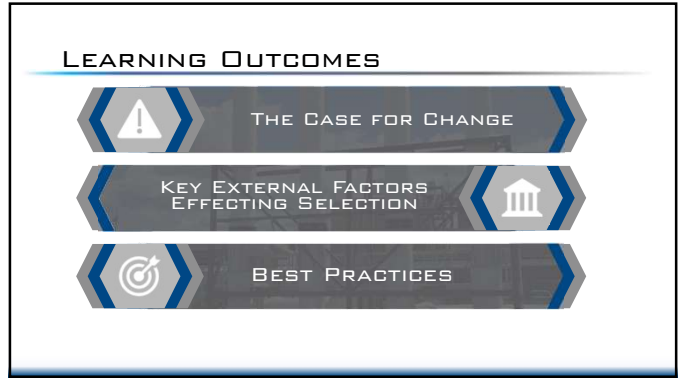




1



2



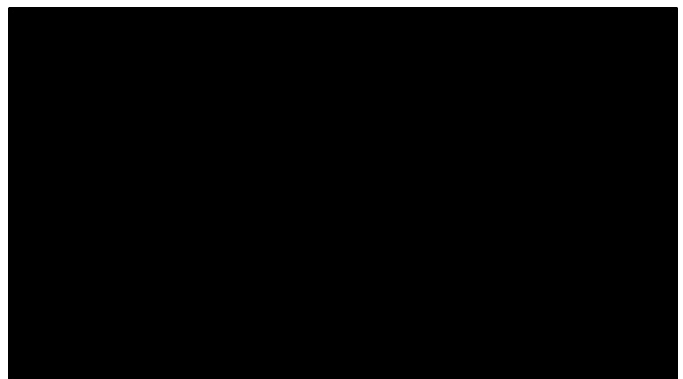
3



4



5



6

ENERGY CONSUMPTION

Share of total U.S. energy consumption by end-use sectors, 2020
Total = 92.94 quadrillion British thermal units

commercial 18%
residential 22%
transportation 27%
industrial 33%

“Commercial and Industrial buildings account for approximately 51% of total U.S. energy use.”

U.S. ENERGY INFORMATION ADMINISTRATION, APRIL 2021

7

ENERGY CONSUMPTION

THE YEARLY CONSUMPTION OF COMMERCIAL & INDUSTRIAL FANS 2020 US ENERGY CONSUMPTION 27,238,916,784,001 KWH

7.6%

WHAT WE CAN DO - 1% REDUCTION
EXTRA HOUSEHOLDS TO POWER
25.6M HOUSEHOLDS

BASED ON AVERAGE HOUSEHOLD CONSUMPTION OF 10,649 KWH / YEAR

SAVINGS
\$34.2 BILLION

BASED ON AVERAGE US ELECTRICITY RATE OF 12.55 CENTS / KWH

8

SAFETY – PANDEMIC

ASHRAE RECOMMENDATIONS FOR COVID-19

- 24/7 OPERATION - ASHRAE 62.1 AIRFLOW RECOMMENDATIONS
- MERV 13 FILTRATION
- ULTRAVIOLET GERMICIDAL DISINFECTION
- PORTABLE ROOM CLEANERS WITH HEPA FILTER
- INCREASE OUTSIDE AIR

9

SAFETY

NHAPS – Nation, Percentage Time Spent

Total n = 9,196

IN A RESIDENCE (68.7%)
OFFICE-FACTORY (5.4%)
BAR-RESTAURANT (1.8%)
OTHER INDOOR LOCATION (11%)
IN A VEHICLE (5.5%)
OUTDOORS (7.6%)
TOTAL TIME SPENT INDOORS (86.9%)

Indoor Air Quality
90% of time spent indoors
2-5x Common Indoor Air Pollutants

Common Indoor Air Pollutants: Volatile Organic Compounds (VOCs), Carbon Dioxide, Radon, Particulate Matter, Nitrogen Dioxide, Ozone, Formaldehyde, Lead, Asbestos, Mold, and Microbes.

NATIONAL HUMAN ACTIVITY PATTERN SURVEY

FUNDED BY EPA (ENVIRONMENTAL PROTECTION AGENCY)

10

INDOOR AIR QUALITY

20%
30%
World Health Organization

ESTIMATED PERCENTAGE OF BUILDINGS WITH COMPLAINTS RELATED TO INDOOR AIR QUALITY

REAL CONSEQUENCES

U.S. INDIRECT COSTS, INCLUDING MISSED WORK AND LOST PRODUCTIVITY

- ASTHMA: \$5 BILLION / YEAR
- ALLERGIC RHINITIS: \$9.7 BILLION / YEAR

ASTHMA & ALLERGY FOUNDATION OF AMERICA, 2021

ENVIRONMENTAL LITIGATION

DANGEROUS INDOOR AIR QUALITY AND SICK BUILDING SYNDROME ARE A GROWING AREA OF LAW FOR LAWYERS IN THE AREAS OF PERSONAL INJURY, REAL ESTATE, CONSTRUCTION, HOMEOWNER ASSOCIATIONS AND BUSINESS.

11

RETURN ON INVESTMENT

PROFESSIONAL PRODUCTIVITY

AVERAGE PRODUCTIVITY SAVINGS OF PROPER VENTILATION
\$6,500 / PERSON / YEAR

AVERAGE COST OF PROPER VENTILATION
\$40 / PERSON / YEAR

RETURN ON INVESTMENT
16,250%

U.S. DEPARTMENT OF LABOR AND HARVARD UNIVERSITY STUDY, 2017

STUDENT PERFORMANCE

“54% OF PUBLIC SCHOOL DISTRICTS NEEDED TO UPDATE OR REPLACE MULTIPLE BUILDING SYSTEMS OR FEATURES IN THEIR SCHOOLS”

U.S. GOVERNMENT ACCOUNTABILITY OFFICE, JUNE 2020

PROPER VENTILATION:
REDUCES RATE OF ABSENTEEISM
IMPROVES OVERALL HEALTH AND PRODUCTIVITY OF TEACHERS
IMPROVES TEST SCORES

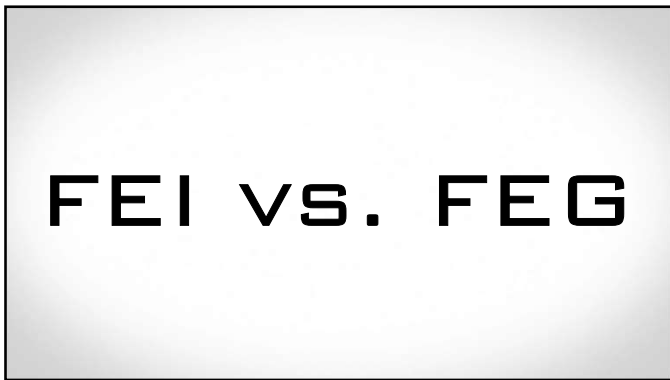
12



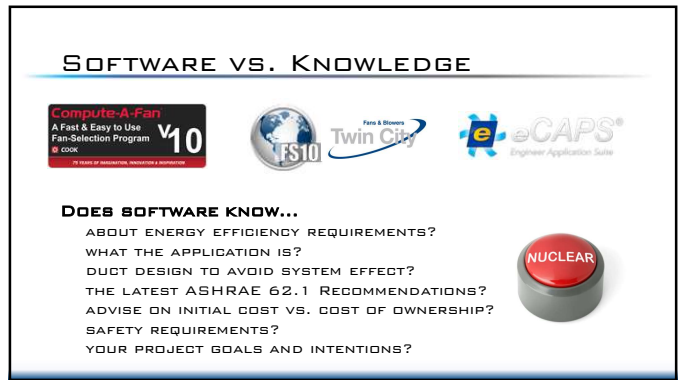
13



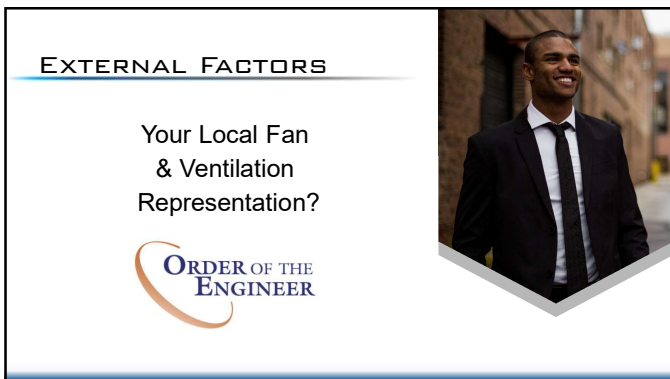
14



15



16



17



18

SELECTION STORY # 1

Mike Johnson, the owner of Wood Cutters Direct has reached out to you because they need to add additional dust collection lines to their Manufacturing facility. Through a discussion you have determined that the fan will be on the clean side of the dust collector and that it will require **30,000 CFM at 10 inches** of static pressure when the filters require cleaning.

Some key facts that you have uncovered are:

- Sanding equipment will be used in the system
- There is currently no process set up for fan maintenance at the facility
- When the filters are clean the system requires the fan to overcome 6 inches of static pressure
- The collector currently does not have a mechanism to shut off in the event a filter is ruptured or breaks.
- The fan is outdoors located on a large concrete pad



19

WHAT TYPE OF FAN IS IT?



CENTRIFUGAL

AXIAL

INLINE / ROOF EXHAUST

20

SINGLE WIDTH OR DOUBLE WIDTH?



SWSI

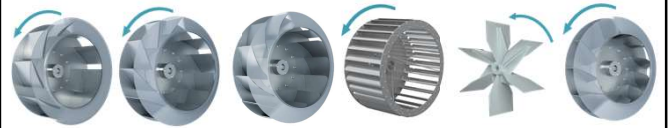


DWDI

21

WHAT CENTRIFUGAL IMPELLER?

AIRFOIL	BACKWARD INCLINED	BACKWARD CURVED	FORWARD CURVED	RADIAL BLADE	RADIAL TIP
Very High Efficiency	High Efficiency	Higher Efficiency	Medium Efficiency	Low Efficiency	Medium - Low Efficiency
Energy savings are of prime importance	Energy savings are important but other factors do not allow for airfoil	Similar effects to airfoil	Low Speed, Noise	Airstream contains heavy particulate or corrosive elements	Airstream contains light particulate and corrosive elements
Clean Air, AHU	Clean Air, AHU, Dust Collection, pneumatic conveying	Clean Air	Clean Air, Residential, Low Cost AHU	Dust Collection	

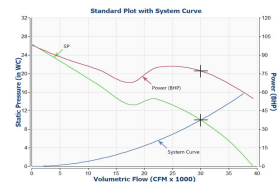


22

AXIAL FANS

Fan Information
 Fan Model: SWSI
 Volumetric Flow (CFM): 3000
 Static Pressure (in. WC): 10
 Blade Angle: 2°
 Power (HP): 2.43
 RPM: 1150
 Outer Dia (FPM): 42.00
 Motor (HP): 2.50
 Density (lb/ft³): 0.075

Adjusted to:



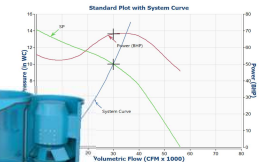
Back to Type of Fan

23

OTHER FAN TYPES

Fan Information
 Fan Model: SWSI
 Volumetric Flow (CFM): 3000
 Static Pressure (in. WC): 10
 Power (HP): 2.43
 RPM: 1150
 Outer Dia (FPM): 42.00
 Motor (HP): 2.50
 Density (lb/ft³): 0.075

Adjusted to:

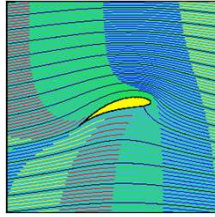


Back to Type of Fan

24

AIRFOIL

- Is the filter media of the dust collector a bag or a cartridge?
- Does the owner have a fan/collector maintenance schedule?



[Back to Type of Impeller](#)

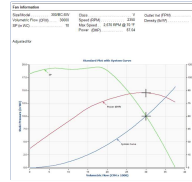
[Back to Type of Fan](#)

25

BACKWARD INCLINED

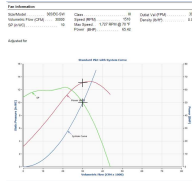


SIZE 300



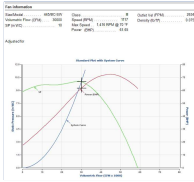
[Back to Type of Impeller](#)

SIZE 365



[Back to Type of Fan](#)

SIZE 445



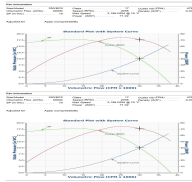
[Final Selections](#)

26

BACKWARD CURVED

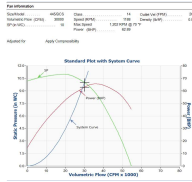


SIZE 330



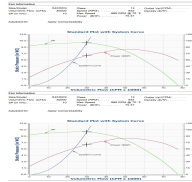
[Back to Type of Impeller](#)

SIZE 445



[Back to Type of Fan](#)

SIZE 542



[Final Selections](#)

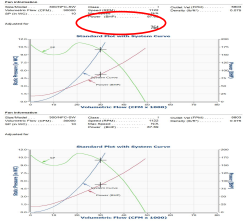
27

FORWARD CURVED



- Too Fast RPM
- Outlet Velocity

SIZE 300



[Back to Type of Impeller](#)

[Back to Type of Fan](#)

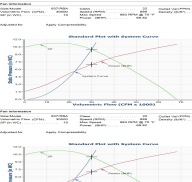
[Final Selections](#)

28

RADIAL BLADE

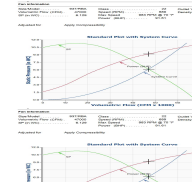


DIRTY FILTERS



[Back to Type of Impeller](#)

CLEAN FILTERS



[Back to Type of Fan](#)

[Final Selections](#)

Possible Solution:

- Outlet Damper
- VFD

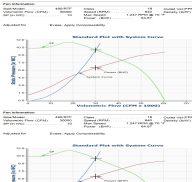
Outlet Velocity?

29

RADIAL TIP

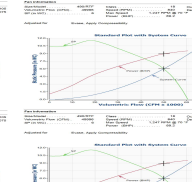


DIRTY FILTERS



[Back to Type of Impeller](#)

CLEAN FILTERS



[Back to Type of Fan](#)

[Final Selections](#)

Possible Solution:

- Outlet Damper
- VFD

30

OPTIONS - SELECTION

OPTION 1

BACKWARD INCLINED SIZE 365

COST : 1.0

OPTION 2

BACKWARD CURVED SIZE 445

COST : 1.12

OPTION 3

RADIAL TIP SIZE 490

COST : 2.87

31

OPTIONS - SELECTION

OPTION 1

BACKWARD INCLINED SIZE 365

COST : 1.0

OPTION 2

BACKWARD CURVED SIZE 445

COST : 1.12

OPTION 3

RADIAL TIP SIZE 490

COST : 2.87

32

OPTIONS - SELECTION

OPTION 1

BACKWARD INCLINE SIZE 365

COST : 1.0

OPTION 2

BACKWARD CURVE SIZE 445

COST : 1.12

OPTION 3

RADIAL TIP SIZE 490

COST : 2.87

33

DIRECT DRIVE OR BELT DRIVEN?

Fan Information

Model: 3050-001 Class: 0 Outlet CFM: 394
 Volume Flow (CFM): 3000 Total RPM: 1500 Density (lb/ft³): 0.075
 SP (inWG): 10 Max Speed: 1321 RPM @ 7.77
 Power (BHP): 65.42

Adjuster:

34

WHAT MOTOR?

TEFC

75 HP | 1800 RPM | 460V

ION

IP

35

WHAT ARRANGEMENT?

ARRANGEMENT 9

BELT DRIVEN
MOTOR MOUNTED ON PEDestal

ARRANGEMENT 1

BELT DRIVEN
MOTOR MOUNTED ON FLOOR OR FAN BASE

75 HP | 1800 RPM | 460V = 1200+ LBS.

36

WHAT MOTOR POSITION?



37

DO WE NEED A BASE?



UNITARY BASE



ISOLATION BASE

38

IS DUST DANGEROUS?



2016 - ABBOTSFORD, BC

39

IS DUST DANGEROUS



Recent Explosions Caused by Dust – Videos Online

- May 2017 – Cambria, WI
Didion Milling Facility
- July 2017 – Switz City, IN
Jordan White Farms Grain Bin Collapse
- May 2018 – Sioux City, NE
Andersen Farms Grain Elevator

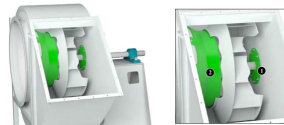
40

IS DUST DANGEROUS?



AMCA TYPE B

IN THIS CASE ~25% ADD



Type C

AMCA TYPE C

IN THIS CASE ~5% ADD

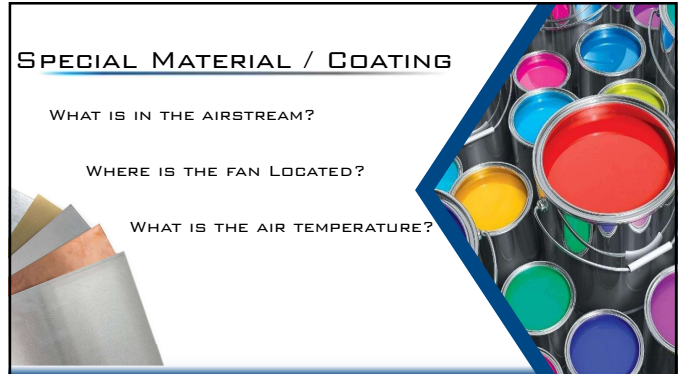
41

SPECIAL MATERIAL / COATING

WHAT IS IN THE AIRSTREAM?

WHERE IS THE FAN LOCATED?

WHAT IS THE AIR TEMPERATURE?



42

WHAT ACCESSORIES DO WE NEED?

ACCESS DOOR

BELT GUARD

SHAFT SEAL

SHAFT AND BEARING GUARD

43

WHAT ACCESSORIES DO WE NEED?

FLEX CONNECTORS

SILENCER

OUTLET DAMPER

DRAIN

44

CONGRATULATIONS!

A SATISFIED CUSTOMER IS THE BEST BUSINESS STRATEGY OF ALL

45

SOME OTHER CENTRIFUGAL APPLICATIONS

AIR HANDLING UNITS

AERATION SYSTEMS

ROOF EXHAUST

DRYING / OVENS

PNEUMATIC CONVEYING

POLLUTION CONTROL

46

AIR HANDLING UNITS – SUPPLY FANS

DOUBLE WIDE

PLENUM FAN

PLENUM FAN ARRAY

40,000 CFM @ 6.5" WC





47

AIR HANDLING UNITS – FAN COMPARE

Metric	Double Wide	Single Plenum	4 Fan Array	16 Fan Array
Fan BHP				
System BHP				
Static Efficiency				
Total System FEI				
Individual Fan FEI*				
System FEP (KW)				
System LwA (db)				
EQ FLH				
KVAH				
Elec Rate				
Operating Cost				
Delta				
System Cost				

48





AIR HANDLING UNITS – FAN COMPARE

Metric	Double Wide	Single Plenum	4 Fan Array	16 Fan Array
Fan BHP	51.68	55.43	14.69	3.77
System BHP	53.75	55.43	58.76	60.32
Static Efficiency	79.3%	74.0%	69.8%	68.0%
Total System FEI	1.27	1.27	1.25	1.22
Individual Fan FEI*	1.27*	1.27*	1.28*	1.34*
System FEP (KW)	44.04	45.41	46.13	47.35
System LwA (db)	103	96	96	99
EQ FLH	6000	6000	6000	6000
KWH	240,585	248,104	263,009	269,992
Elec Rate	.12	.12	.12	.12
Operating Cost	\$28,870	\$29,772	\$31,561	\$32,399
Delta	Base	\$902	\$2691	\$3529
System Cost	1.15	1.0	1.58	3.23

49





AIR HANDLING UNITS – FAN COMPARE

Metric	Double Wide	Single Plenum	4 Fan Array	16 Fan Array
Fan BHP	51.68	55.43	14.69	3.77
System BHP	53.75	55.43	58.76	60.32
Static Efficiency	79.3%	74.0%	69.8%	68.0%
Total System FEI	1.27	1.27	1.25	1.22
Individual Fan FEI*	1.27*	1.27*	1.28*	1.34*
System FEP (KW)	44.04	45.41	46.13	47.35
System LwA (db)	103	96	96	99
EQ FLH	6000	6000	6000	6000
KWH	240,585	248,104	263,009	269,992
Elec Rate	.12	.12	.12	.12
Operating Cost	\$28,870	\$29,772	\$31,561	\$32,399
Delta	Base	\$902	\$2691	\$3529
System Cost	1.15	1.0	1.58	3.23

50

AIR HANDLING UNITS – FAN COMPARE

Metric	Double Wide	Single Plenum	4 Fan Array	16 Fan Array
Fan BHP	51.68	55.43	14.69	3.77
System BHP	53.75	55.43	58.76	60.32
Static Efficiency	79.3%	74.0%	69.8%	68.0%
Total System FEI	1.27	1.27	1.25	1.22
Individual Fan FEI*	1.27*	1.27*	1.28*	1.34*
System FEP (KW)	44.04	45.41	46.13	47.35
System LwA (db)	103	96	96	99
EQ FLH	6000	6000	6000	6000
KWH	240,585	248,104	263,009	269,992
Elec Rate	.12	.12	.12	.12
Operating Cost	\$28,870	\$29,772	\$31,561	\$32,399
Delta	Base	\$902	\$2691	\$3529
System Cost	1.15	1.0	1.58	3.23

51

AIR HANDLING UNITS – DIFFUSER TECH

Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71


Outlet dB: 98 99 98 94 91 86 80 74

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71

Outlet dB: 98 99 99 94 89 82 75 72



52

AIR HANDLING UNITS – DIFFUSER TECH

Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71


Outlet dB: 98 99 98 94 91 86 80 74

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71

Outlet dB: 98 99 99 94 89 82 75 72



53

AIR HANDLING UNITS – DIFFUSER TECH

Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Estimated Sound Pressure

Distance: 1 3 5

Inlet dBA: 93 83 79

Outlet dBA: 96 86 82

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71


Outlet dB: 98 99 98 94 91 86 80 74

Sound Power Levels

Octave: 1 2 3 4 5 6 7 8 LwA

Inlet dB: 93 98 98 87 83 79 74 71

Outlet dB: 98 99 99 94 89 82 75 72



54

AIR HANDLING UNITS – DIFFUSER TECH

Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96

Estimated Sound Pressure

Distance 1 3 5

Inlet dB 83 83 79


Outlet dB 91 85 82

Estimated Sound Pressure

Distance 1 3 5

Inlet dB 83 83 79


Outlet dB 91 85 82



55

AIR HANDLING UNITS – DIFFUSER TECH


Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96
EQ FLH	6000	6000
KWH	248000	237000
Elec Rate	.12	.12
Operating Cost	\$29,760	\$28440
Delta First Cost	Base	\$1,320
Cost Diffuser	-	~\$1500
Payback	-	Under 14 Months



56

AIR HANDLING UNITS – DIFFUSER TECH


Metric	Single Plenum	Single Plenum w/ Diffuser
Fan BHP	55.43	52.90
System BHP	55.43	52.90
S.E.	74.0%	77.5%
Fan FEI	1.27	1.33
Fan FEP (KW)	45.41	43.34
System FEI	1.27	1.33
System FEP (KW)	45.41	43.34
System LwA (db)	96	96
EQ FLH	6000	6000
KWH	248000	237000
Elec Rate	.12	.12
Operating Cost	\$29,760	\$28440
Delta First Cost	Base	\$1,320
Cost Diffuser	-	~\$1500
Payback	-	Under 14 Months



57

AIR HANDLING UNITS – AIR VELOCITY


Metric	4 Fan Array	4 Fan Array
Coil / Filter Velocity (FPM)	500	450
CFM	40000	40000
Static	6.5	5
Fan BHP	14.69	11.34
System BHP	58.76	45.36
S.E.	69.8%	69.5%
Fan FEI	1.28	1.30
Fan FEP (KW)	11.78	9.09
System FEI	1.25	1.27
System FEP (KW)	46.13	35.62
System LwA (db)	96	88
EQ FLH	6000	6000
KWH	263009	203,031
Elec Rate	.12	.12
Operating Cost	\$31,561	\$24,363
Delta First Cost	Base	\$7,168



58

AIR HANDLING UNITS – AIR VELOCITY


Metric	4 Fan Array	4 Fan Array
Coil / Filter Velocity (FPM)	500	450
CFM	40000	40000
Static	6.5	5
Fan BHP	14.69	11.34
System BHP	58.76	45.36
S.E.	69.8%	69.5%
Fan FEI	1.28	1.30
Fan FEP (KW)	11.78	9.09
System FEI	1.25	1.27
System FEP (KW)	46.13	35.62
System LwA (db)	96	88
EQ FLH	6000	6000
KWH	263009	203,031
Elec Rate	.12	.12
Operating Cost	\$31,561	\$24,363
Delta First Cost	Base	\$7,168



59

AIR HANDLING UNITS – AIR VELOCITY

Metric	4 Fan Array	4 Fan Array
Coil / Filter Velocity (FPM)	500	450
CFM	40000	40000
Static	6.5	5
Fan BHP	14.69	11.34
System BHP	58.76	45.36
S.E.	69.8%	69.5%
Fan FEI	1.28	1.30
Fan FEP (KW)	11.78	9.09
System FEI	1.25	1.27
System FEP (KW)	46.13	35.62
System LwA (db)	96	88
EQ FLH	6000	6000
KWH	263009	203,031
Elec Rate	.12	.12
Operating Cost	\$31,561	\$24,363
Delta First Cost	Base	\$7,168



60

AIR HANDLING UNITS – AIR VELOCITY

Metric	4 Fan Array	4 Fan Array
Coil / Filter Velocity (FPM)	500	450
CFM	40000	40000
Static	6.5	9
Fan BHP	14.69	11.34
System BHP	58.76	45.38
S.E.	69.8%	69.5%
Fan FEI	1.28	1.30
Fan FEP (KW)	11.78	9.09
System FEI	1.25	1.27
System FEP (KW)	46.13	35.62
System LwL (db)	96	88
EQ FWH	6000	5000
KWH	293009	203,051
Elec Rate	.12	.12
Operating Cost	\$31,361	\$24,363
Delta First Cost	Base	57,168

61

AIR HANDLING UNITS – SUPPLY FANS




01. Making Love Out Of Nothing At All
 02. Having You Near Me
 03. Lonely Is the Night
 04. I Can Wait Forever
 05. Goodbye
 06. Here I Am
 07. Without You
 08. All Out Of Love
 09. Two Less Lonely People
 10. Even The Nights Are Better
 11. The Power Of Love
 12. Now And Forever
 13. Sweet Dream
 14. Lost In Love
 15. Just As I Am
 16. I'll Never Get Enough Of You

62

3 TAKEAWAYS

- We have a choice -
 - Increasing safety requirements
 - Energy efficiency is more important then ever
- Regulations are here and more are coming
- Every selection is different and important. Rely on the experts with your questions.




63

QUESTIONS?

64

COPYRIGHT MATERIALS

This educational material is protected by U.S. and International copyright laws. Reproduction, distribution, display and use of the educational activity without written permission of the presenter is prohibited.



©2021 Twin City Fan Companies, Ltd.

65