The Future of FANWALL TECHNOLOGY®

Dan McCarty, Outside Sales Engineer | Partner | Patent Holder
SVL, Inc.

Today's Plan

- Fan Wall History
- The FANWALL® Advantages
- Latest FANWALL Innovations

Today's Plan

- Fan Wall History

Concept Started in Clean Room Industry – West Coast

Clean Room Design went for Large Vaneaxial System to Re-Circulation Units.

Re-Circulation units needed to reliable & ultra low vibration

The genius idea - VFD's operating above 60 hz

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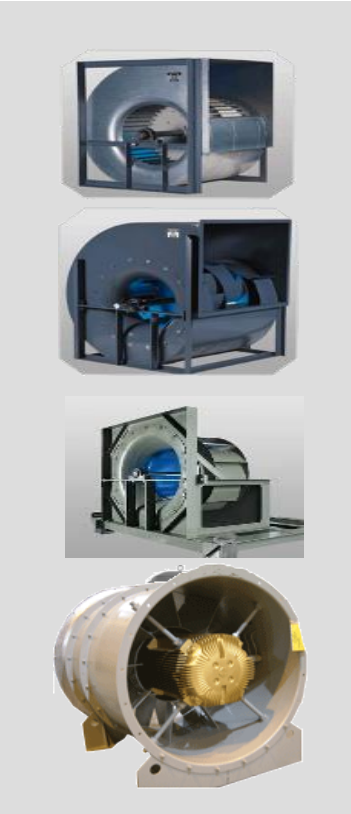
Today's Plan

- The FANWALL® Advantages
- Latest FANWALL Innovations

FANWALL TECHNOLOGY®

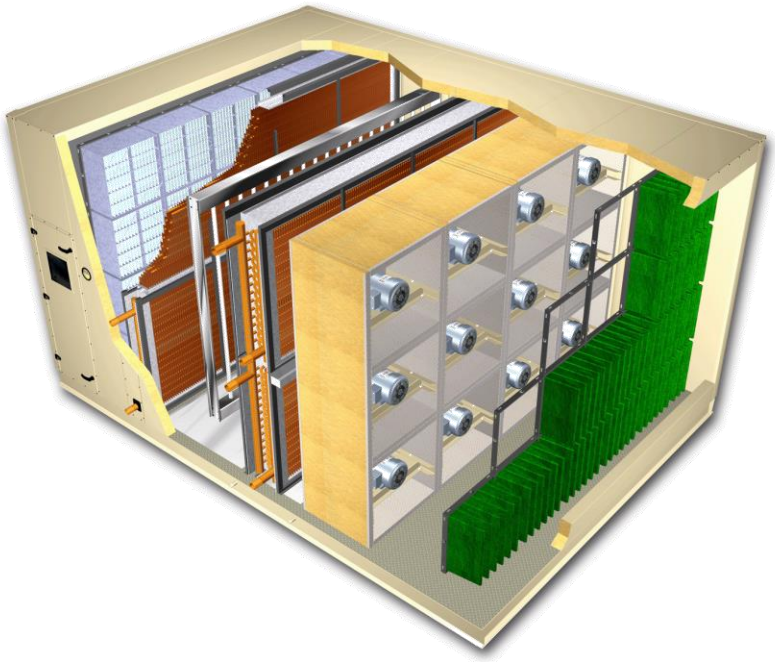
Quick Definition

- Break down large single or dual fan systems into an array of smaller, more efficient, quieter, and easier to maintain fan cells



Why Consider FANWALL TECHNOLOGY®

The original and most widely used fan array solution



1. Need a smaller/lighter unit?
2. Want to improve system reliability?
3. Desire lower sound levels and vibration levels?
4. Want lower power consumption?
5. Want to improve coil & filter effectiveness?
6. Need to lower maintenance costs?
7. Need to retrofit an old air handler?
8. Need controls that optimize performance?

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Smaller AHU Footprint

With FANWALL TECHNOLOGY

Advantage 1

- Less Floor Space Required
  - *Fan sections shortened in length by 50% or greater*
  - *Inlet and discharge plenum lengths are reduced for Supply and Return Fans*

- In this example:

308” - 206” = 102” reduction

or

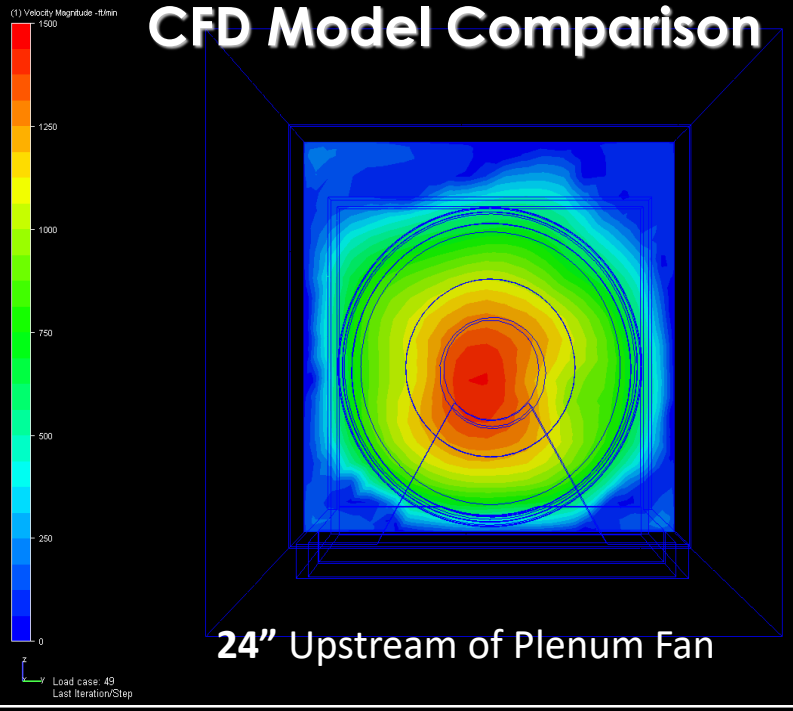
8.5 foot savings in unit length!

*Plus the **weight** savings associated with the extra length*

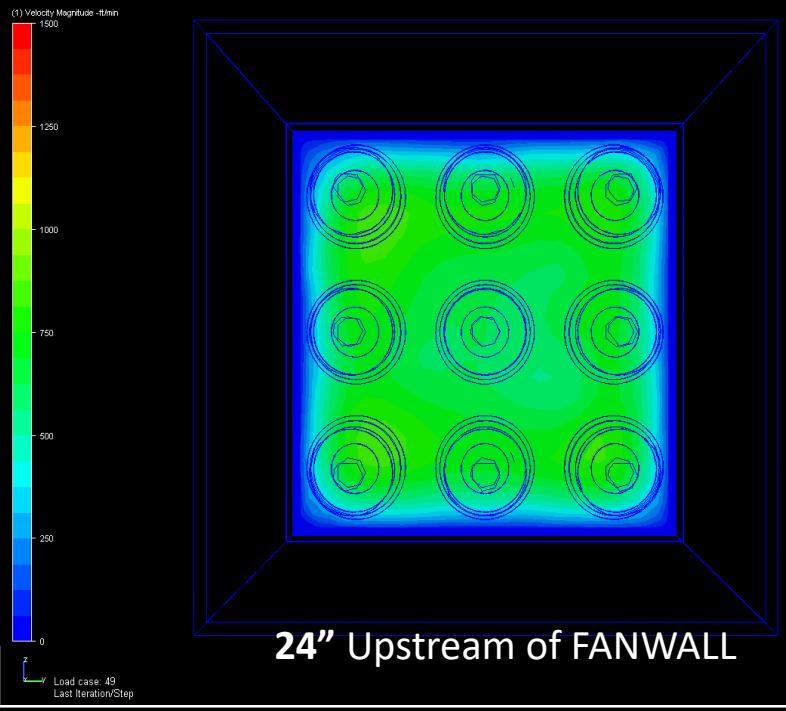
FANWALL Air Handler – 44,000 cfm @7.0” TSP

Conventional Air Handler – 42,000 cfm @ 7.0” TSP

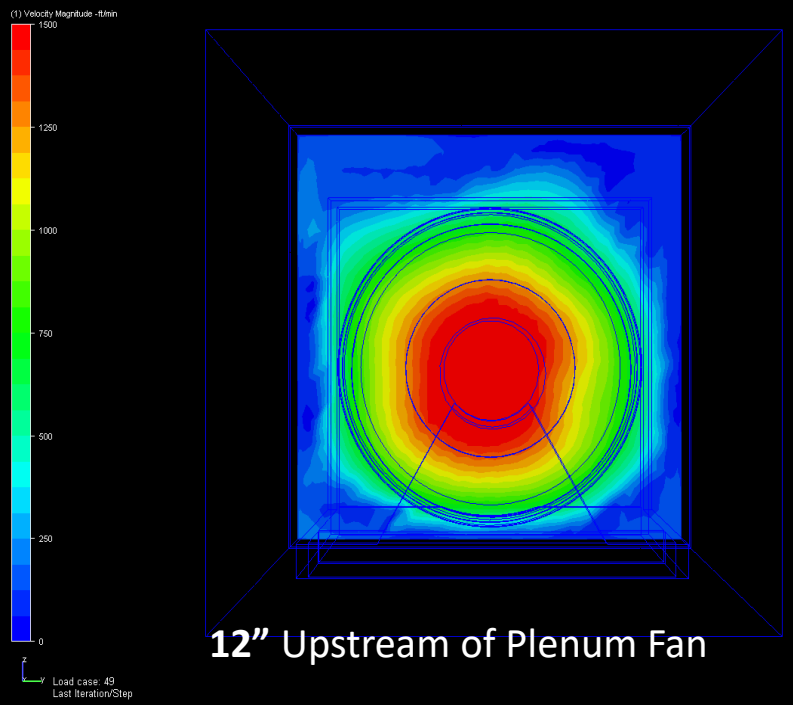
CFD Model Comparison



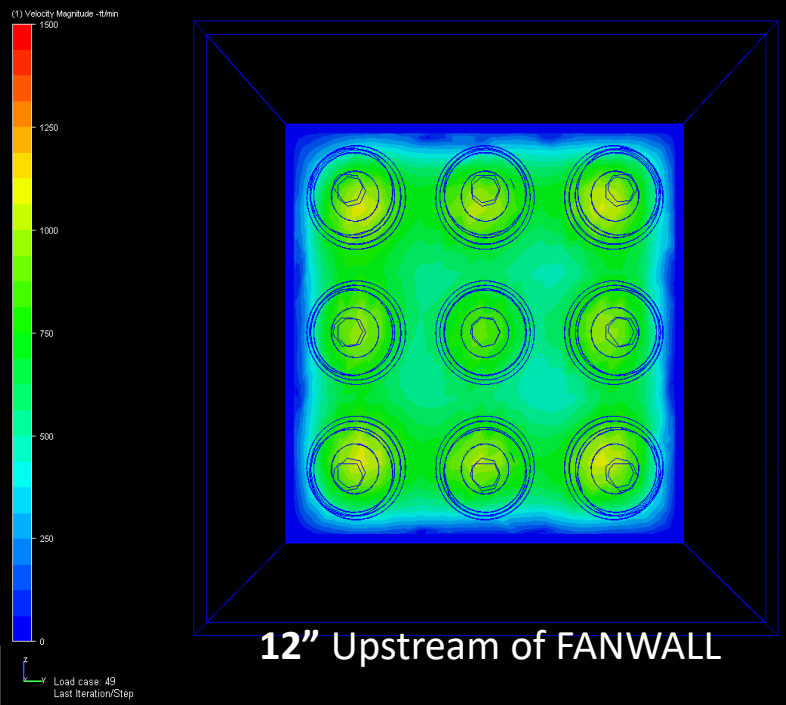
24” Upstream of Plenum Fan



24” Upstream of FANWALL



12” Upstream of Plenum Fan



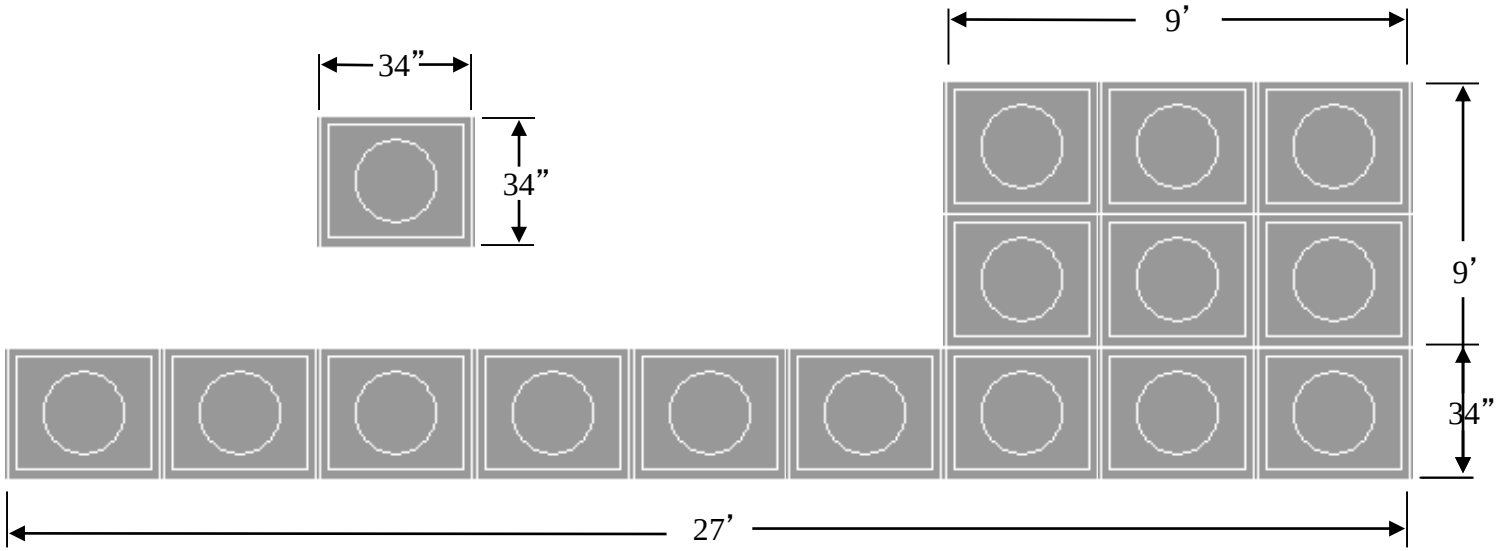
12” Upstream of FANWALL

FANWALL TECHNOLOGY

Application Considerations

- Greater Flexibility in Unit Dimensions:
  - *FANWALL TECHNOLOGY offers greater flexibility in unit sizing. Designers are able to incorporate lower profile units where height restrictions are involved.*

Approximate 25k CFM



Increase Reliability through Redundancy

With FANWALL TECHNOLOGY

Advantage 2

- Multiple fans provide true N+1 redundancy without the need for standby units
  - *Increase speed of remaining fans to meet the capacity requirement*
- Arrangement 4 fans eliminate belts, sheaves, and fan bearings
- Fans balanced to Clean Room Standards & Internal or External Vibration Isolation is NOT required
- Greatly reduces / eliminates the exposure of downtime due to mechanical failure
- Standard “off-the-shelf” motors
  - *Shaft grounding kits ???*
  - *Ceramic Bearing motors by Toshiba*

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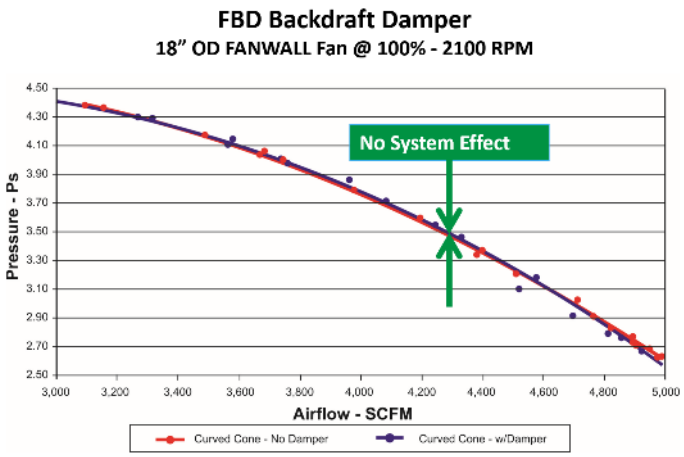
FBD Backdraft Damper

Near Zero System Effect For FANWALL® Systems

- A backdraft damper is critical for providing on/off control of fans
  - *Prevents recirculation of system air in disabled fans*
  - *Near zero net system effect*
  - *Extremely low leakage*
  - *Positive impact on acoustics*

Near Zero Net System Effect Backdraft Damper

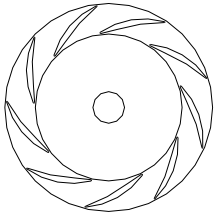


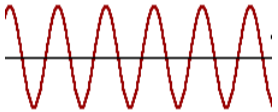
Lower Sound Levels and Vibration

With FANWALL TECHNOLOGY

Advantage 3

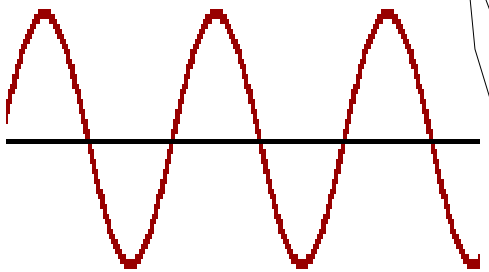
- Small, Light Aluminum Wheel Construction
  - *FANWALL TECHNOLOGY® systems utilize extremely efficient small diameter wheels. These smaller, lighter wheels produce less vibration than conventional larger, heavier wheels.*
- Acoustical Benefits –
  - *Low frequency noise is greatly reduced due to higher tip speeds.*
  - *Higher frequency noise far less difficult to attenuate.*
- Ideal for acoustically sensitive applications.
  - *Concert Halls*
  - *Lecture Halls*
  - *Performing Arts Centers*
  - *Libraries*

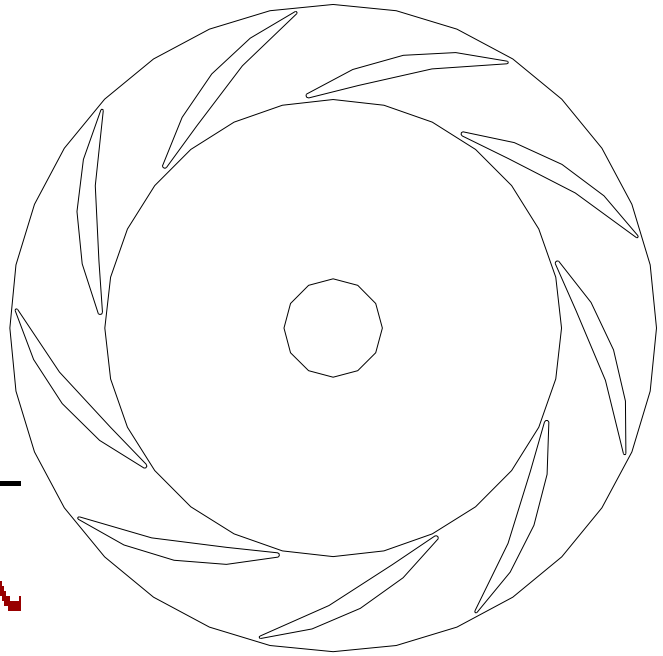




High Frequency

Low Frequency

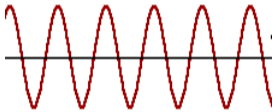




Lower Sound Levels and Vibration

With FANWALL TECHNOLOGY

Advantage 3



High Frequency

VIBRO-ACOUSTICS®
A Swegon Group company

RMB-LV-F1
RECTANGULAR MOLDBLOCK
LOW VELOCITY SILENCER (<750 FPM)

Unit: Imperial

CERTIFIED PERFORMANCE DATA

Insertion Loss (IL)

LENGTH (inches)	FACE VELOCITY (feet per minute)	OCTAVE BAND -Hz/DYNAMIC INSERTION LOSS (dB)							
		63	125	250	500	1000	2000	4000	8000
36	-750	7	11	17	18	21	15	15	13
36	+750	5	10	16	17	20	18	16	13
60	-750	10	15	27	29	34	24	18	16
60	+750	8	14	24	27	34	25	20	16
84	-750	13	19	36	40	47	33	21	18
84	+750	11	18	33	37	47	33	23	18
108	-750	17	23	45	50	55	41	24	21
108	+750	13	21	42	47	55	40	27	21

+: "forward flow" where noise & airflow move in same direction (e.g. supply side)

-: "reverse flow" where noise & airflow move in opposite directions (e.g. return side)

DIL above 50 dB may be limited due to noise flanking around the silencer or along the duct walls. If more than 50 dB DIL is required, contact your local Vibro-Acoustics Representative or call 1-800-565-8401.

Pressure Drop (PD)

CENTER LENGTH (inches)	FACE VELOCITY (feet per minute) / Pressure Drop (in.w.g.)						
	250	500	750	1000	1250	1500	1750
36	0.02	0.07	0.15	0.27	0.42	0.61	0.83
60	0.02	0.09	0.20	0.36	0.56	0.80	1.09
84	0.03	0.11	0.25	0.44	0.70	1.00	1.36
108	0.03	0.13	0.30	0.53	0.83	1.20	1.63

: Acceptable (0 - 0.35")

: Caution (>0.35") Pressure Drop may be too high for certain applications

Pressure drops are reported in accordance with ASTM E477 methods and are based upon IDEAL flow conditions (5 diameters of straight duct on silencer inlet and 10 on outlet). Less than ideal conditions will result in an increase in pressure drop due to System Effects.

CROSS-SECTION SIZES*
"A" dimension (Silencer width) (inches):
14.5–15.5
29–31
58–62
87–93
116–124
145–155
174–186
203–217
232–248
"B" dimension (silencer height):
ANY SIZE

*To ensure a silencer selection that matches the ductwork dimensions, see page 4.25 or 5.3.

Generated Noise (GN) @ 5 sq. ft. face area

LENGTH (inches)	FACE VELOCITY (feet per minute)	OCTAVE BAND - Hz/GENERATED NOISE (dB re 10^{-12} watts)							
		63	125	250	500	1000	2000	4000	8000
ALL	-750	52	44	40	44	48	46	34	27
ALL	-500	52	41	38	40	39	32	22	28
ALL	+500	54	38	31	29	31	27	21	28
ALL	+750	52	43	36	34	38	38	28	28

GN correction chart at right must be used to correct GN to other face areas.

FACE AREA (sq.ft.)	2.5	5	10	20	40	80
dB	-3	0	+3	+6	+9	+12

Questions? 1-800-565-8401

We reserve the right to improve our designs and data at any time without notice.

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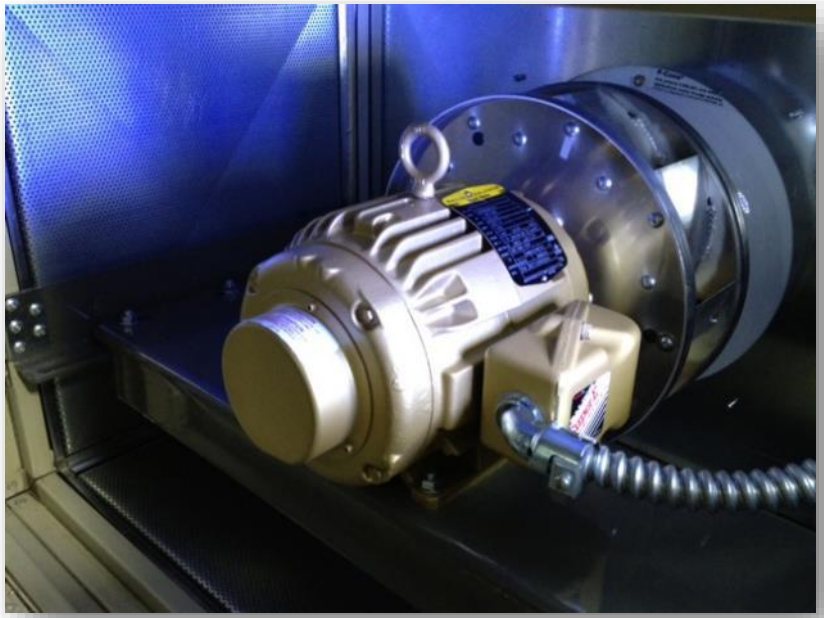
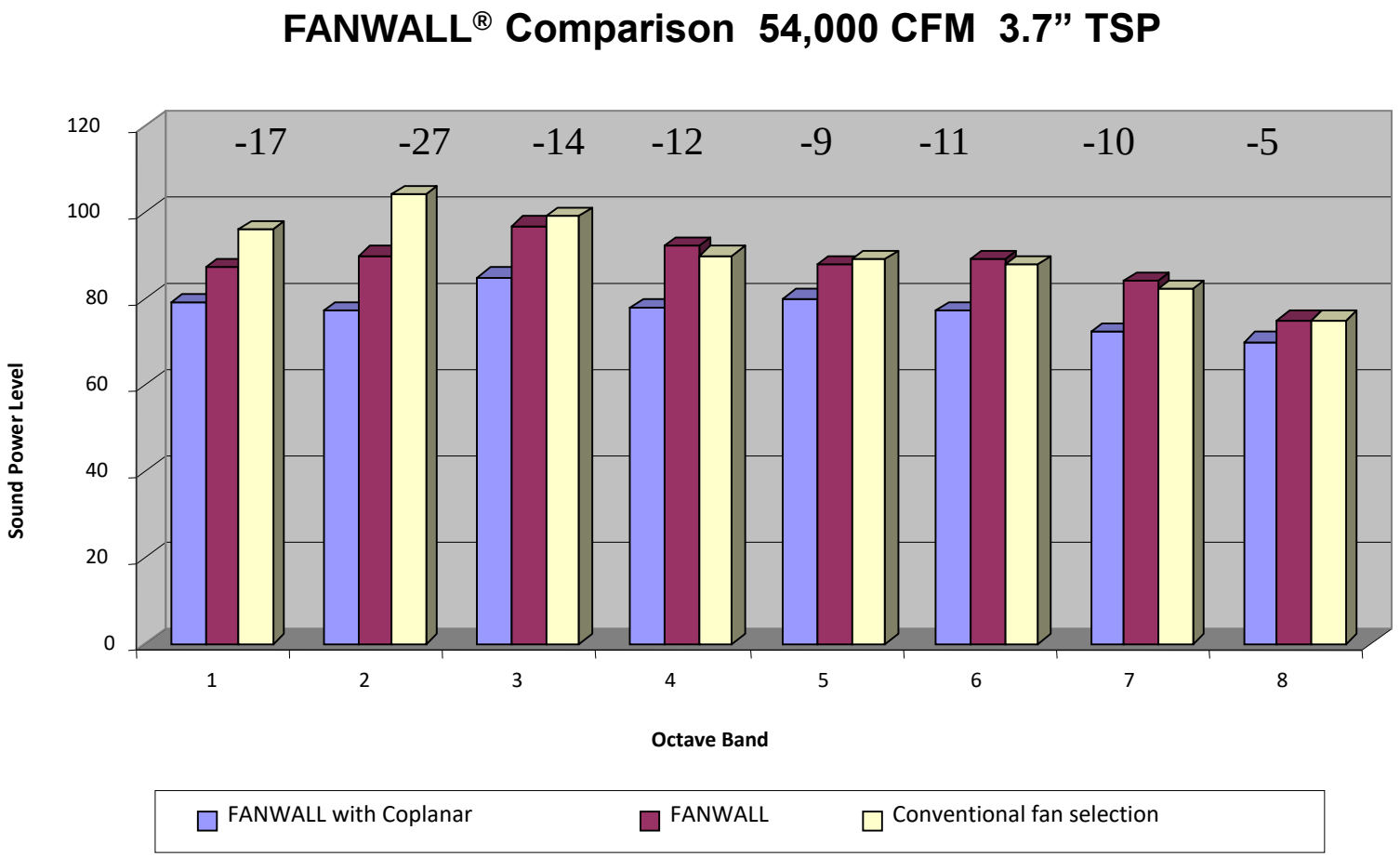
FANWALL Coplanar Silencer®

- Silencer Package –
  - *No added airway length for splitters*
  - *No added pressure drop*
  - *Relatively low cost*



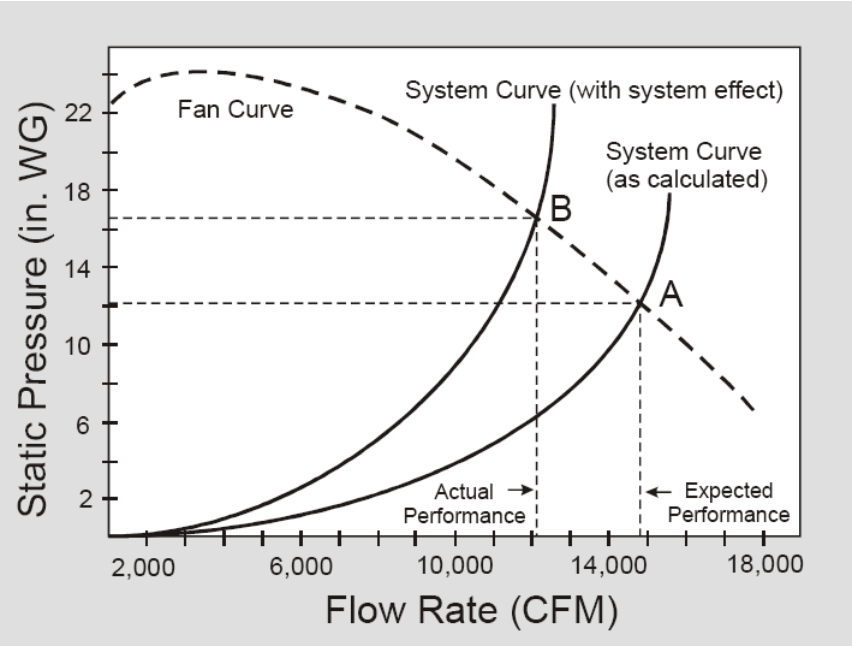
FANWALL - Coplanar Silencer Advantage

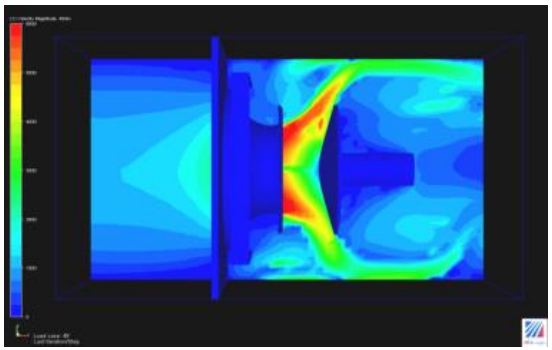


Systems Effect Has Huge Impact On Energy

Advantage 4

- The difference between Curve A and Curve B is caused by system effect.
- An airstream develops swirls and vortices and uneven flow distributions caused by interference with system components. The net result is that actual total pressure drops (losses) are higher than the theoretical loss would indicate.
- Systems that are composed of straight, open paths are conducive to low (pressure drop) losses and a much lower system effect
- A FANWALL array has a lower system effect than larger single fan systems.





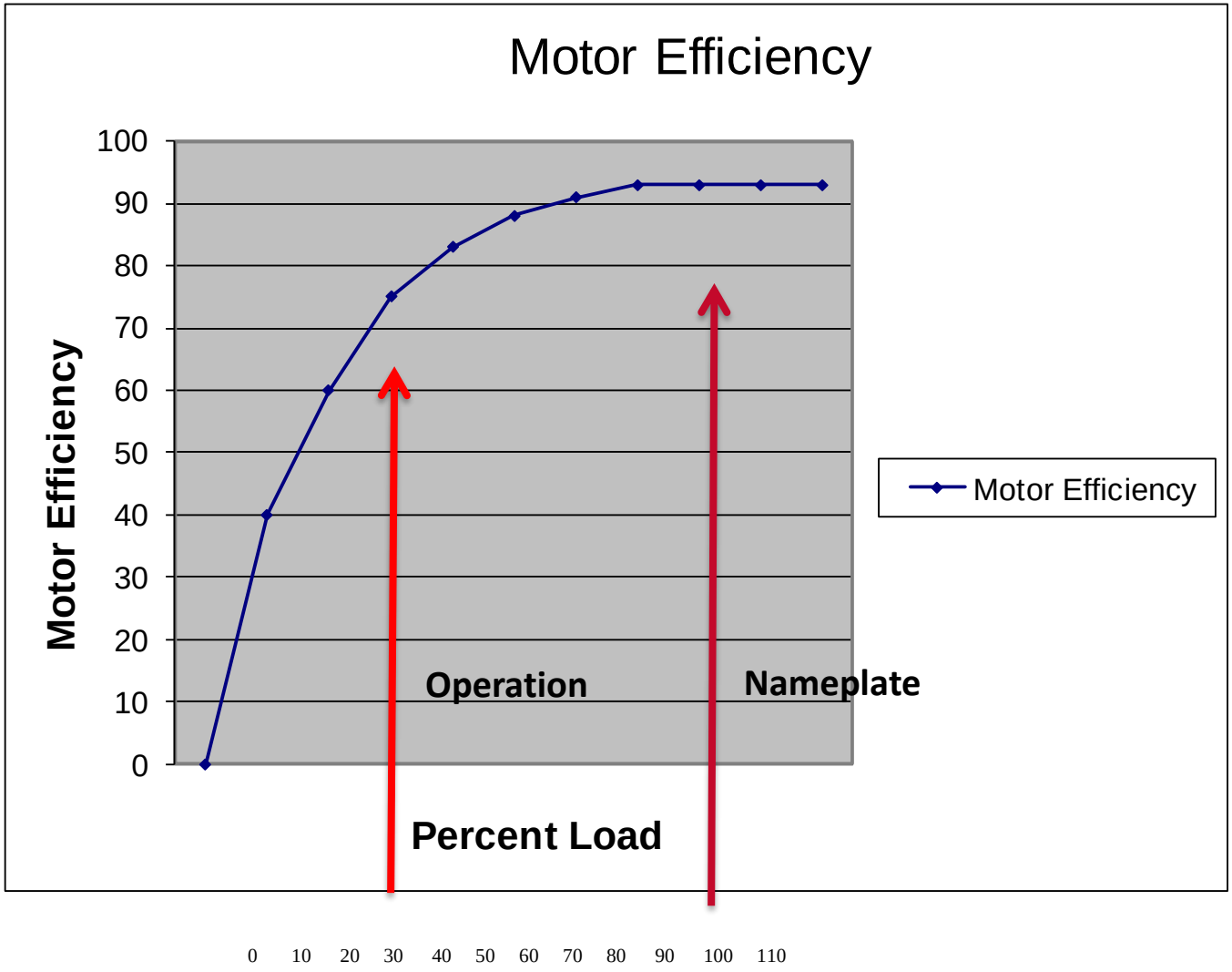
Lower Power Consumption

Matched Motor HP

- 17 additional options to more closely match required BHP
  - *Reduce total connected horsepower*
  - *Reduce wire sizing and associated electrical costs*

Typical Horsepower Selections	Expanded Horsepower Selections
1.0	1.0
3.0	1.5
	2.0
	2.5
	3.0
5.0	3.5
	4.0
	4.5
	5.0
7.5	5.5
	6.0
	6.5
	7.0
	7.5
10.0	8.0
	8.5
	9.0
	9.5
	10.0
15.0	10.5
	11.0
	11.5
	12.0
	15.0

Motor Efficiency Curve

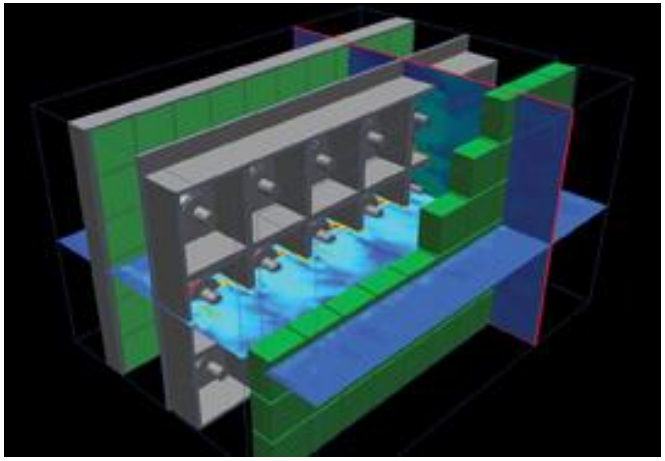


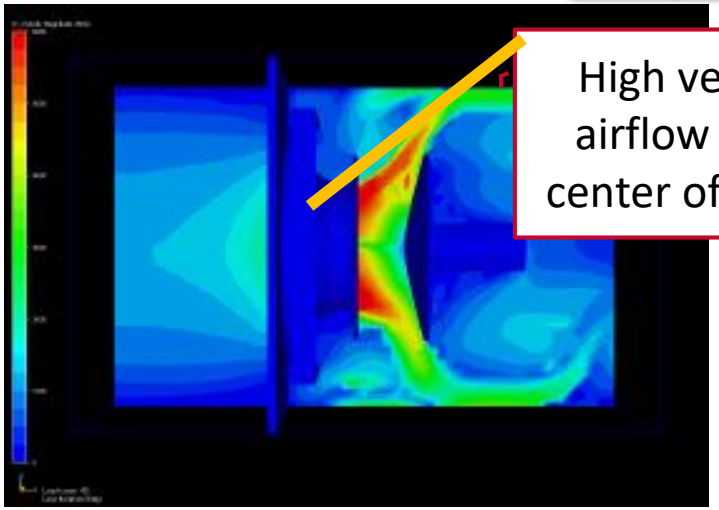
Airflow Uniformity

Impacts Filtration and Coil Performance

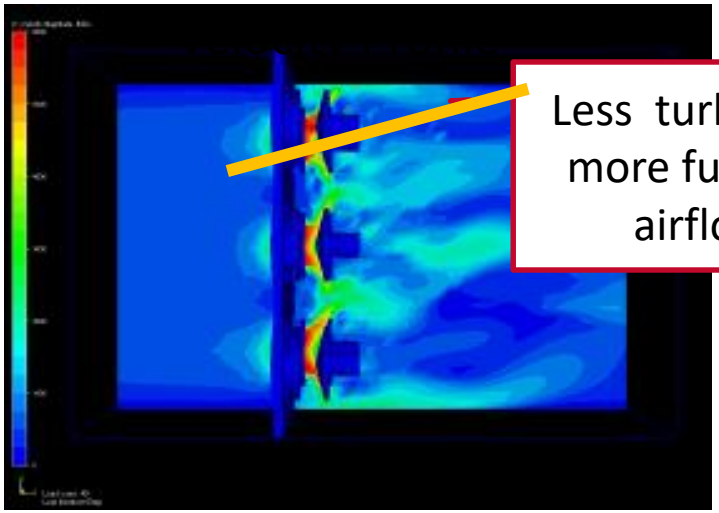
Advantage 5

- FANWALL array creates a “piston of air” through the air tunnel
- Improves heat transfer of heating/cooling coils by utilizing near full-face area
- Extends filter life by using near full-face area
- Lower system effect in a FANWALL array lowers energy use





Large Diameter Fan



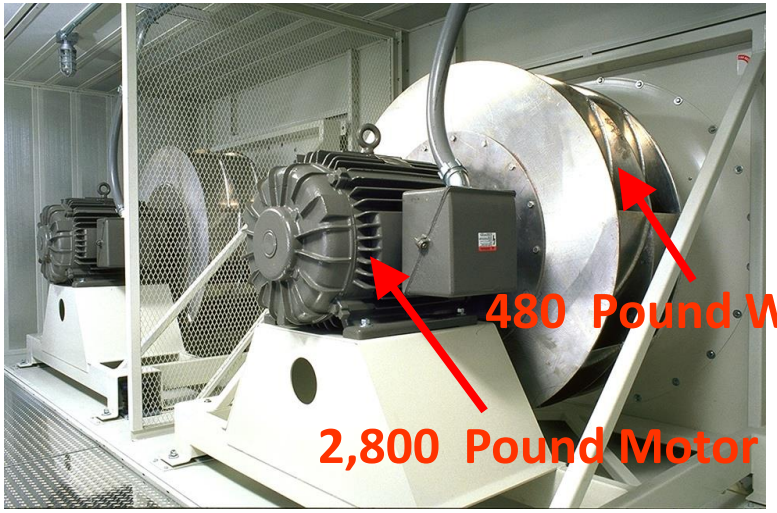
FANWALL Array

Reduced Maintenance

With FANWALL TECHNOLOGY

Advantage 6

Vs.



FANWALL® Cell

- 150 lb motor
- 18 lb wheel
- No belts to maintain
- No bearings to grease

Dual Fans

- 2800 lb motor
- 480 lb wheels
- Bearings to grease periodically
- (Belts to adjust/change annually if Arr. 3)

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Ease of Performing Fan Retrofits

Design for Reliability - Plan for Failure

Advantage 7

FANWALL® Cell Replacement

Vs.

Dual Fan Unit Replacement

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System Optimization Controls

Individual On/Off Control of Fans For FANWALL® Systems

Advantage 8

- Improved control algorithms
  - *Dynamic staging to optimize performance*
  - *Captures and communicates performance metrics*
- Individual VFD control
  - *Eliminates motor circuit ground fault issues*
  - *Eliminates bypass VFD*
  - *Reduces control panel size*
  - *Reduces unit main wire sizing*
- Near zero net system effect FBD back draft damper is standard
- Standalone or BAS interface

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FANWALL Key Design Principles

Recap

1. Keep motor and fan size down to serviceable size
2. Reliability through redundancy in multiple fans
3. Smaller diameter fans produce less low frequency sound and vibration, and higher frequency sound is easier to attenuate with integral coplanar silencer -you will often eliminate expensive, energy hog sound traps
4. Motors can be operated near peak efficiency during part-load conditions by shutting off fans
5. Create a “piston of air” through the air tunnel to maximize use of heat exchanger and filter surface areas
6. No belt or bearing maintenance
7. Cells fit through a doorway for easy fan retrofits

Today's Plan

- Nortek Overview
- The FANWALL® Advantages
- Latest FANWALL Innovations

Newest Innovations

Advancing the Technology

- Gen II Fan Cell
- ECMi Polymer Wheel

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FANWALL® Gen-II Fan Cell

Advantage 9

FANWALL® Gen-II Fan Cell

- Reduced weight
- Space saving
- Dimensional flexibility

Discharge View

Inlet View

Introduction to ebm-papst & EC Technology

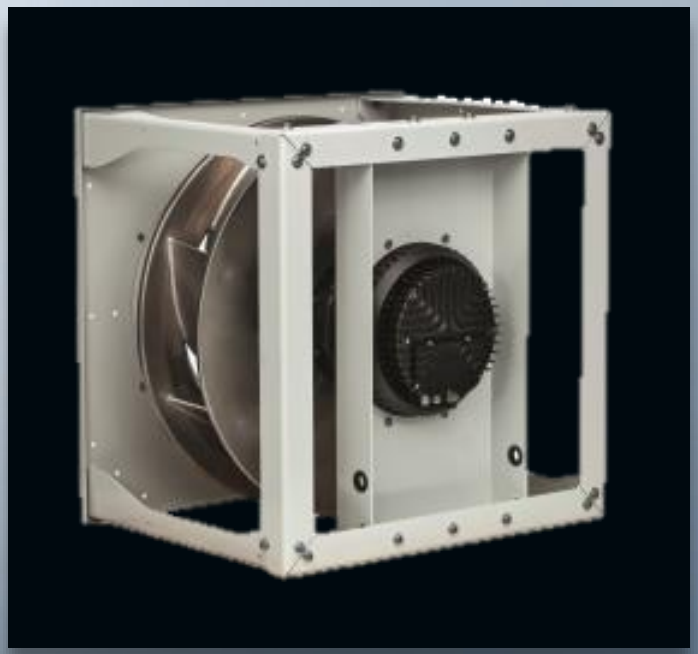
- SVL

ebmpapst

The engineer's choice

GREEN TECH

- **The Next Great Evolution in Fan Systems**
  - *Range from simple fan trays to complex, Multi-fan configurations*



Competencies

Three Core Technologies

High Efficiency Permanent Magnet External Rotor Motor

Integrated Drive Electronics

Aerodynamically Optimized Impeller and Inlet Ring

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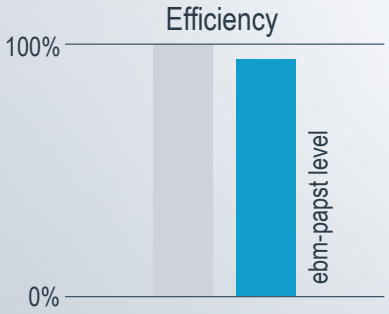
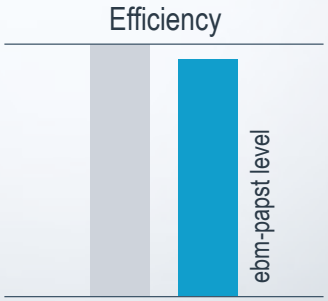
Our Core Competences

Where is the Potential?

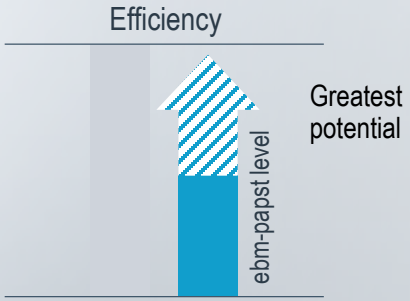
Electronics



Motor technology



Aerodynamics



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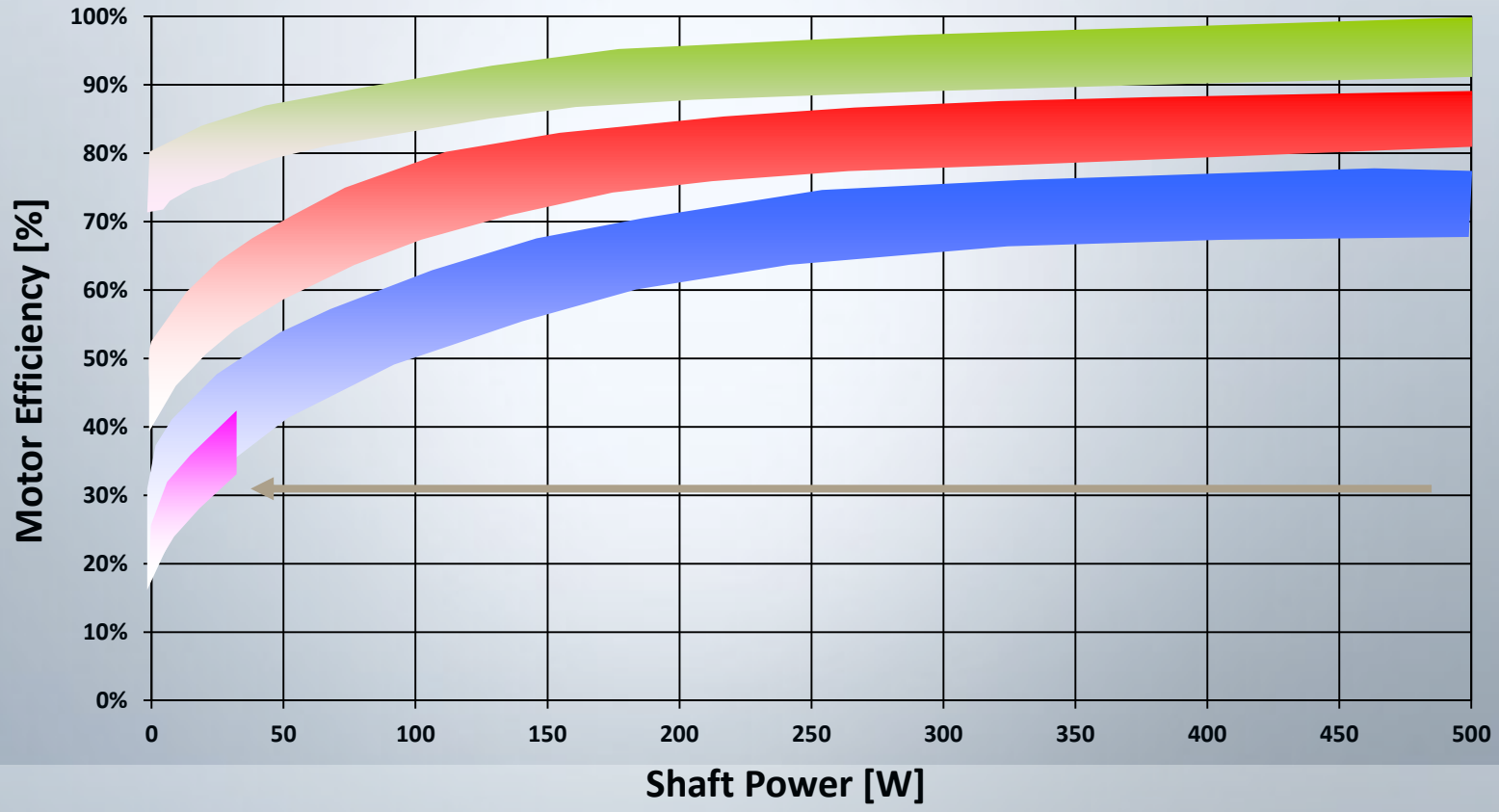
Different Types of Motors
and Their Efficiencies



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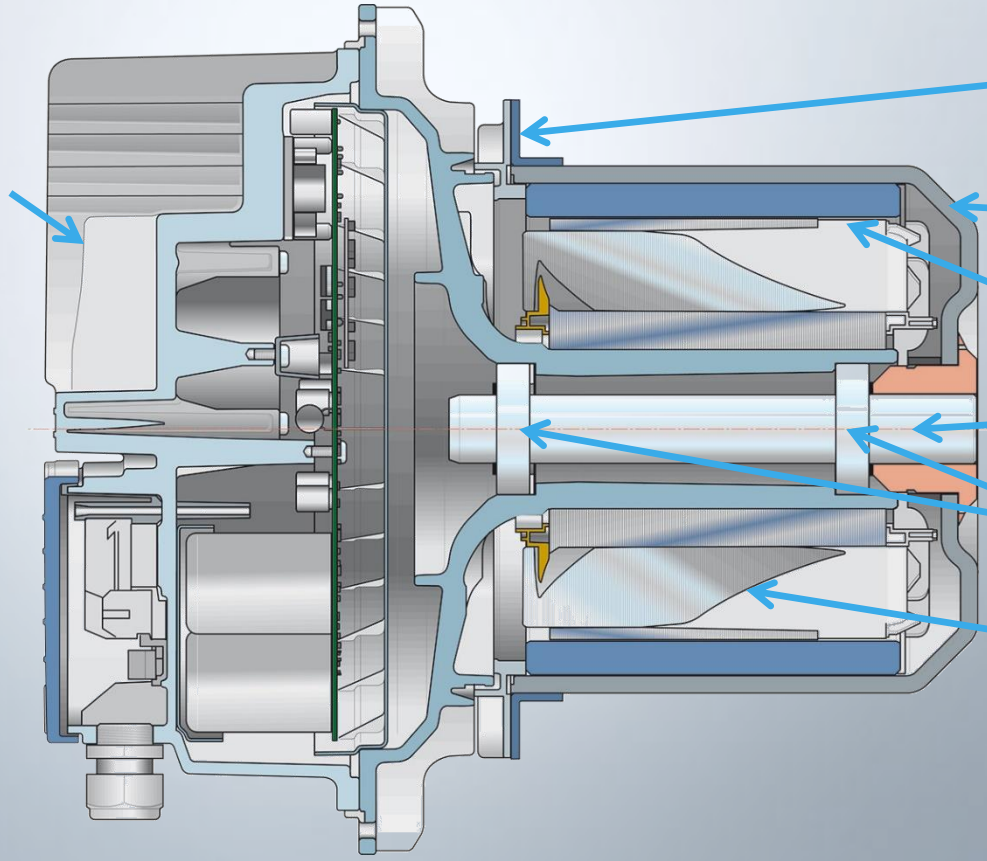
EC External Rotor Motor

Design Overview



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Impeller Technology

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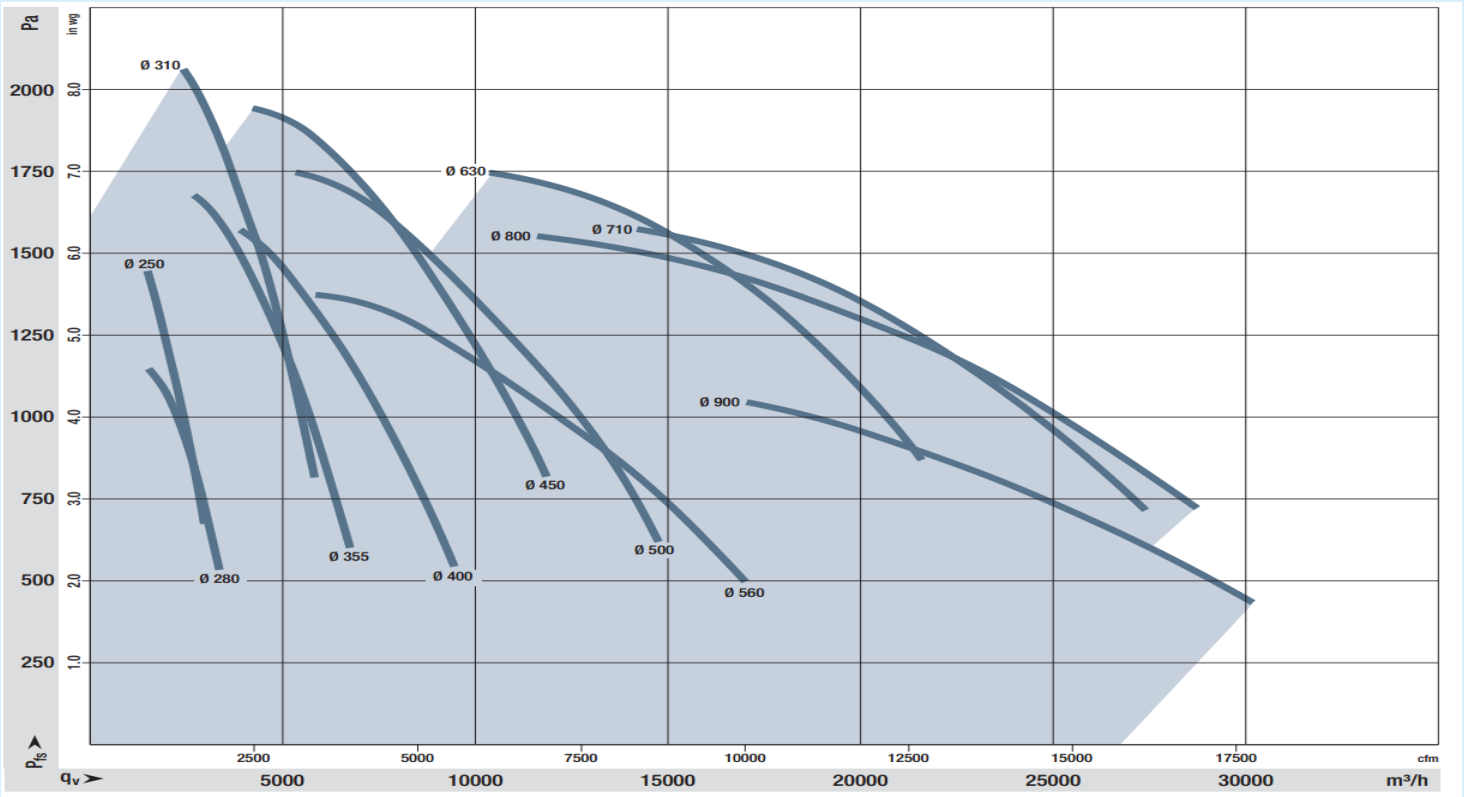
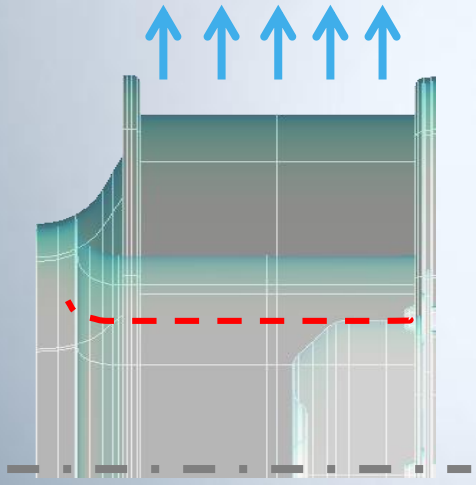
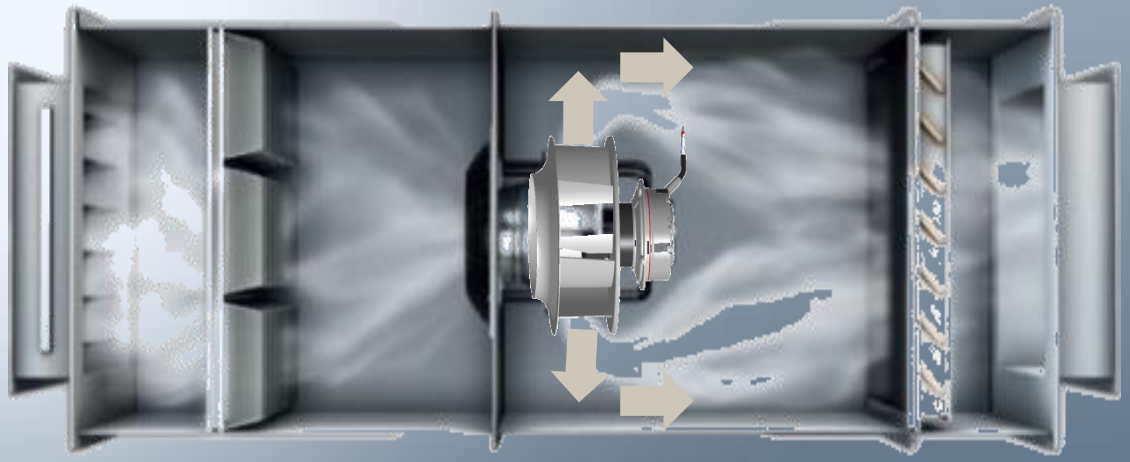
RadiPac II - Performance Range



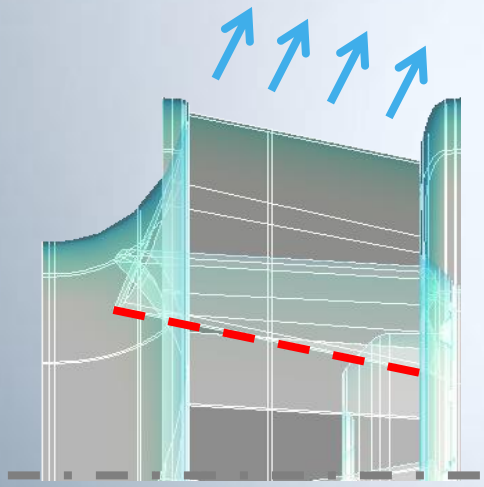
RadiPac
Interaction Fan - AHU



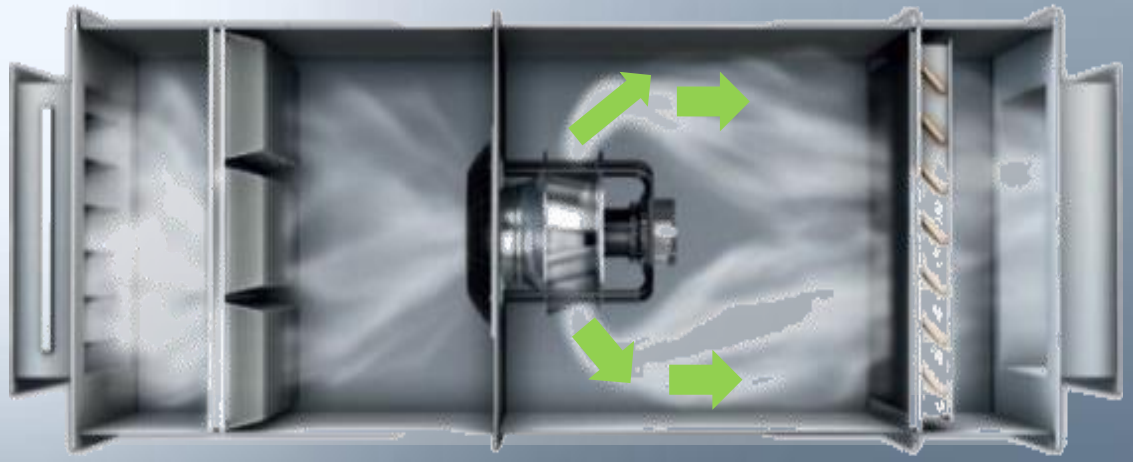
Fan Mounted in AHU – Old Flow Pattern



RadiPac
Interaction Fan - AHU



Fan Mounted in AHU – New Impeller Flow Pattern



6

FanGrid:
Multi-Fan
Grid Array

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Thank You

Credit: Nortek Air Solutions