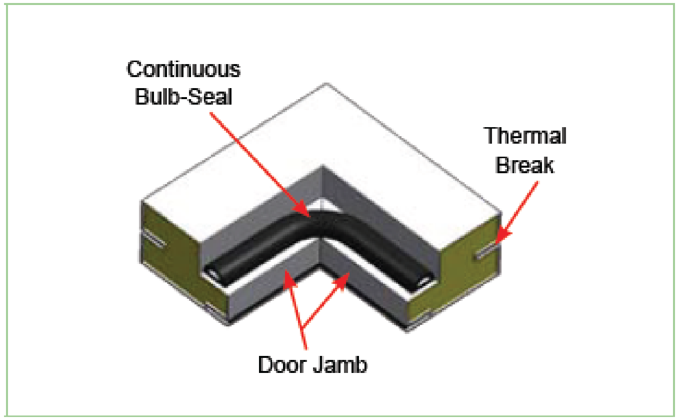
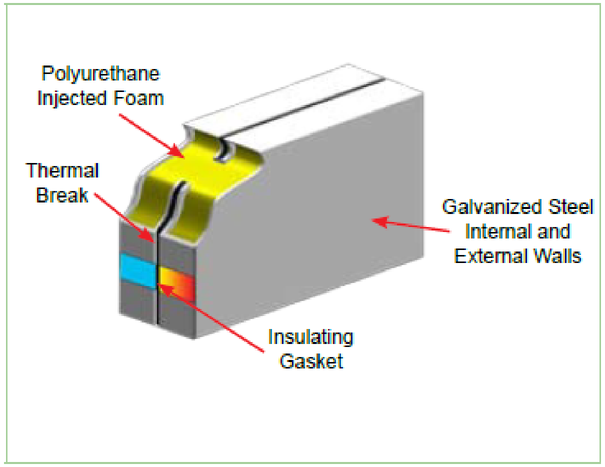
R-13 Foam Panel Construction w/ Thermal Break

- Air Seals
- Rigid
- Cleanable
- Extended Life
- Energy Savings



AAON Rigid Polyurethane Foam Panels



AAON Rigid Polyurethane Foam Panels

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R-13 Foam Panel Energy Savings

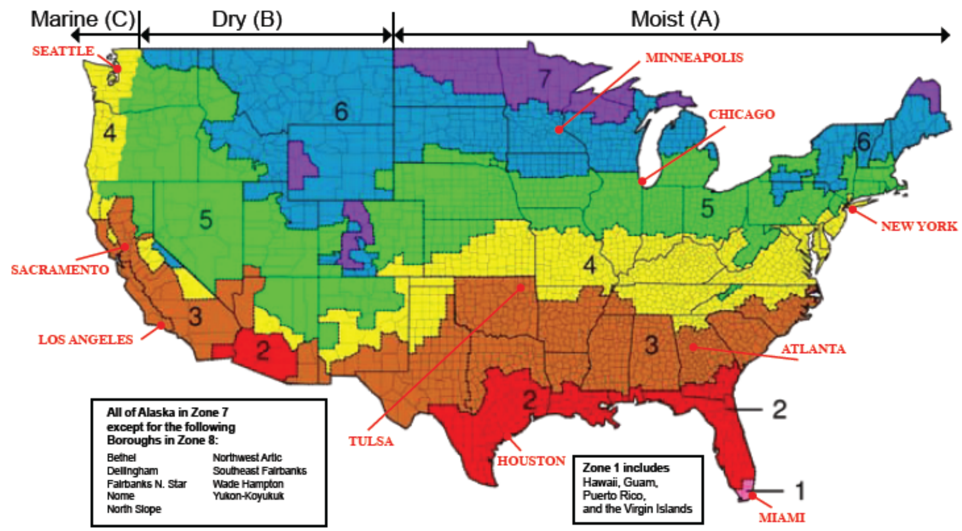

Figure 8: ASHRAE Climate Zones

Heating Savings

	Nominal Tons							
	5	10	20	35	75	125	175	210
Atlanta	$91	$170	$310	$553	$1,142	$1,722	$2,353	$2,794
Chicago	$154	$287	$522	$931	$1,924	$2,985	$4,078	$4,843
Houston	–	–	–	–	–	–	–	–
Los Angeles	–	–	–	–	–	–	–	–
Miami	–	–	–	–	–	–	–	–
Minneapolis	$177	$331	$603	$1,074	$2,221	$3,446	$4,707	$5,590
New York	$130	$242	$440	$784	$1,622	$2,516	$3,437	$4,081
Sacramento	$107	$200	$364	$649	$1,342	$2,084	$2,846	$3,380
Seattle	$146	$273	$497	$886	$1,833	$2,844	$3,885	$4,613
Tulsa	$105	$196	$356	$635	$1,313	$2,037	$2,783	$3,305

Table 13: Estimated Heating Savings from AAON Rigid Polyurethane Foam Cabinet
($0.12/kWh and $1.20/therm)

Cooling Savings

	Nominal Tons							
	5	10	20	35	75	125	175	210
Atlanta	$151	$295	$574	$1,009	$2,139	$3,496	$4,861	$5,818
Chicago	$74	$144	$279	$491	$1,040	$1,693	$2,351	$2,812
Houston	$278	$544	$1,058	$1,861	$3,946	$6,442	$8,958	$10,719
Los Angeles	$46	$91	$177	$311	$662	$1,088	$1,516	$1,816
Miami	$394	$769	$1,493	$2,628	$5,569	$9,089	$12,635	$15,117
Minneapolis	$67	$130	$253	$444	$941	$1,534	$2,133	$2,552
New York	$82	$159	$308	$542	$1,147	$1,867	$2,593	$3,101
Sacramento	$56	$106	$198	$350	$731	$1,158	$1,158	$1,898
Seattle	$14	$27	$51	$89	$187	$302	$418	$500
Tulsa	$166	$324	$625	$1,100	$2,327	$3,781	$5,249	$6,277

Table 12: Estimated Cooling Savings from AAON Rigid Polyurethane Foam Cabinet
($0.12/kWh and $1.20/therm)

Psychrometrics of Motor Heat

- Draw Through
- Blow Through

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Applications – Blow Through

- Large VAV systems
- High sensible loads
- Higher efficiency requirements
- Sound sensitive applications

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Blow Thru - 60,000 ft2 Bldg

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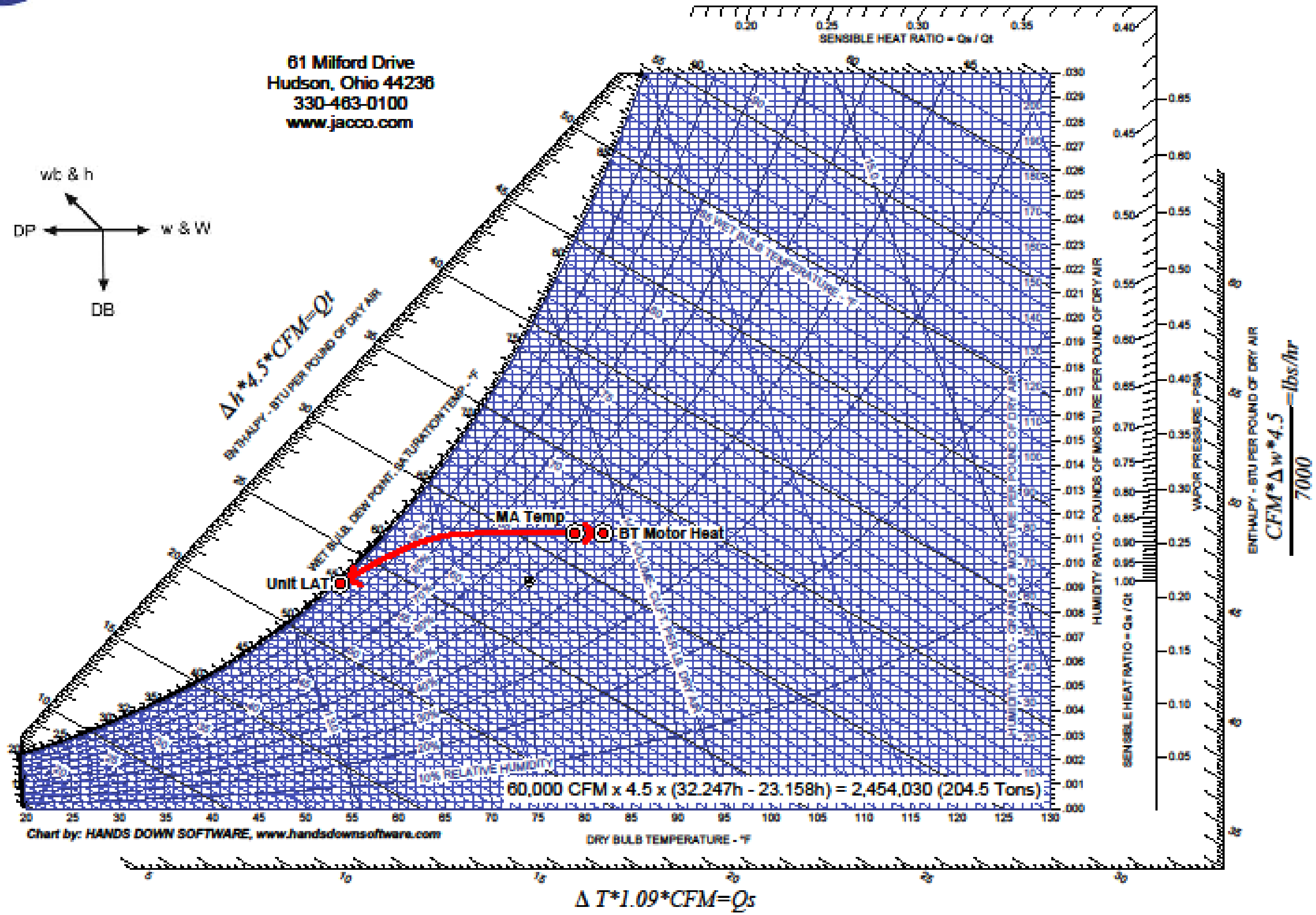
330-463-0100
www.jacco.com



Applications – Draw Through

- Compact space requirements
- High latent loads
  - DOAS
  - Pools
  - Underfloor or Displacement
- Initial cost constraints

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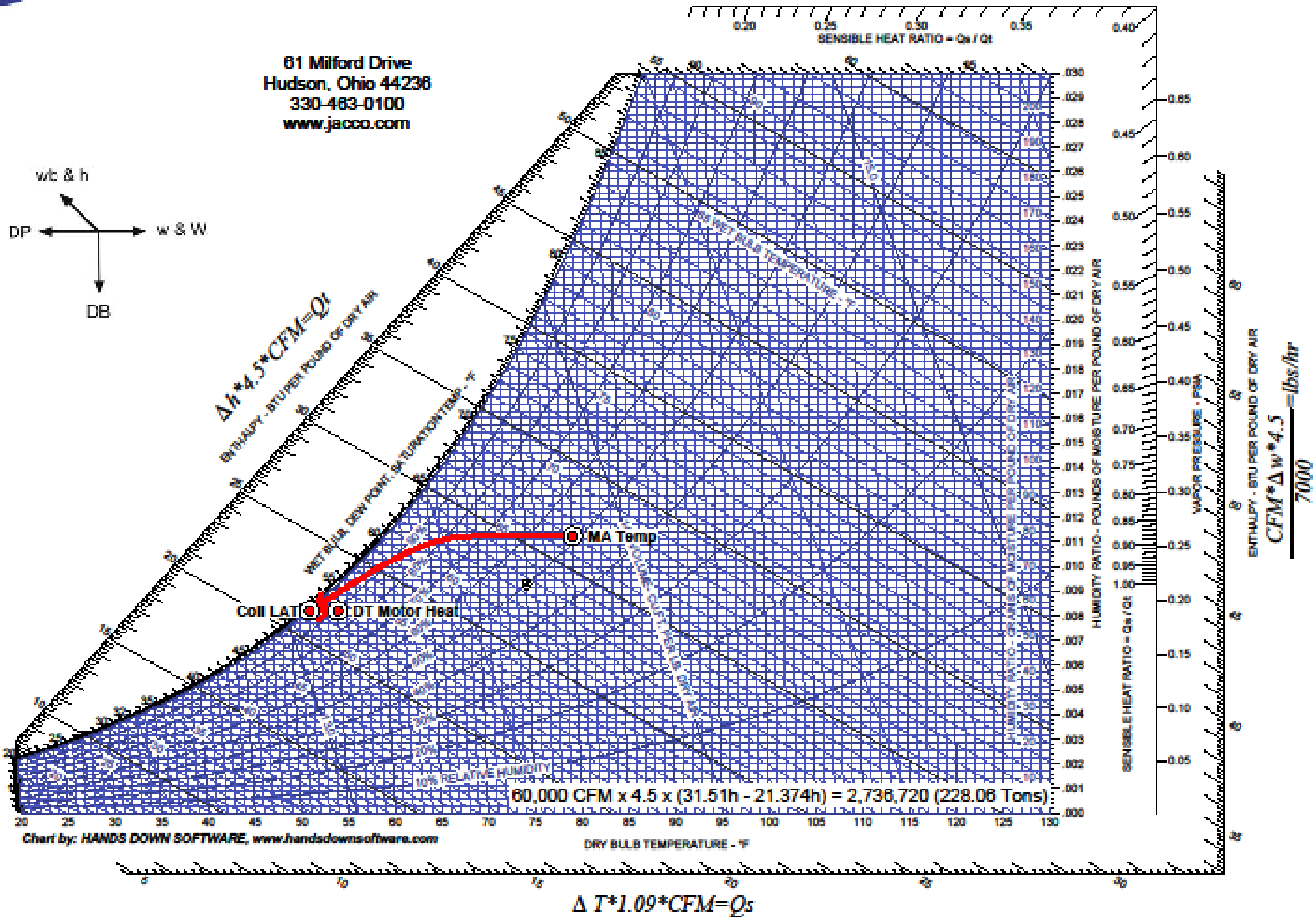
Draw Thru - 60,000 ft2 Bldg

61 Milford Drive
Hudson, Ohio 44236
330-463-0100
www.jacco.com



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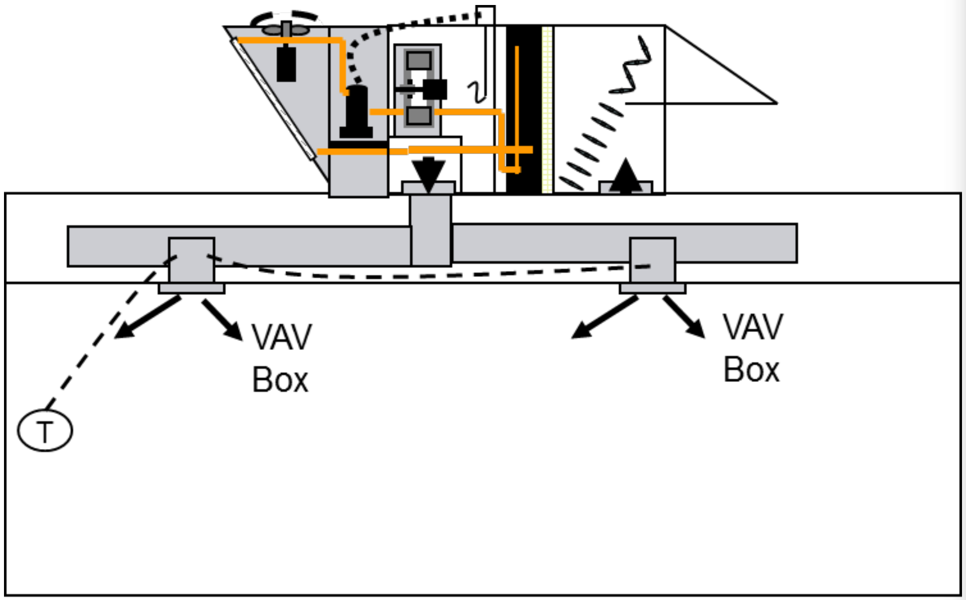
Traditional VAV Systems

- Traditional VAV systems feed multiple zones from one unit
- Supply airflow changes to maintain supply duct pressure
- Unit capacity changes to maintain supply air temperature



Minimum VAV Flow

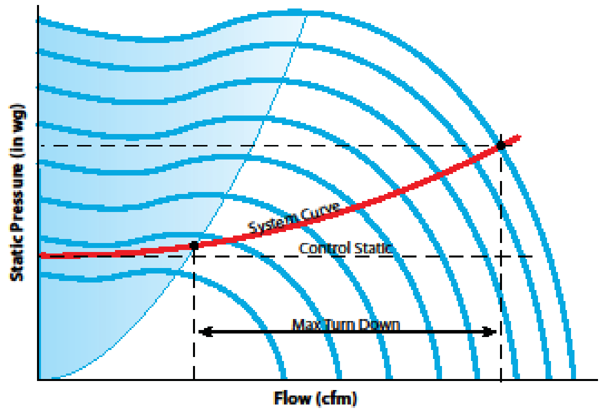


Fig. 25: VAV System Selected Further Right of Peak Static

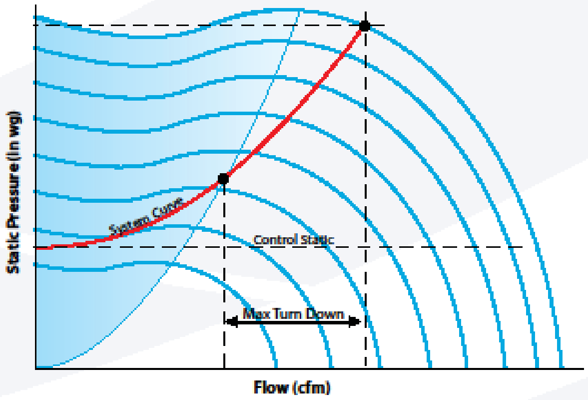


Fig. 24: VAV System Selected Close to Peak Static & Efficency

Exhaust Fans or…

- Assume 6400 CFM, 15 Ton Unit
  - 1” Supply ESP & .50” Return ESP

- Supply Fan Sized for 1.5” ESP
- Exhaust Fan Sized for .5” ESP
  - 7.5 HP SF & 3 HP EF

Return Fans

- Assume 6400 CFM, 15 Ton Unit
  – 1" Supply ESP & .50" Return ESP

- Supply Fan Sized for 1" ESP
- Return Fan Sized for .5" ESP
  – 5 HP SF & 3 HP RF

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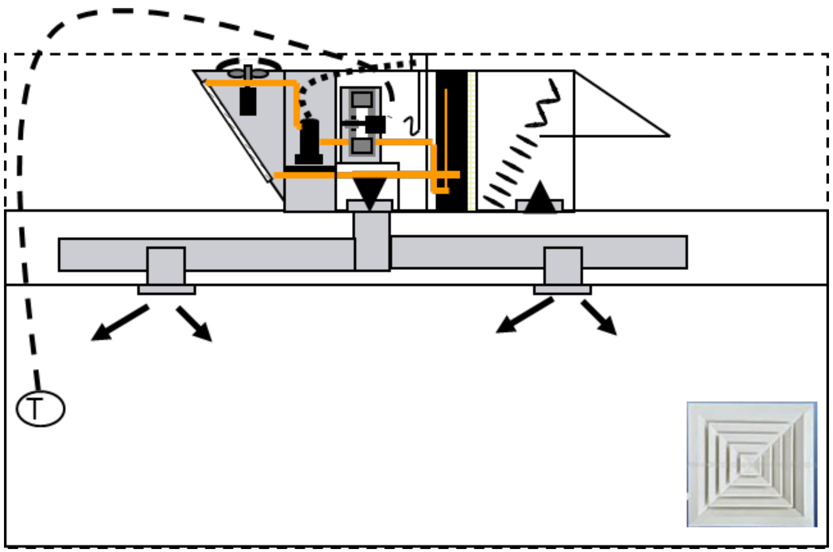
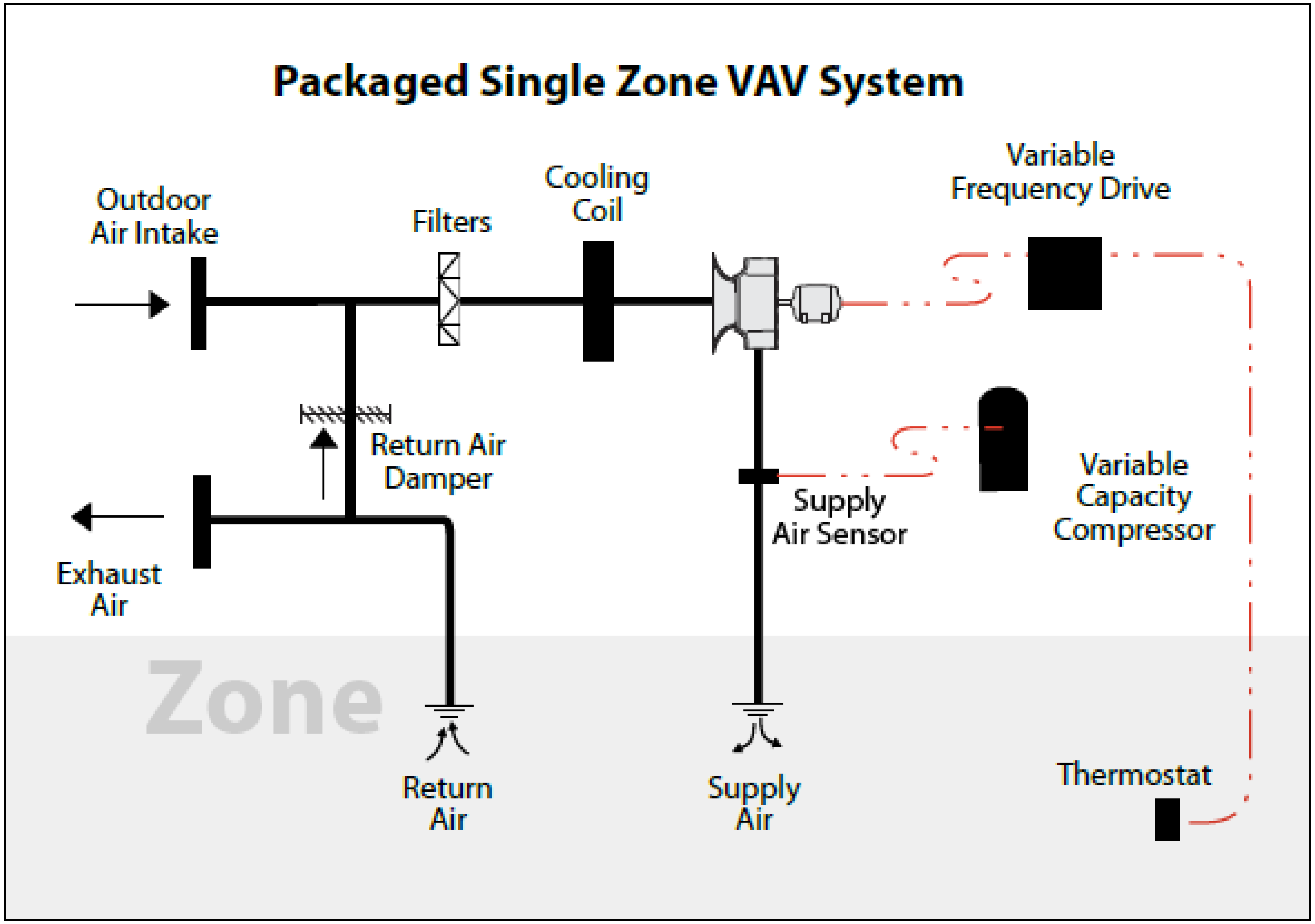
Single Zone VAV Systems

- Single Zone VAV systems serve one zone.
- Airflow changes based on space load
- Unit capacity changes to maintain supply air temperature
- SAT set point can be reset to maintain humidity control (if reheat available)
- VAV boxes not required

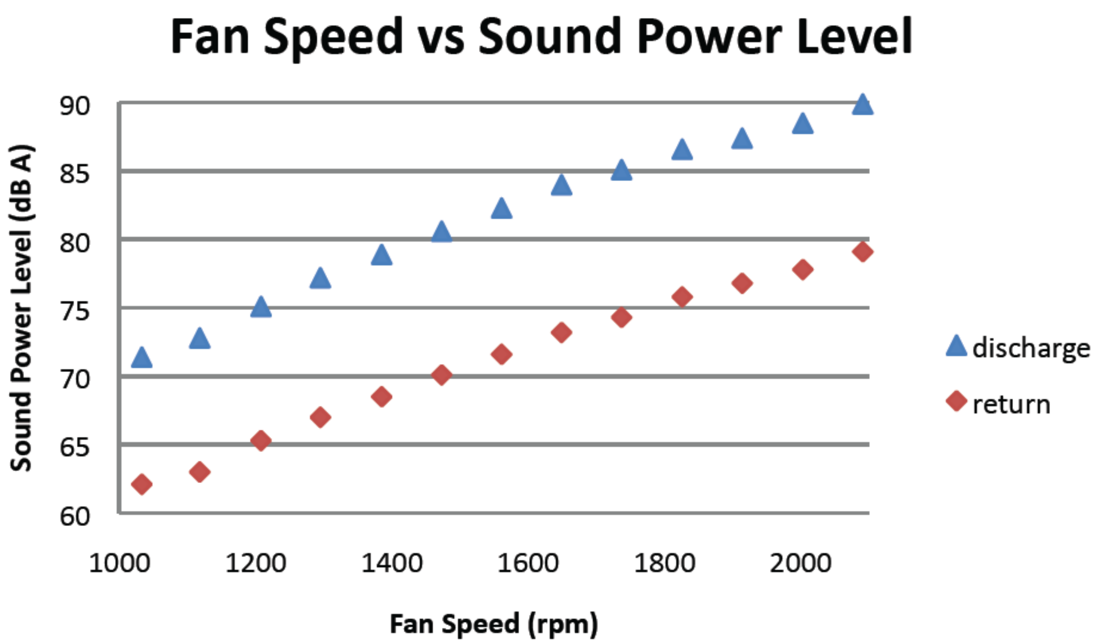


Single Zone VAV Controls



VAV Sound Benefit

Another benefit to airflow reduction is the reduction in fan noise due to change in speed



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Best Installation Practices

- Location
- Clearance
- Sound
- Isolation
  - Spring or Rubber in Shear (RIS)

Acoustical Considerations

Proper unit placement is critical to reducing transmitted sound levels from the unit to the building. Do not locate units directly above areas such as: **offices, conference rooms, executive office areas, and classrooms**. Instead, ideal locations to consider are: **corridors, utility rooms, toilets, or other areas** where higher sound levels directly below the units are acceptable.

1. Never cantilever the compressor side of the unit. A structural cross member or full perimeter roof curb, supported by roof structural members, must support this side of the unit.
2. Locate the unit's center of gravity close to or over column or main support beam.
3. If the roof structure is very light, replace roof joists by a structural shape in the critical areas described above.
4. If several units are to be placed on one span, stagger them to reduce deflection over that span.
5. Use the quietest fans available!!!!

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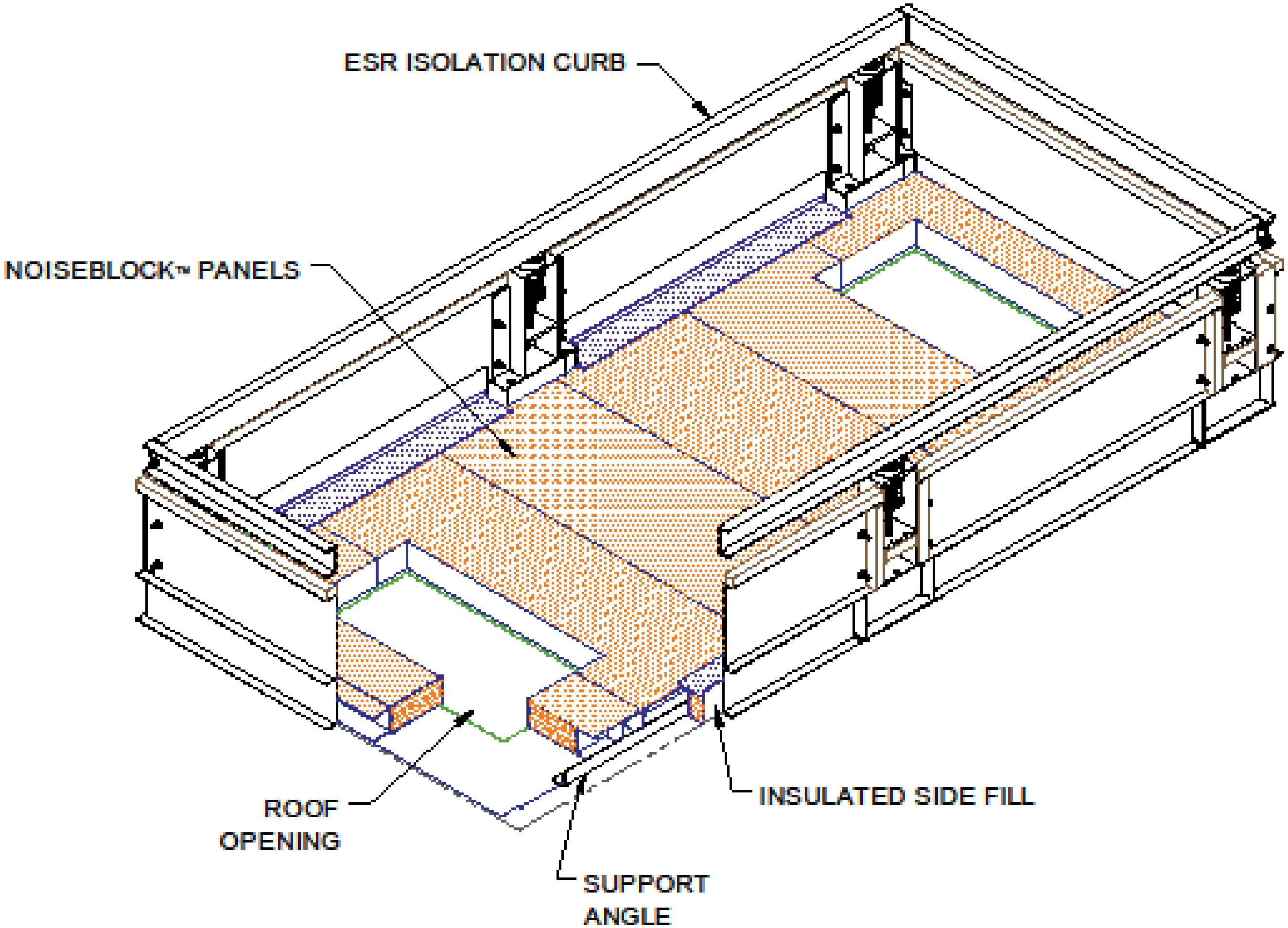
Vibration/Acoustical Curbs



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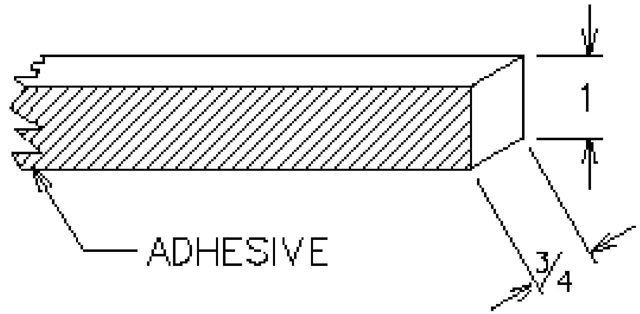
Poor Man Vibration Curb

SPECIFICATIONS:

NOMINAL SIZE: 1" W X 3/4" H

MATERIAL: NEOPRENE TYPE SCE 42 (CLOSED CELL)

TREATMENT: PRESSURE SENSITIVE ADHESIVE ON 1" SIDE



Clearance Requirements

Follow the recommended unit clearances to assure adequate serviceability, maximum capacity, and peak operating efficiency.

1. Do the clearances available allow for major service work, such as changing compressors or coils?

2. Do the clearances available allow for proper outside air intake, exhaust air removal, and condenser airflow?

3. If screening around the unit is used, is there a possibility of air recirculation from the exhaust to the outside air intake or from condenser exhaust to condenser intake.

When two or more units are placed side by side, increase the distance between the units to twice the recommended single unit clearance. Stagger the units for these two reasons:

1. To reduce span deflection if more than one unit is placed on a single span.
2. To assure proper exhaust air diffusion before contact with the adjacent unit's outside air intake.

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Duct Design

A well-designed duct system is essential to meet the rated capacities of the unit .

1. Satisfactory air distribution throughout the system requires an unrestricted and uniform airflow from the unit discharge duct.

2. When job conditions dictate installation of elbows near the unit outlet, using turning vanes may reduce capacity loss and static pressure loss.

3. Plenum return duct design should incorporate multiple turns before return air openings.

AAON Rooftops

- Rooftop Package Units
    - Air & Water Cooled Condensing
    - Evaporative Condensing
    - Geothermal / Water Source Heat Pump
    - Air Source Heat Pump
    - DOAS & 100% OA
- Rooftop air handling units – 800 to 70,000 cfm

The RQ Series Rooftop

- 2 through 6 Tons
- A Different Choice

The RN Series Rooftop

- 6 through 140 Tons
- Large Capacity, Small Footprint, Lightweight

JACCO

The RL Series Rooftop
40 to 240+ Tons

JACCO

Tulsa, OK Facility

- 1.3 M sq. ft. on 54 acres
- 1,160 employees
- Rooftop package units
- Rooftop air handlers
- Chillers/Boiler/Pumping packages
- Large condensing units
- Large air handlers

JACCO

Longview, TX Facility

- AAON Coil Products, Inc. was founded in 1991 with the acquisition of Coils Plus, Inc. of Longview, Texas.
- 251,000 sq. ft.
- 25 acres
- 394 employees
- Coils, condensing units, smaller air handling units

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Some AAON Rooftop Applications

- High Efficiency
- DOAS / Make Up Air
- Tight Temperature & Humidity Control
- VAV / SZVAV
- Pool Units
- Seismic Certification
- Horizontal Supply & Return Duct Connections

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Seismic Certification Compliance

- RQ & RN Rooftop Units
- IBC-2000
- IBC-2003
- IBC-2006
- IBC-2009
- IBC-2012

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Low Dewpoint ~ 38F Dewpoint

AAON®

Unit Rating

2425 South Yukon Ave - Tulsa, Oklahoma 74107-2728 - Ph. (918) 583-2266 Fax (918) 583-6094
AAONEcat32 Ver. 4.238 (SN: 6196192-)

RN-006-3-0-CB01-11A:A000-D0B-DBC-AHC-0HMAHBE-00-0000000AB

Tag: RTU# 1

Job Information

Job Name:	*Gooch & Housego*
Job Number:	*NB Engineers*
Site Altitude:	*0 ft*
Refrigerant	*R-410A*

Unit Information

Approx. Op./Ship Weights:	*1101 / 1101 lbs. (±5%)*
Supply CFM/ESP:	*1400 / 1.05 in. wg.*
Pre-Filter FV / Qty:	*157.50 fpm / 4*
Final Filter FV / Qty:	*157.50 fpm / 4*
Outside CFM:	*60*
Ambient Temperature:	*81.3 °F DB / 75.6 °F WB*
Return Temperature:	*70 °F DB / 53 °F WB*

Static Pressure

External:	*1.05 in. wg.*	Economizer:	*0.03 in. wg.*
Evaporator:	*0.14 in. wg.*	Heating:	*0.02 in. wg.*
Filters Clean:	*0.17 in. wg.*	Cabinet:	*0.03 in. wg.*
Dirt Allowance	*0.35 in. wg.*	Re-Heat Coil:	*0.01 in. wg.*
		Total:	*1.80 in. wg.*

Cooling Section

	Gross	Net
Total Capacity:	*52.90*	*50.96 MBH*
Sensible Capacity:	*49.26*	*47.32 MBH*
Latent Capacity:	*3.65 MBH*	
Mixed Air Temp:	*70.48 °F DB*	*54.23 °F WB*
Entering Air Temp:	*70.48 °F DB*	*54.23 °F WB*
Lv Air Temp (Coil):	*37.83 °F DB*	*37.67 °F WB*
Lv Air Temp (Unit)	*39.10 °F DB*	*38.36 °F WB*
Supply Air Fan:	*1 x RN150 @ 0.65 BHP*	
SA Fan RPM / Width:	*1657 / 3.259"*	
Evaporator Coil:	*8.5 ft² / 6 Rows / 14 FPI*	
Evaporator Face Velocity:	*164.6 fpm*	

Heating Section

PreHeat Type:	*Std (No Preheat)*
Heating Type:	*Electric Heat*
Heating CFM:	*1400*
Total Capacity:	*34.1 MBH*
OA Temp:	*0.0 °F DB / -1.0 °F WB*
RA Temp:	*70.0 °F DB / 53.0 °F WB*
Entering Air Temp:	*67.0 °F DB / 51.4 °F WB*
Leaving Air Temp:	*89.6 °F DB / 60.3 °F WB*
Input:	*10.0 kW*
Heater Qty:	*1*
Electric Heat FLA:	*12*

Re-Heat Coil:

Capacity:	*49 MBH*
LA DB / WB:	*70.00 °F / 53.03 °F*
RH:	*30%*

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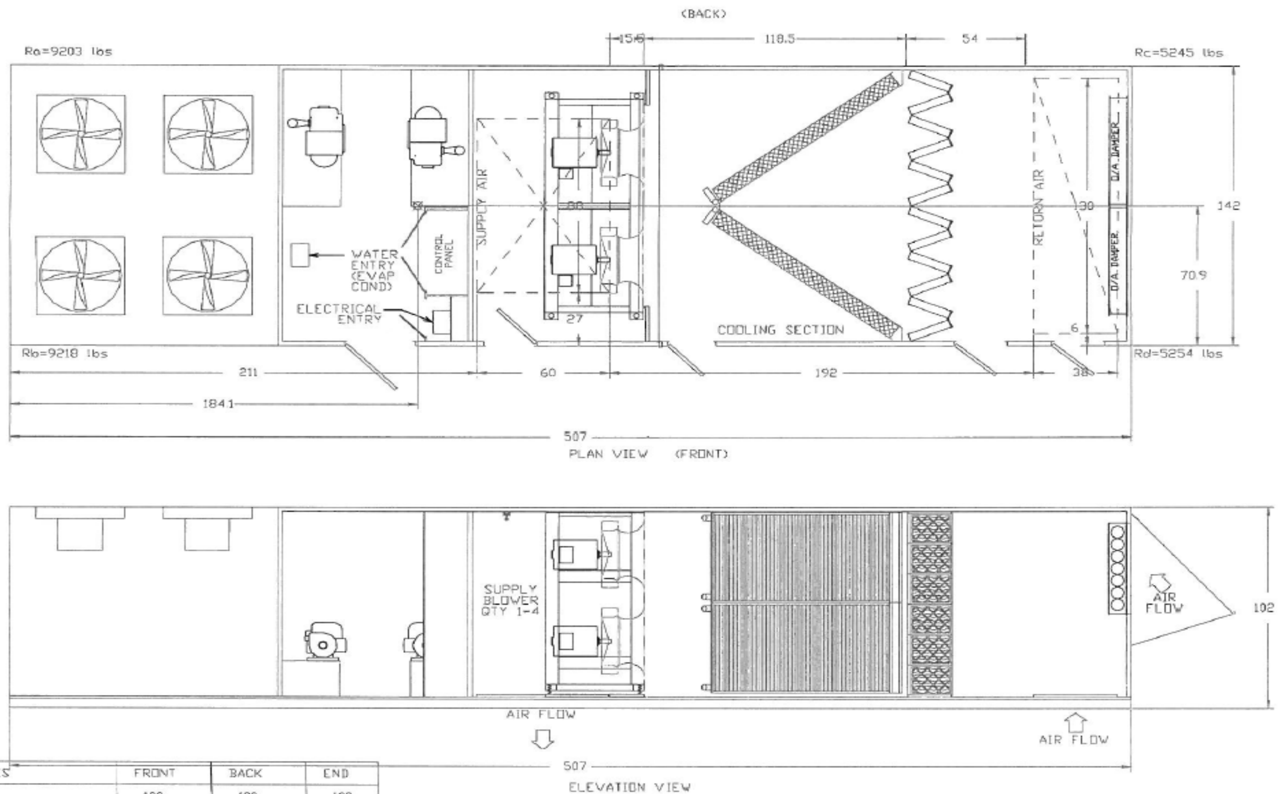
Aaon Rooftops w/ Oil Free, Magnetic Bearing Centrifugal Compressors - from 90 to 240+ Tons



SECTION CLEARANCES	FRONT	BACK	END
CONDENSER	100	100	100
COOLING	100	100	0

JACCO

150 Ton RTU - 17.8 EER

Unit Rating

2425 South Yukon Ave - Tulsa, Oklahoma 74107-2728 - Ph. (918) 583-2266 Fax (918) 583-6094
AAONEcat32 Ver. 4.238 (SN: 6196192-)

RL-150-3-0-DE0Z-000:0000-000-QBG-000-000000D-00-000000BJB

Tag: RTU# 3

Job Information

Job Name:	*RTU Efficiency w/ TurboCor EC*
Job Number:	*May Presentation*
Site Altitude:	*0 ft*
Refrigerant	*R-134a*

Unit Information

Approx. Op./Ship Weights:	*26119 / 21219 lbs. (±5%)*
Supply CFM/ESP:	*43400 / 1.5 in. wg.*
Pre-Filter FV / Qty:	*325.50 fpm / 48*
Outside CFM:	*13020*
Ambient Temperature:	*95 °F DB / 75 °F WB*
Return Temperature:	*75 °F DB / 62 °F WB*

Static Pressure

External:	*1.50 in. wg.*	Economizer:	*0.18 in. wg.*
Evaporator:	*0.42 in. wg.*	Heating:	*0.00 in. wg.*
Filters Clean:	*0.13 in. wg.*	Cabinet:	*0.40 in. wg.*
Dirt Allowance	*0.35 in. wg.*	Total:	*2.98 in. wg.*

Cooling Section

	Gross	Net
Total Capacity:	*1688.91*	*1604.97 MBH*
Sensible Capacity:	*1229.95*	*1146.02 MBH*
Latent Capacity:	*458.95 MBH*	
Mixed Air Temp:	*80.00 °F DB*	*67.00 °F WB*
Entering Air Temp:	*81.77 °F DB*	*67.56 °F WB*
Lv Air Temp (Coil):	*54.90 °F DB*	*54.42 °F WB*
Lv Air Temp (Unit)	*54.90 °F DB*	*54.42 °F WB*
Supply Air Fan:	*BT - 4 x 300 @ 7.56 BHP Ea.*	
SA Fan RPM / Width:	*1138 / 6.810"*	
Evaporator Coil:	*95.8 ft² / 4 Rows / 12 FPI*	
Evaporator Face Velocity:	*452.9 fpm*	

Heating Section

PreHeat Type:	*Std (No Preheat)*
Heating Type:	*No Heat*

Rating Information

EER @ AHRI Conditions:	*13.9*	**EER Compressor Only @ AHRI Conditions:**	*17.8*
Application EER @ Op. Conditions:	*11.9*	**Condensing Unit EER @ Op. Conditions:**	*15.3*

Electrical Data

Rating:	*460/3/60*	Minimum Circuit Amp:	*281*
Unit FLA:	*244*	Maximum Overcurrent:	*400*

JACCO

Oil Free, Magnetic Bearing Centrifugal Compressors

- 50,000 TurboCor Compressors Installed Worldwide!
- 20,000 TurboCor Compressors installed in the USA!

Question for You

- Is a DX Rooftop as Efficient as a Chilled Water System?
  - Fans are the Same
  - Coils are the Same
  - Compressors are the Same
  - Cabinet is Better

Question for You

- Is a DX Rooftop more Competitive than a Chilled Water System?
  - No Pumps or Equipment Rooms
  - No Piping or Insulation
  - Less Controls

Thank You

Jerry Cohen
President
Jacco & Assoc.