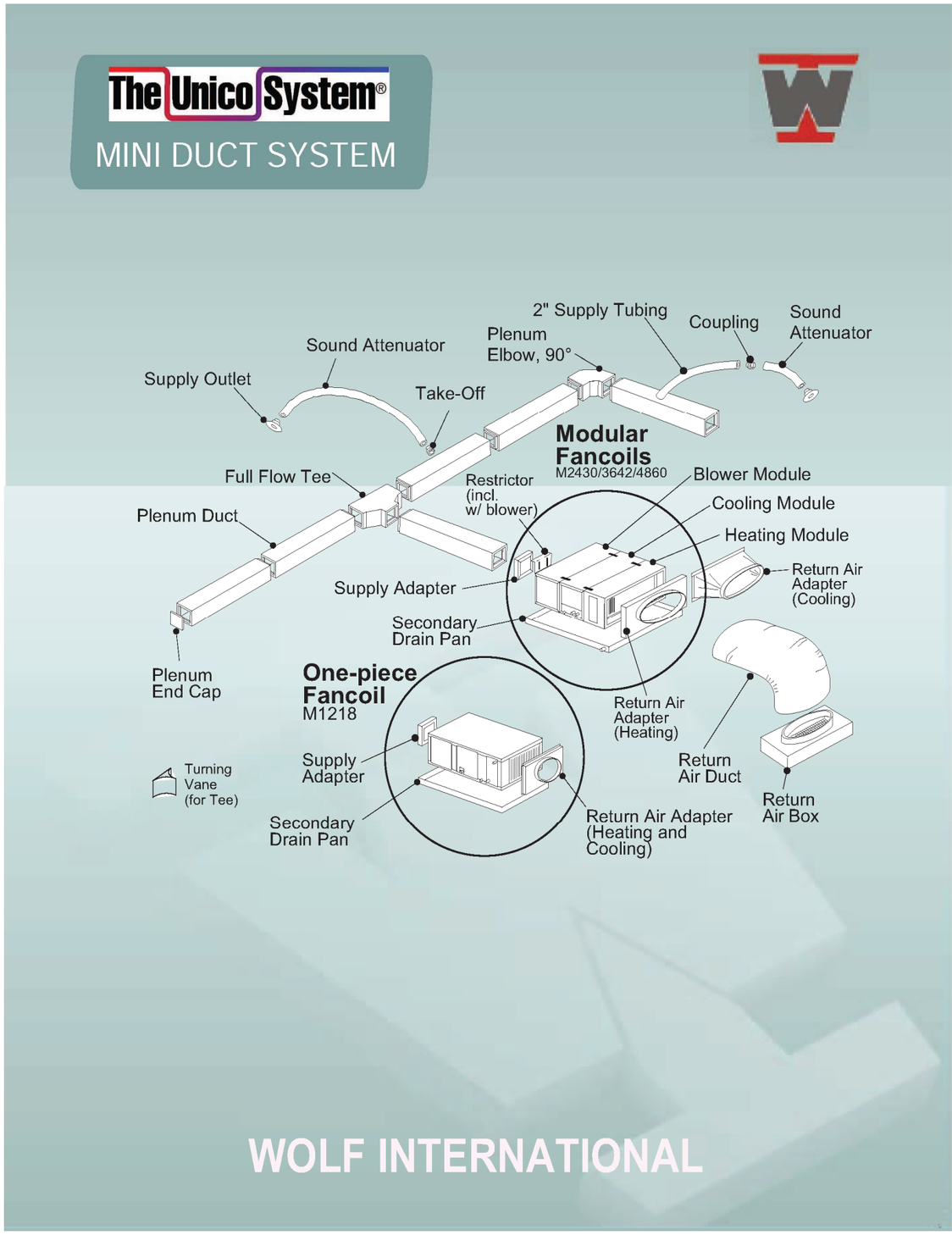
STANDARD DX SYSTEM
Vs
MINI DUCT SYSTEM

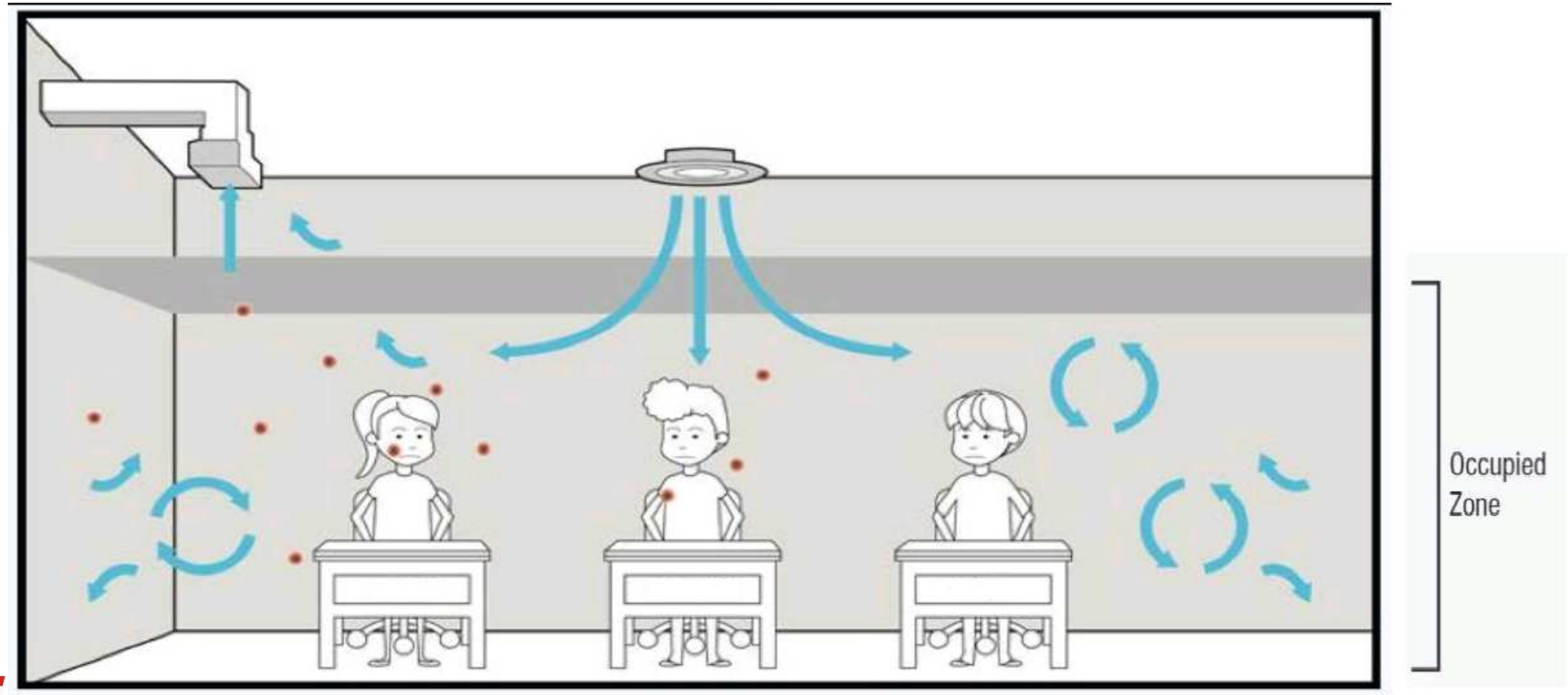
MINI DUCT SYSTEM IS POWER SAVING APPLICATION FOR

- OFFICES
- SCHOOLS
- SPORTS
- LARGE HALLS
- GYMNASIUMS
- THEATERS



STANDARD AC SYSTEM

- TYPICAL ROOM OF 10M X 10M.
- AIR SUPPLY & RETURN FROM CEILING.
- ROOM TEMP 75 ^{O}F (23.9 ^{O}C) / 50% RH
- AMBIENT TEMP 115 ^{O}F (46 ^{O}C) / 30% RH

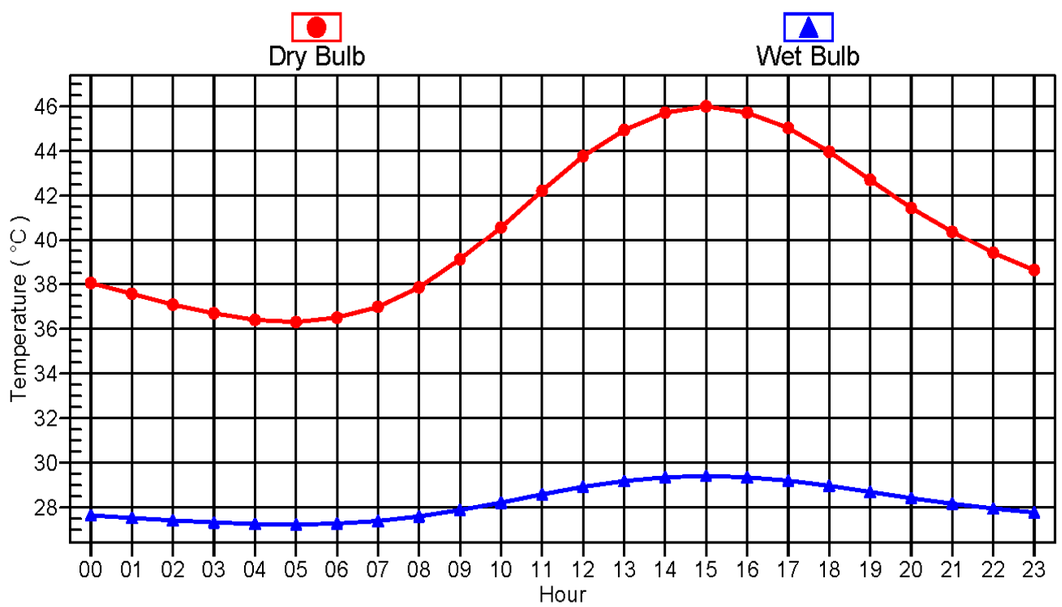


STANDARD AC SYSTEM – HEAT LOAD CALCULATION – AMBIENT DATA

Design Temperature Profile

MINI DUCT SYSTEM SAMPLE — 12/12/2020
WOLFrost INTERNATIONAL — 05:59PM

Design Temperature Profiles for July



Design Weather Parameters & MSHGs

MINI DUCT SYSTEM SAMPLE — 12/12/2020
WOLFrost INTERNATIONAL — 05:59PM

Design Parameters:

City Name	**Dubai**	
Location	**United Arab Emirates**	
Latitude	**25.2**	Deg.
Longitude	**55.3**	Deg.
Elevation	**16.0**	m
Summer Design Dry-Bulb	**46.0**	°C
Summer Coincident Wet-Bulb	**29.4**	°C
Summer Daily Range	**9.7**	°K
Winter Design Dry-Bulb	**12.2**	°C
Winter Design Wet-Bulb	**7.4**	°C
Atmospheric Clearness Number	**1.00**	
Average Ground Reflectance	**0.20**	
Soil Conductivity	**1.385**	W/(m-°K)
Local Time Zone (GMT +/- N hours)	**-4.0**	hours
Consider Daylight Savings Time	**No**	
Simulation Weather Data	**noneN/A**	
Current Data is	**User Modified**	
Design Cooling Months	**January to December**	

Design Day Maximum Solar Heat Gains

(The MSHG values are expressed in W/m²)

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	83.3	83.3	133.2	372.2	613.4	753.3	795.4	760.0	724.5
February	93.6	93.6	261.5	493.0	686.2	783.7	759.5	678.5	616.1
March	104.9	121.0	398.8	607.3	719.6	752.9	681.8	543.3	449.5
April	115.5	266.1	501.3	659.0	717.2	665.7	544.3	356.3	252.8
May	133.5	361.1	561.4	676.1	690.0	600.2	432.2	227.3	155.0
June	170.9	398.7	581.4	675.8	669.3	563.3	384.2	185.0	138.2
July	137.2	366.6	558.6	664.5	671.2	577.3	422.5	221.2	153.0
August	120.5	262.5	492.2	637.4	687.4	639.5	524.6	343.4	244.7
September	108.7	126.7	370.0	579.0	696.4	710.9	657.4	528.5	442.8
October	96.7	96.7	235.2	495.3	664.5	742.1	745.7	663.7	603.5
November	84.8	84.8	123.8	389.0	581.8	740.8	785.2	754.7	717.6
December	78.8	78.8	90.9	326.4	569.5	732.5	790.0	779.8	756.0
Month	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**HOR**	**Mult**
January	765.2	801.4	738.3	614.3	390.7	120.8	83.3	654.8	1.00
February	677.8	763.0	781.9	692.7	495.7	258.1	93.6	765.0	1.00
March	536.7	672.6	759.2	731.7	592.3	393.8	135.5	855.5	1.00
April	350.8	535.7	676.0	716.5	648.2	491.0	278.1	887.4	1.00
May	223.8	430.0	604.6	687.3	667.6	551.0	372.5	887.8	1.00
June	181.7	384.7	569.0	664.5	662.5	573.6	406.6	878.9	1.00
July	218.8	420.8	589.0	667.9	648.6	551.3	373.4	872.8	1.00
August	338.4	514.5	650.9	691.0	627.6	478.2	276.3	866.9	1.00
September	527.6	656.5	714.6	699.8	577.8	363.3	130.6	830.8	1.00
October	663.5	744.4	750.1	653.8	494.0	245.2	96.7	756.1	1.00
November	753.8	782.7	742.5	587.2	386.3	126.9	84.8	654.8	1.00
December	785.6	797.3	728.3	555.8	345.8	80.4	78.8	608.3	1.00

Mult. = User-defined solar multiplier factor.

STANDARD DX SYSTEM – HEAT LOAD CALCULATION – SPACE INPUT DATA

Standard DX Unit System Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 07:53AM

1. General Details:
- Air System Name ..... **STANDARD FCU**
- Equipment Type ..... **Terminal Units**
- Air System Type ..... **Split DX Fan Coil**
- Number of zones **1**
- Ventilation ..... **Direct Ventilation**

2. Ventilation System Components:
(Common Ventilation System not used: no inputs)

3. Zone Components:
Space Assignments:

Zone 1: Zone 1	
STANDARD AC	x1

Thermostats and Zone Data:
- Zone ..... **All**
- Cooling T-stat: Occ. ..... **23.9** °C
- Cooling T-stat: Unocc. ..... **29.4** °C
- Heating T-stat: Occ. ..... **21.1** °C
- Heating T-stat: Unocc. ..... **15.6** °C
- T-stat Throttling Range ..... **0.83** °K

- Thermostat Schedule ..... **Schedule 4**
- Unoccupied Cooling is ..... **Available**

Common Terminal Unit Data:
Cooling Coil:
- Design Supply Temperature ..... **14.4** °C
- Coil Bypass Factor **0.100**
- Cooling Source ..... **Air-Cooled DX**
- Schedule ..... **JFMAMJJASOND**

- Fan Control ..... **Fan On**
- Ventilation Sizing Method ..... **Sum of Space OA Airflows**

Terminal Units Data:
- Zone ..... **All**
- Terminal Type ..... **Fan Coil**
- Minimum Airflow ..... **0.00** L/s/person
- Fan Performance ..... **0** Pa
- Fan Overall Efficiency ..... **50** %

4. Sizing Data (Computer-Generated):
System Sizing Data:
- Cooling Supply Temperature ..... **14.4** °C

Hydronic Sizing Specifications:
- Chilled Water Delta-T ..... **5.6** °K
- Hot Water Delta-T ..... **11.1** °K

Safety Factors:
- Cooling Sensible ..... **10** %
- Cooling Latent ..... **5** %
- Heating ..... **0** %

Zone Sizing Data:
- Zone Airflow Sizing Method ..... **Sum of space airflow rates**
- Space Airflow Sizing Method ..... **Individual peak space loads**

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	Ventilation (L/s)
1	1003.2	-	-	55.0

5. Equipment Data Terminal Cooling Units - Air-Cooled DX

Zone	Estimated Maximum Load (kW)	Design OAT (°C)	Equipment Sizing	Gross Cooling Capacity (kW)	Capacity Oversizing Factor (%)	Compressor + OD Fan Power (kW)	ARI Performance Rating (EER)	Conventional Cutoff OAT (°C)
All	14.7	35.0	Auto-Sized	-	0		2.96	12.8

Hourly Analysis Program v.4.4 — Page 1 of 1

Standard DX Unit Space Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 07:53AM

STANDARD DX UNIT

1. General Details:
- Floor Area ..... **100.0** m²
- Avg. Ceiling Height ..... **3.0** m
- Building Weight ..... **498.0** kg/m²

1.1. OA Ventilation Requirements:
- Space Usage ..... **OFFICE: Office space**
- OA Requirement 1 ..... **2.5** L/s/person
- OA Requirement 2 ..... **0.30** L/(s-m²)
- Space Usage Defaults ..... **ASHRAE Std 62.1-2004**

2. Internals:
2.1. Overhead Lighting:
- Fixture Type ..... **Recessed (Unvented)**
- Wattage ..... **10.00** W/m²
- Ballast Multiplier **1.00**
- Schedule ..... **LIGHTING SCHEDULE**

2.2. Task Lighting:
- Wattage ..... **0.00** W/m²
- Schedule ..... **None**

2.3. Electrical Equipment:
- Wattage ..... **25.00** W/m²
- Schedule ..... **EQUIP.SCHEDULE**

2.4. People:
- Occupancy ..... **10.0** People
- Activity Level ..... **Sedentary Work**
- Sensible ..... **82.1** W/person
- Latent ..... **79.1** W/person
- Schedule ..... **EQUIP.SCHEDULE**

2.5. Miscellaneous Loads:
- Sensible ..... **0** W
- Schedule ..... **None**
- Latent ..... **0** W
- Schedule ..... **None**

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	30.0	1	0	0
E	30.0	1	0	0
S	30.0	1	0	0
W	30.0	1	0	0

3.1. Construction Types for Exposure N
- Wall Type ..... **Default Wall Assembly**
- 1st Window Type **W1**

3.2. Construction Types for Exposure E
- Wall Type ..... **Default Wall Assembly**
- 1st Window Type **W1**

3.3. Construction Types for Exposure S
- Wall Type ..... **Default Wall Assembly**
- 1st Window Type **W1**

3.4. Construction Types for Exposure W
- Wall Type ..... **Default Wall Assembly**
- 1st Window Type **W1**

4. Roofs, Skylights:

Exp.	Roof Gross Area (m²)	Roof Slope (deg.)	Skylight Qty.
H	100.0	0	0

4.1. Construction Types for Exposure H
- Roof Type ..... **Light Weight Roof**

5. Infiltration:
- Design Cooling ..... **1.00** L/s
- Design Heating ..... **0.00** L/s
- Energy Analysis ..... **0.00** L/s

Infiltration occurs only when the fan is off.

6. Floors:
- Type ..... **Floor Above Unconditioned Space**
- Floor Area ..... **100.0** m²
- Total Floor U-Value ..... **0.568** W/(m²-°K)
- Unconditioned Space Max Temp. ..... **23.9** °C
- Ambient at Space Max Temp. ..... **35.0** °C
- Unconditioned Space Min Temp. ..... **23.9** °C
- Ambient at Space Min Temp. ..... **12.8** °C

Hourly Analysis Program v.4.4 — Page 1 of 1

STANDARD DX SYSTEM – HEAT LOAD CALCULATION – LOAD SUMMARY

Standard DX Unit - Air System Design Load Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:51AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 41.4 °C / 28.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 12.2 °C / 7.4 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	12 m²	305	-	12 m²	-	-
Wall Transmission	108 m²	1187	-	108 m²	511	-
Roof Transmission	100 m²	4071	-	100 m²	675	-
Window Transmission	12 m²	399	-	12 m²	203	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	100 m²	-1	-	100 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	1000 W	1000	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2500 W	2500	-	0	0	-
People	10	821	791	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	1028	40	0%	0	0
>> Total Zone Loads	-	11311	831	-	1389	0
Zone Conditioning	-	11274	831	-	-174	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	55 L/s	1124	1427	55 L/s	204	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	12399	2258	-	30	0
Terminal Unit Cooling	-	12399	2266	-	0	0
Terminal Unit Heating	-	0	-	-	0	-
>> Total Conditioning	-	12399	2266	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Standard DX Unit Ventilation Sizing Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
01:47PM

1. Summary

Ventilation Sizing Method ..... Sum of Space OA Airflows

2. Space Ventilation Analysis Table

Zone Name / Space Name	Mult.	Floor Area (m²)	Maximum Occupants	Maximum Supply Air (L/s)	Required Outdoor Air (L/s/person)	Required Outdoor Air (L/(s-m²))	Required Outdoor Air (L/s)	Required Outdoor Air (% of supply)	Uncorrected Outdoor Air (L/s)
Zone 1									
STANDARD AC	1	100.0	10.0	1003.2	2.50	0.30	0.0	0.0	55.0
Totals (incl. Space Multipliers)				1003.2					55.0

Standard DX Unit - Zone Sizing Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:51AM

Air System Information

Air System Name ..... STANDARD FCU
Equipment Class ..... TERM
Air System Type ..... SPLT-FC

Number of zones 1
Floor Area ..... 100.0 m²
Location ..... Dubai, United Arab Emirates

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s ..... Sum of space airflow rates
Space L/s ..... Individual peak space loads

Calculation Months ..... Jan to Dec
Sizing Data ..... Calculated

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	11.4	1003	1003	Jul 2100	1.4	100.0	10.03

Terminal Unit Sizing Data - Cooling

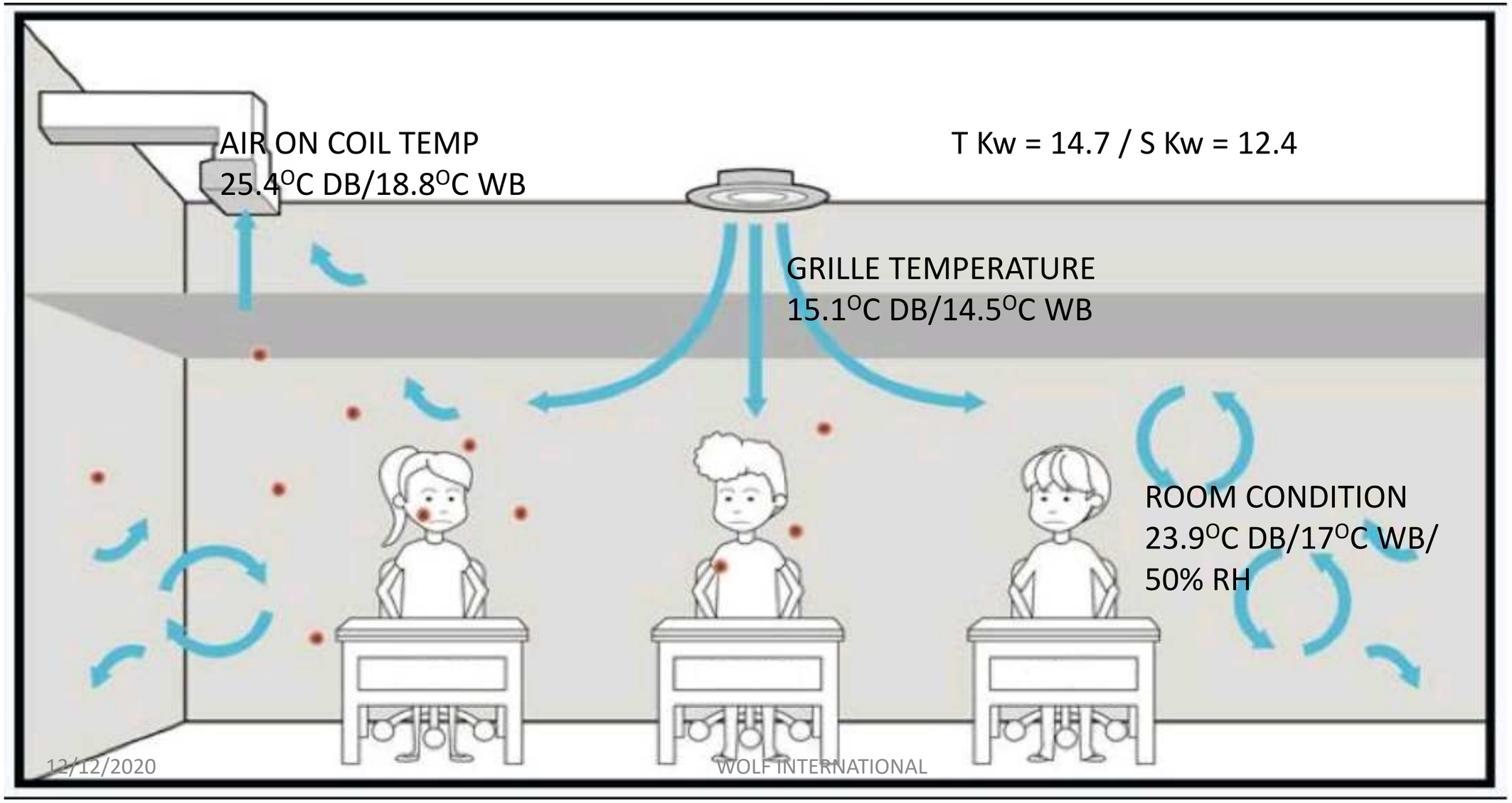
Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (°C)	Coil Leaving DB / WB (°C)	Water Flow @ 5.6 °K (L/s)	Time of Peak Load
Zone 1	14.7	12.4	25.4 / 18.8	15.1 / 14.5	-	Jul 2000

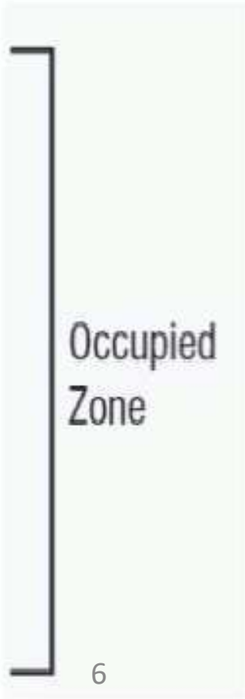
Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
Zone 1							
STANDARD AC	1	11.4	Jul 2100	1003	1.4	100.0	10.03

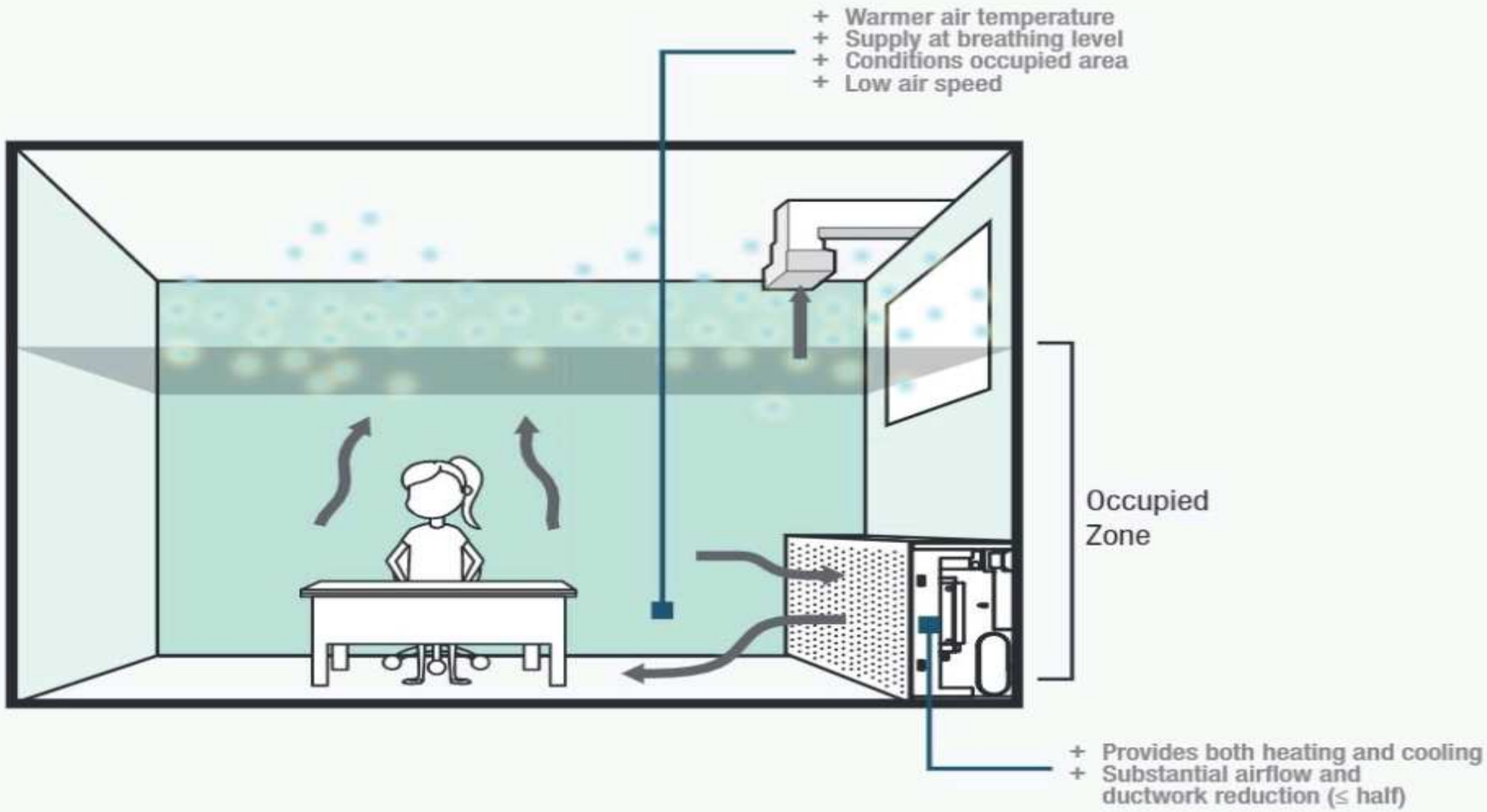
STANDARD DX SYSTEM - ISSUES

- UNEVEN AIR DISTRIBUTION
- UNEVEN TEMPERATURE IN ROOM
- CONTAMINATION OF AIR LINGERS IN ROOM
- HIGHER POWER CONSUMPTION





SOLUTION – AIR SUPPLY AT OCCUPIED LEVEL



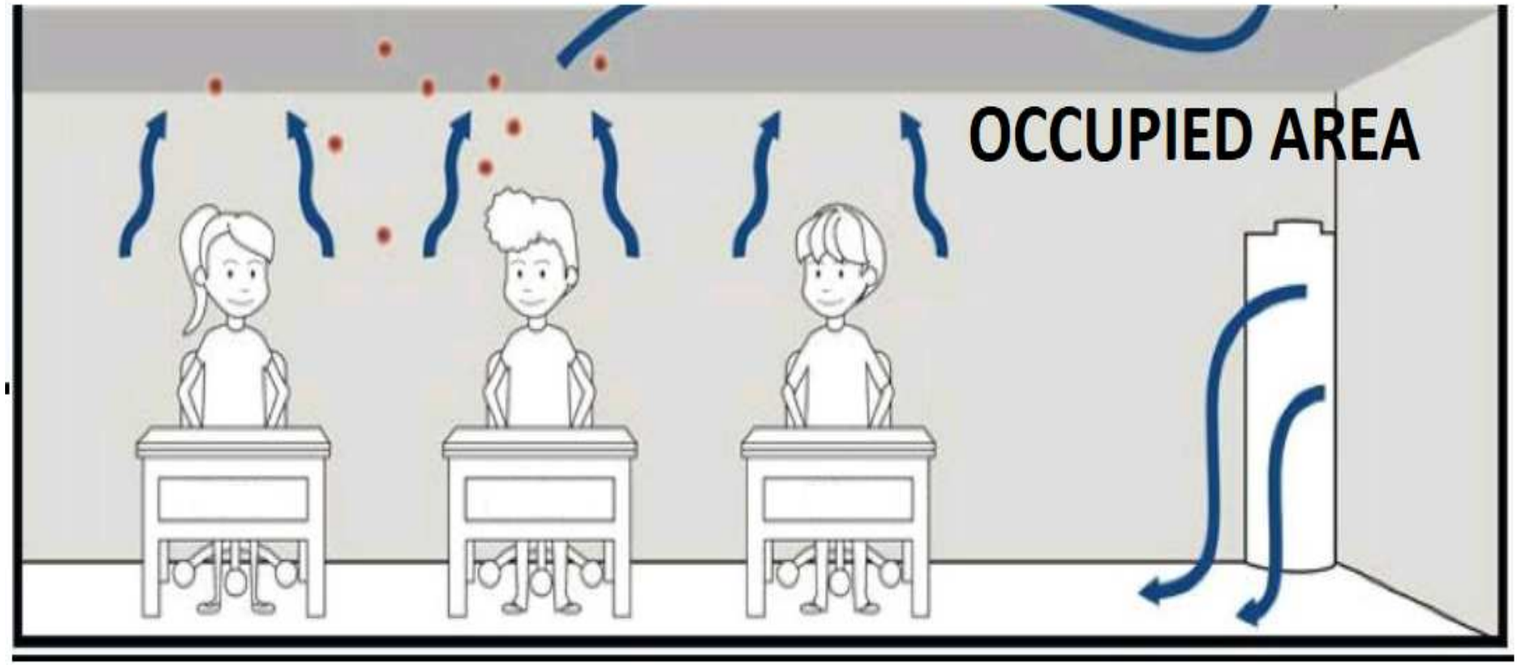
APPLICATION

- SPLIT TOTAL AREA IN 2 PARTS.
  - OCCUPIED AREA.
  - UNOCCUPIED PLENUM AREA.
- AIR SUPPLIED AT FLOOR LEVEL.
  - COLLECTS HEAT AT OCCUPIED LEVEL.
- QUICKLY MOVES TO UNOCCUPIED AREA.
  - REMOVES AIR CONTAMINATION FAST.
- SEPARATE HEAT LOAD CALCULATION
  - OCCUPIED AREA
  - UNOCCUPIED PLENUM AREA
- CALCULATE
  - AIR QUANTITY REQUIRED
  - TEMPERTURES
    - GRILLES
    - PLENUM
    - RETURN AIR
- EFFECT ON UNIT SELECTION & NET POWER CONSUMPTION

1M HEIGHT OF UNOCCUPIED AREA

UNOCCUPIED AREA HEAT GAINS FROM ROOF, WALLS, OVERHEAD LIGHTS, VENTILATION LOAD.

OCCUPIED AREA HEAT GAINS FROM FLOOR, WALLS, EQUIPMENT, PEOPLE LOAD.



2M HEIGHT OF OCCUPIED AREA

OCCUPIED AREA – HEAT LOAD CALCULATION – SPACE INPUT DATA

Occupied Area Space Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 07:54AM

MINI DUCT SYSTEM-OCCUPIE

1. General Details:
- Floor Area ..... 100.0 m²
- Avg. Ceiling Height ..... 2.0 m
- Building Weight ..... 498.0 kg/m²

1.1. OA Ventilation Requirements:
- Space Usage ..... OFFICE: Office space
- OA Requirement 1 ..... 2.5 L/s/person
- OA Requirement 2 ..... 0.30 L/(s-m²)
- Space Usage Defaults ..... ASHRAE Std 62.1-2004

2. Internals:

2.1. Overhead Lighting:
- Fixture Type ..... Recessed (Unvented)
- Wattage ..... 0.00 W/m²
- Ballast Multiplier 1.00
- Schedule ..... None

2.2. Task Lighting:
- Wattage ..... 0.00 W/m²
- Schedule ..... None

2.3. Electrical Equipment:
- Wattage ..... 25.00 W/m²
- Schedule ..... EQUIP.SCHEDULE

2.4. People:
- Occupancy ..... 10.0 People
- Activity Level ..... Sedentary Work
- Sensible ..... 82.1 W/person
- Latent ..... 79.1 W/person
- Schedule ..... EQUIP.SCHEDULE

2.5. Miscellaneous Loads:
- Sensible ..... 0 W
- Schedule ..... None
- Latent ..... 0 W
- Schedule ..... None

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	20.0	1	0	0
E	20.0	1	0	0
S	20.0	1	0	0
W	20.0	1	0	0

3.1. Construction Types for Exposure N
- Wall Type ..... Default Wall Assembly
- 1st Window Type W1

3.2. Construction Types for Exposure E
- Wall Type ..... Default Wall Assembly
- 1st Window Type W1

3.3. Construction Types for Exposure S
- Wall Type ..... Default Wall Assembly
- 1st Window Type W1

3.4. Construction Types for Exposure W
- Wall Type ..... Default Wall Assembly
- 1st Window Type W1

4. Roofs, Skylights:
(No Roof or Skylight data).

5. Infiltration:
- Design Cooling ..... 1.00 L/s
- Design Heating ..... 0.00 L/s
- Energy Analysis ..... 0.00 L/s

Infiltration occurs only when the fan is off.

6. Floors:
- Type ..... Floor Above Unconditioned Space
- Floor Area ..... 100.0 m²
- Total Floor U-Value ..... 0.568 W/(m²-°K)
- Unconditioned Space Max Temp. ..... 35.0 °C
- Ambient at Space Max Temp. ..... 35.0 °C
- Unconditioned Space Min Temp. ..... 35.0 °C
- Ambient at Space Min Temp. ..... 12.8 °C

7. Partitions:
(No partition data).

Hourly Analysis Program v.4.4 — Page 1 of 1

Occupied area System Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 08:00AM

1. General Details:
- Air System Name ..... MINI DUCT SYSTEM OCCUPIED
- Equipment Type ..... Terminal Units
- Air System Type ..... Split DX Fan Coil
- Number of zones 1
- Ventilation ..... Direct Ventilation

2. Ventilation System Components:
(Common Ventilation System not used: no inputs)

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
MINI DUCT SYSTEM-OCCUPIE	x1

Thermostats and Zone Data:
- Zone ..... All
- Cooling T-stat: Occ. ..... 23.9 °C
- Cooling T-stat: Unocc. ..... 29.4 °C
- Heating T-stat: Occ. ..... 21.1 °C
- Heating T-stat: Unocc. ..... 15.6 °C
- T-stat Throttling Range ..... 0.83 °K

- Thermostat Schedule ..... Schedule 4
- Unoccupied Cooling is ..... Available

Common Terminal Unit Data:

Cooling Coil:
- Design Supply Temperature ..... 16.7 °C
- Coil Bypass Factor 0.100
- Cooling Source ..... Air-Cooled DX
- Schedule ..... JFMAMJJASOND

- Fan Control ..... Fan On
- Ventilation Sizing Method ..... Sum of Space OA Airflows

Terminal Units Data:
- Zone ..... All
- Terminal Type ..... Fan Coil
- Minimum Airflow ..... 0.00 L/s/person
- Fan Performance ..... 0 Pa
- Fan Overall Efficiency ..... 50 %

4. Sizing Data (User-Modified):

System Sizing Data:
- Cooling Supply Temperature ..... 16.7 °C

Hydronic Sizing Specifications:
- Chilled Water Delta-T ..... 5.6 °K
- Hot Water Delta-T ..... 11.1 °K

Safety Factors:
- Cooling Sensible ..... 10 %
- Cooling Latent ..... 5 %
- Heating ..... 0 %

Zone Sizing Data:
- Zone Airflow Sizing Method ..... Sum of space airflow rates
- Space Airflow Sizing Method ..... Individual peak space loads

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	Ventilation (L/s)
1	698.0	-	-	55.0

Hourly Analysis Program v.4.4 — Page 1 of 1

OCCUPIED AREA – HEAT LOAD CALCULATION – LOAD SUMMARY

Ocuupied Area - Air System Design Load Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:59AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 45.7 °C / 29.3 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 12.2 °C / 7.4 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	12 m²	310	-	12 m²	-	-
Wall Transmission	68 m²	722	-	68 m²	322	-
Roof Transmission	0 m²	0	-	0 m²	0	-
Window Transmission	12 m²	461	-	12 m²	203	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	100 m²	0	-	100 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	2500 W	2500	-	0	0	-
People	10	821	791	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	481	40	0%	0	0
>> Total Zone Loads	-	5295	831	-	524	0
Zone Conditioning	-	5295	831	-	-292	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	0 L/s	0	-	0 L/s	0	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	5295	831	-	12	0
Terminal Unit Cooling	-	5295	831	-	0	0
Terminal Unit Heating	-	0	-	-	0	-
>> Total Conditioning	-	6023	831	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Occupied Area Zone Sizing Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:59AM

Air System Information

Air System Name ..... **MINI DUCT SYSTEM OCCUPIED**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **100.0** m²
Location ..... **Dubai, United Arab Emirates**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s ..... **Sum of space airflow rates**
Space L/s ..... **Individual peak space loads**

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	5.3	698	698	Jul 0000	0.5	100.0	6.98

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Area Leaving DB / WB (°C)	Area Entering DB / WB (°C)	Water Flow @ 5.6 °K (L/s)	Time of Peak Load
Zone 1	6.1	5.3	23.9 / 17.0	17.3 / 14.7	-	Jul 1600

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
Zone 1							
MINI DUCT SYSTEM-OCCUPIED	1	6.0	Jul 0000	696	-	100.0	6.96

UNOCCUPIED AREA – HEAT LOAD CALCULATION – SPACE INPUT DATA

Unoccupied area Space Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 07:56AM

MINI DUCT SYSTEM-UNOCCUP

1. General Details:
- Floor Area ..... 100.0 m²
- Avg. Ceiling Height ..... 1.0 m
- Building Weight ..... 498.0 kg/m²

1.1. OA Ventilation Requirements:
- Space Usage ..... OFFICE: Office space
- OA Requirement 1 ..... 2.5 L/s/person
- OA Requirement 2 ..... 0.30 L/(s-m²)
- Space Usage Defaults ..... ASHRAE Std 62.1-2004

2. Internals:

2.1. Overhead Lighting:
- Fixture Type ..... Recessed (Unvented)
- Wattage ..... 1.00 W/m²
- Ballast Multiplier 1.00
- Schedule ..... LIGHTING SCHEDULE

2.2. Task Lighting:
- Wattage ..... 0.00 W/m²
- Schedule ..... None

2.3. Electrical Equipment:
- Wattage ..... 0.00 W/m²
- Schedule ..... None

2.4. People:
- Occupancy ..... 0.0 Person
- Activity Level ..... Sedentary Work
- Sensible ..... 82.1 W/person
- Latent ..... 79.1 W/person
- Schedule ..... None

2.5. Miscellaneous Loads:
- Sensible ..... 0 W
- Schedule ..... None
- Latent ..... 0 W
- Schedule ..... None

3. Walls, Windows, Doors:

Exp.	Wall Gross Area (m²)	Window 1 Qty.	Window 2 Qty.	Door 1 Qty.
N	10.0	0	0	0
E	10.0	0	0	0
S	10.0	0	0	0
W	10.0	0	0	0

3.1. Construction Types for Exposure N
- Wall Type ..... Default Wall Assembly

3.2. Construction Types for Exposure E
- Wall Type ..... Default Wall Assembly

3.3. Construction Types for Exposure S
- Wall Type ..... Default Wall Assembly

3.4. Construction Types for Exposure W
- Wall Type ..... Default Wall Assembly

4. Roofs, Skylights:

Exp.	Roof Gross Area (m²)	Roof Slope (deg.)	Skylight Qty.
H	100.0	0	0

4.1. Construction Types for Exposure H
- Roof Type ..... Light Weight Roof

5. Infiltration:
- Design Cooling ..... 1.00 L/s
- Design Heating ..... 0.00 L/s
- Energy Analysis ..... 0.00 L/s

Infiltration occurs only when the fan is off.

6. Floors:
- Type ..... Floor Above Conditioned Space

(No additional input required for this floor type).

7. Partitions:

(No partition data).

Unoccupied Area System Input Data

Project : Standard DX Unit Vs Mini Duct System — 12/14/2020 07:56AM

1. General Details:
- Air System Name ..... MINI DUCT SYSTEM UNOCCUPIED
- Equipment Type ..... Terminal Units
- Air System Type ..... Split DX Fan Coil
- Number of zones 1
- Ventilation ..... Direct Ventilation

2. Ventilation System Components:

(Common Ventilation System not used: no inputs)

3. Zone Components:

Space Assignments:

Zone 1: Zone 1	
MINI DUCT SYSTEM-UNOCCUP	x1

Thermostats and Zone Data:
- Zone ..... All
- Cooling T-stat: Occ. ..... 29.4 °C
- Cooling T-stat: Unocc. ..... 29.4 °C
- Heating T-stat: Occ. ..... 21.1 °C
- Heating T-stat: Unocc. ..... 15.6 °C
- T-stat Throttling Range ..... 0.83 °K

- Thermostat Schedule ..... Schedule 4
- Unoccupied Cooling is ..... Available

Common Terminal Unit Data:

Cooling Coil:
- Design Supply Temperature ..... 23.9 °C
- Coil Bypass Factor 0.100
- Cooling Source ..... Air-Cooled DX
- Schedule ..... JFMAMJJASOND

- Fan Control ..... Fan On
- Ventilation Sizing Method ..... Sum of Space OA Airflows

Terminal Units Data:
- Zone ..... All
- Terminal Type ..... Fan Coil
- Minimum Airflow ..... 0.00 L/s/person
- Fan Performance ..... 0 Pa
- Fan Overall Efficiency ..... 50 %

4. Sizing Data (User-Modified):

System Sizing Data:
- Cooling Supply Temperature ..... 23.9 °C

Hydronic Sizing Specifications:
- Chilled Water Delta-T ..... 5.6 °K
- Hot Water Delta-T ..... 11.1 °K

Safety Factors:
- Cooling Sensible ..... 10 %
- Cooling Latent ..... 5 %
- Heating ..... 0 %

Zone Sizing Data:
- Zone Airflow Sizing Method ..... Sum of space airflow rates
- Space Airflow Sizing Method ..... Individual peak space loads

Zone	Supply Airflow (L/s)	Zone Htg Unit (kW)	Reheat Coil (kW)	Ventilation (L/s)
1	698.0	-	-	30.0

UNOCCUPIED AREA – HEAT LOAD CALCULATION – LOAD SUMMARY

Unoccupied Air System Design Load Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:57AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 41.4 °C / 28.4 °C			HEATING DATA AT DES HTG HEATING OA DB / WB 12.2 °C / 7.4 °C		
ZONE LOADS	Details	Sensible (W)	Latent (W)	Details	Sensible (W)	Latent (W)
Window & Skylight Solar Loads	0 m²	0	-	0 m²	-	-
Wall Transmission	40 m²	444	-	40 m²	189	-
Roof Transmission	100 m²	4071	-	100 m²	675	-
Window Transmission	0 m²	0	-	0 m²	0	-
Skylight Transmission	0 m²	0	-	0 m²	0	-
Door Loads	0 m²	0	-	0 m²	0	-
Floor Transmission	0 m²	0	-	0 m²	0	-
Partitions	0 m²	0	-	0 m²	0	-
Ceiling	0 m²	0	-	0 m²	0	-
Overhead Lighting	1000 W	1000	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 5%	552	0	0%	0	0
>> Total Zone Loads	-	6067	0	-	865	0
Zone Conditioning	-	6067	0	-	-110	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 L/s	0	-	0 L/s	0	-
Ventilation Load	55 L/s	1124	1427	55 L/s	204	0
Ventilation Fan Load	0 L/s	0	-	0 L/s	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	7091	1427	-	17	0
Terminal Unit Cooling	-	7091	0	-	0	0
Terminal Unit Heating	-	0	-	-	0	-
>> Total Conditioning	-	7091	1427	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Unoccupied Area Zone Sizing Summary

Project : Standard DX Unit Vs Mini Duct System

12/14/2020
07:57AM

Air System Information

Air System Name ..... **MINI DUCT SYSTEM UNOCCUPIED**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **100.0** m²
Location ..... **Dubai, United Arab Emirates**

Sizing Calculation Information

Zone and Space Sizing Method:

Zone L/s ..... **Sum of space airflow rates**
Space L/s ..... **Individual peak space loads**

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **User-Modified**

Zone Sizing Data

Zone Name	Maximum Cooling Sensible (kW)	Design Air Flow (L/s)	Minimum Air Flow (L/s)	Time of Peak Load	Maximum Heating Load (kW)	Zone Floor Area (m²)	Zone L/(s-m²)
Zone 1	7.1	698	698	Jul 2100	0.9	100.0	6.98

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (kW)	Sens Coil Load (kW)	Coil Entering DB / WB (°C)	Area Entering DB / WB (°C)	Water Flow @ 5.6 °K (L/s)	Time of Peak Load
Zone 1	8.5	7.1	32.3 / 20.2	23.9 / 17.0	-	Jul 2000

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (kW)	Time of Load	Air Flow (L/s)	Heating Load (kW)	Floor Area (m²)	Space L/(s-m²)
Zone 1							
MINI DUCT SYSTEM-UNOCCUP	1	5.6	Jul 2100	698	-	100.0	6.90

MINI DUCT SYSTEM – UNIT SELECTION

- STANDARD HEAT LOAD CALCULATION
- T kW = 14.7
- S kW = 12.4
- L/s = 1003
- External Static Pressure = 50 Pa
- Design Condition
  - Room Db = 23.9 ^{O}C
  - Room Wb = 16.9 ^{O}C
- Air Entering Room
  - Room Db = 15.1 ^{O}C
  - Room Wb = 14.5 ^{O}C
- Air Leaving Room
  - Room Db = 25.4 ^{O}C
  - Room Wb = 18.8 ^{O}C

- OCCUPIED AREA HEAT LOAD
- T kW = 6.1
- S kW = 5.3
- L/s = 698
- External Static Pressure = 1”
- Design Condition
  - Room Db = 23.9
  - Room Wb = 16.9
- Air Entering Room

Db = Room Db–(SkWx1000/1.006x1.202x L/s)

Db = 23.9–(5.3x1000/1.006x1.202x698)

Db = 17.62 ^{O}C

- Air Enteringing Room

Enthalpy = Room E–(TkW/1.202xAir Volume)

= 47.8–(6.1x1000/1.202x0.698)

= 40.5 KJ/kg d.a

Wb = 14.7 ^{O}C

- UNOCCUPIED AREA HEAT LOAD
- T kW = 8.52
- S kW = 7.1
- L/s = 698
- External Static Pressure = 1”
- Design Condition
  - Room Db = 23.9
  - Room Wb = 16.9
- Air Leaving Room

Db = Room Db + (SkWx1000/1.006x1.202xL/s)

Db = 23.9 –(7.1x1000/1.006x1.202x698)

Db = 32.3 ^{O}C

- Air Leaving Room

Enthalpy = Room E+(TkWx1000/1.202x L/s)

= 47.8 + (8.52x1000/1.202x698)

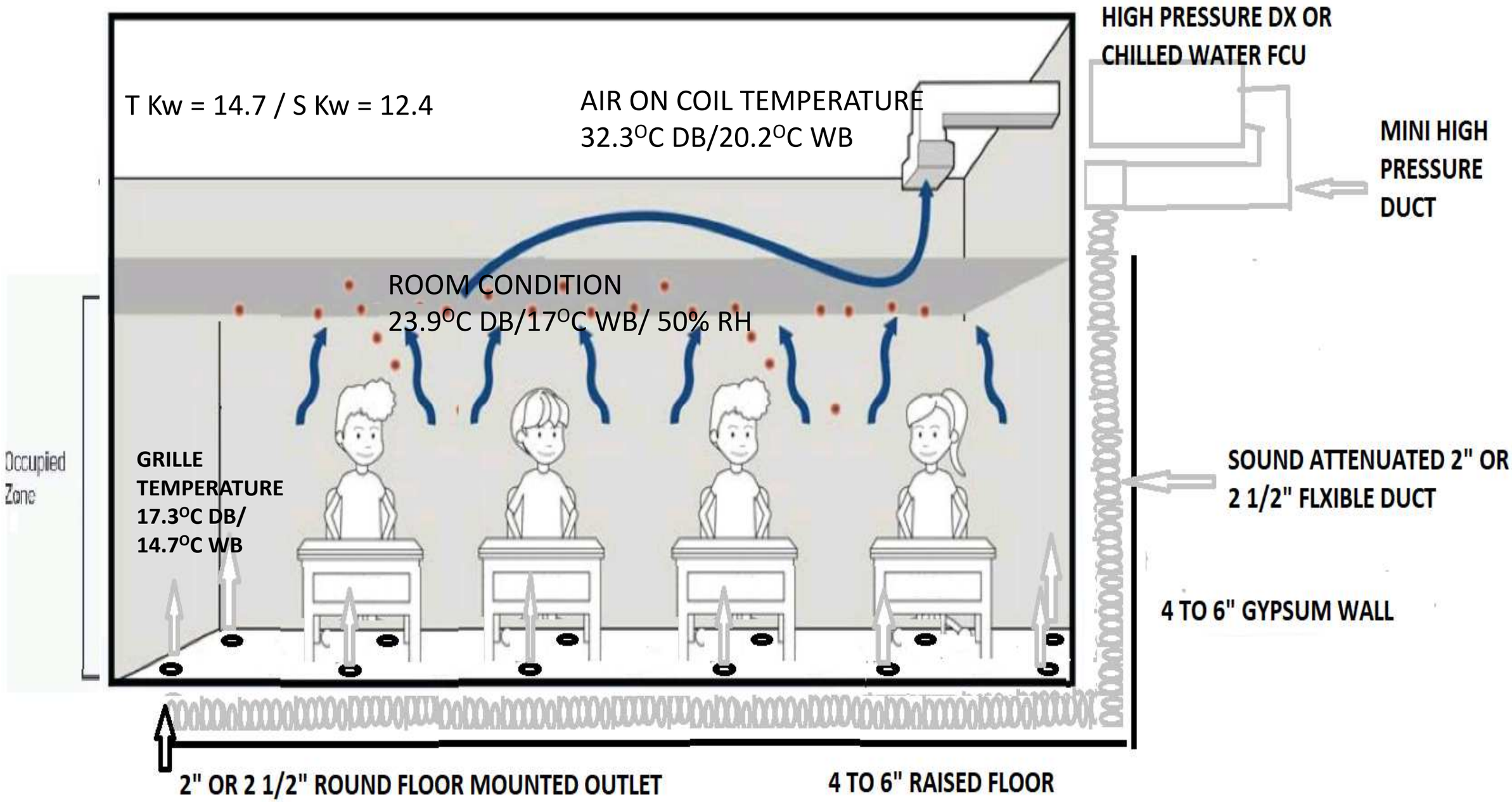
= 57.96 KJ/kg d.a

Wb = 20.2 ^{O}C

<u>UNIT SELECTION PARAMETERS</u>

- **T kW = 14.62**
- **S kW = 12.4**
- **L/s = 698**
- **External Static Pressure = 1”**
- **Design Condition**
  - **Room Db = 23.9 ^{O}C**
  - **Room Wb = 16.9 ^{O}C**
- **Air Entering Room**
  - **Room Db = 17.62 ^{O}C**
  - **Room Wb = 14.7 ^{O}C**
- **Air Leaving Room**
  - **Room Db = 32.2 ^{O}C**
  - **Room Wb = 20.2 ^{O}C**

The Unico system - Application



M SERIES BLOWER MODULE

The Unico System® ENGINEERING SPECIFICATIONS

Blower Module Specifications – 60 Hz

Model No.		M2430B-	M3642BL	M4860BL
Electrical Characteristics		208 – 230 Volts / 60 / 1 phase		
Motor Size, HP (kW)		1/2 (0.37)	1 (0.75)	
Motor Type	-STD, -ACB	PSC		
	-SCB	EC (variable speed)		
Motor Capacitor, mfd.	-STD, -ACB	10		
Motor Capacitor, mfd.	-SCB	none		
Motor Full Load Amps	-STD	3.0	6.2	6.2
	-ACB	3.3	4.8	4.8
	-SCB	3.2	6.1	6.1
Motor Speed, RPM	-STD	1700		
	-ACB	1700/800		
	-SCB	400-1800		
Blower Wheel Nom. Diameter, in. (mm)		9.5 (241)		
Blower Wheel Width, inch (mm)		3.75 (95)	5.0 (127)	7.75 (197)
*Nominal Air Flow Rate, CFM (L/s)		600 (283)	900 (425)	1250 (590)
*Plenum Static Pressure, in. water (Pa)		1.5 (373)	1.5 (373)	1.5 (373)
Minimum Plenum Size, ID, inch (mm)		7 (178)	9 (229)	10 (254)
Sound Pressure Level	dB(A)	56	56	58
	NC	50	47	50
Shipping Weight, lb (kg)		62 (28)	72 (33)	72 (33)

* based on full open restrictor and minimum plenum size at 230V.

Measuring airflow.

To determine the airflow when using the single or two-speed motors (-STD, -ACB models), measure the amperage and look up the airflow in the following table. This is not necessary for the variable speed motors because they are programmed to deliver the airflow that you need.

Blower Performance (with cooling module installed) –STD and –ACB models

External Static Pressure, in. water (Pa)	1.0 (250)		1.25 (310)		1.5 (370)		1.75 (435)		2.0 (500)	
Model	CFM (L/s)	Amps	CFM (L/s)	Amps	CFM (L/s)	Amps	CFM (L/s)	Amps	CFM (L/s)	Amps
60 Hz – 230V										
STD models										
M2430LB	870 (410)	3.1	810 (383)	2.9	740 (351)	2.7	660 (310)	2.4	510 (240)	2.0
M3642LB	1240 (585)	4.8	1170 (552)	4.5	1070 (505)	4.1	925 (437)	3.6	745 (352)	3.1
M4860LB	1472 (695)	4.7	1400 (660)	4.5	1300 (610)	4.2	1162 (548)	3.9	953 (450)	3.4
ACB models										
M2430LB+ACB	760 (360)	2.3	700 (330)	2.1	640 (302)	2.0	550 (260)	1.7	450 (212)	1.5
M3642LB+ACB	1380 (617)	5.2	1300 (613)	4.9	1200 (566)	4.5	1090 (514)	4.0	950 (448)	3.6
M4860LB+ACB	1480 (698)	5.0	1430 (674)	4.4	1360 (642)	4.5	1220 (575)	4.0	930 (439)	3.1

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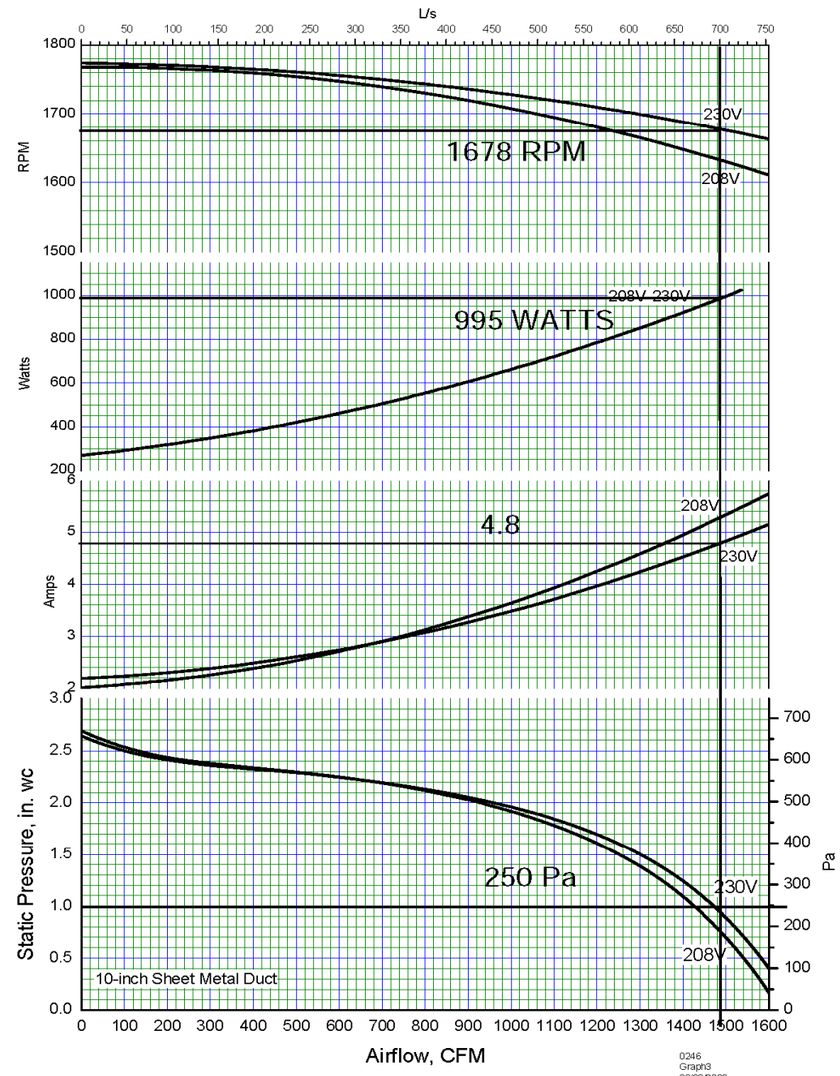
The Unico System® ENGINEERING SPECIFICATIONS

MB4860L

Wheel: FC950-775D
Housing: 950M
Motor: 1 HP, 1650 RPM, (Dayton Model 9MTV8)
Equip: MB4860L+MC4860C
Supply: 10" sheet metal duct reduced to 9" to tee (see photo)
Return: UPC-104 connected to UPC-05C terminating into UPC-02E with one 90° bend



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Tested by: J Riley
Approved by: C. Messmer

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MINI DUCT SYSTEM – UNIT SELECTION

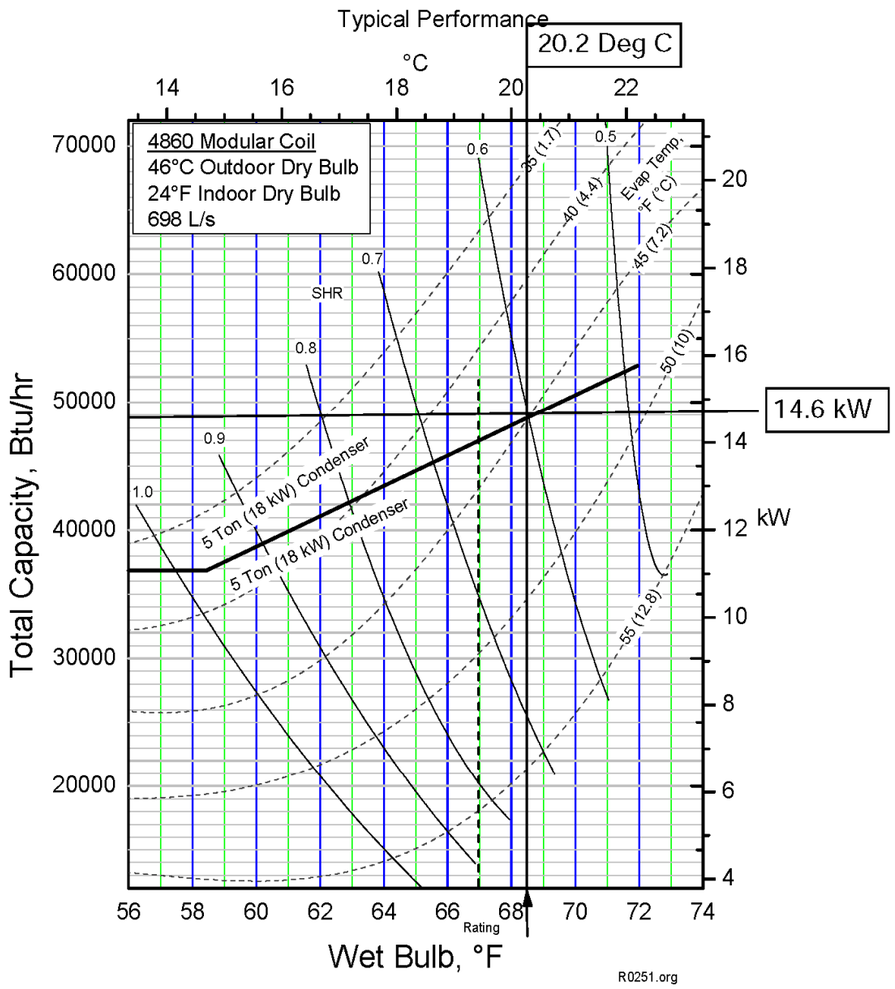
M SERIES COOLING MODULE

REFRIGERANT COILS for R-22, R-407C, R-410A

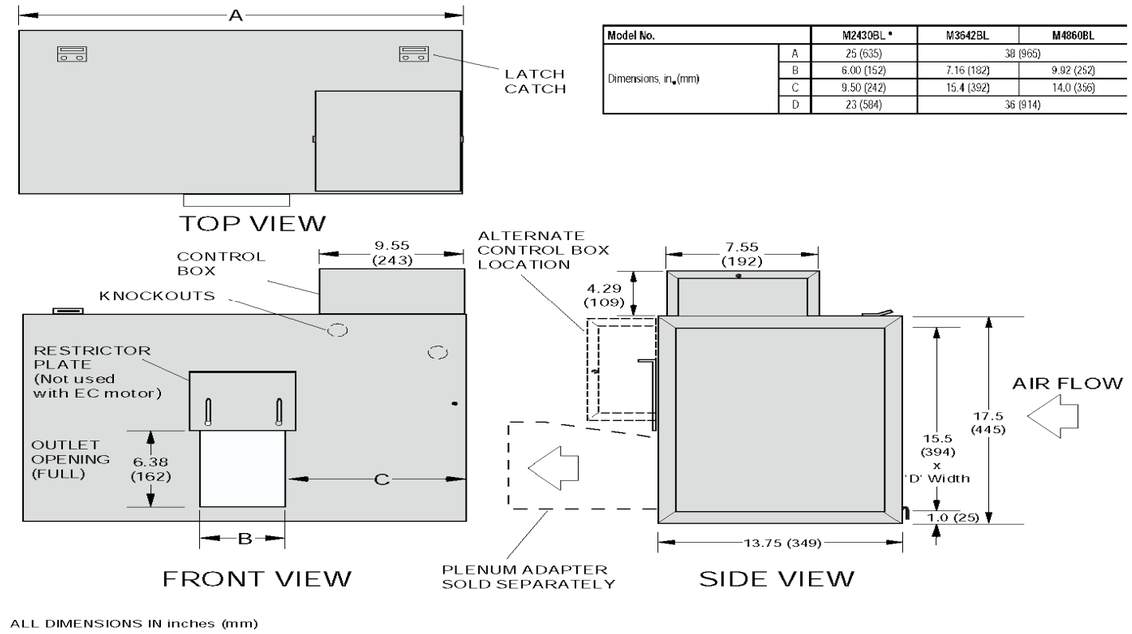
The Unico System®

ENGINEERING SPECIFICATIONS

UNIT PERFORMANCE AT REQUIRED PARAMETERS - BLOWER MB4860L+ COIL MC4860C



Dimensional Data

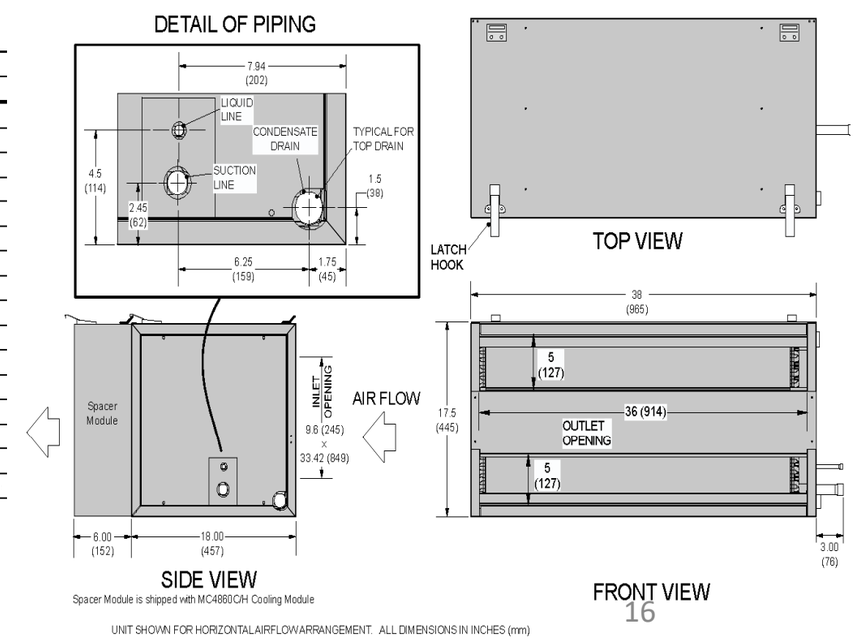


Model No.		M2430BL *	M3642BL	M4860BL
Dimensions, in. (mm)	A	25 (635)	38 (965)	
	B	6.00 (152)	7.16 (182)	9.92 (252)
	C	9.50 (242)	15.4 (392)	14.0 (356)
	D	23 (584)	36 (914)	

MC4860x Specifications

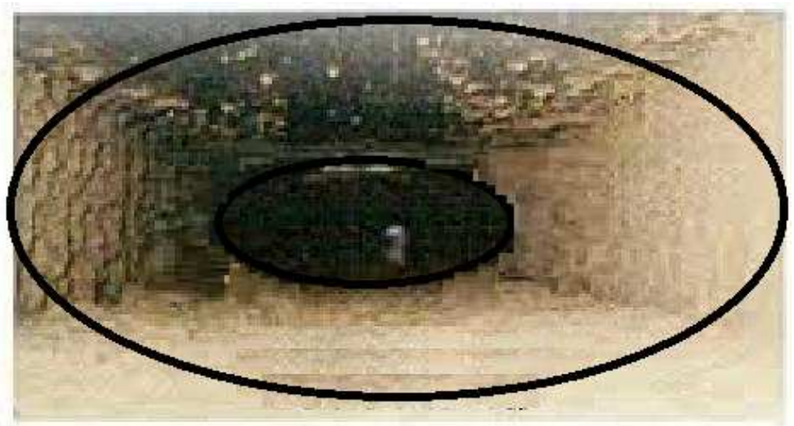
Type of System		Cooling Only	Heat Pump
Model No.		MC4860C	MC4860H
Compatible Condenser Size, Ton (kW)		4-5 (14-17.6)	
Evaporator Coil	Net Face Area, ft^2 (m^2)	7.44 (0.69)	
	Tube diameter, in. (mm)	3/8 (9.5)	
	Number of rows	3	4
	Fins per inch (m)	14 (551)	
	Suction line, in. (mm) OD	7/8 (22.2)	
	Liquid line, in. (mm) OD	3/8 (9.5)	
	Fin Type	sinewave	sinewave
	Number of Circuits	10	8
	Valve, R-22, Part No.	A00805-005	A00808-005
	Valve, R-410A, Part No.	A00805-015	A00808-015
Design Pressure, psig (kPa)		500 (3447)	
Condensate Connection, in. (mm) FPT		3/4 (19)	
Refrigerant		R-22, R-407C, R-410A*	
Coil Shipping Weight, lb. (kg)		88 (40)	
Factory Installed Expansion Device		TXV	TXV with Check Valve

* TXV shipped loose



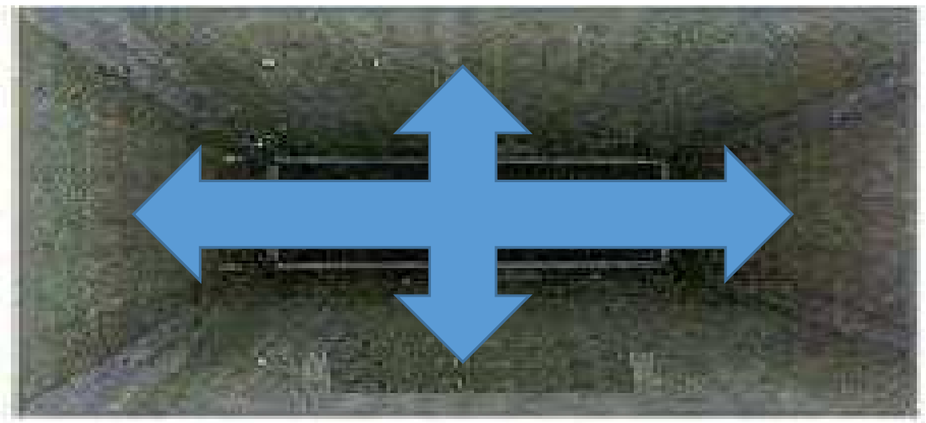
STANDARD DX UNITS VS MINI DUCT UNITS

- STANDARD AC UNITS – AIR DISTRIBUTION
  - High Volume – Low External Static Fan.
  - Air is pushed through low pressure ducting. Fan is the source of Air. Air terminal units are the Air Exit point.



  - Air moves in elliptical path in Rectangular duct. It leaves corners in most condition forming fungus. Dry fungus drops in duct, get carried in AC are causing allergies to occupants.

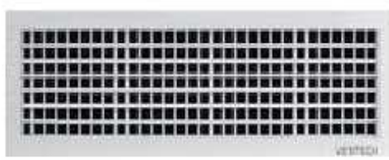
- MINI DUCT UNITS – AIR DISTRIBUTION
  - Low Volume – High External Static Fan.
  - Main Duct is closed form all sides. Air is delivered under high pressure in the duct. Once desired pressure is built, air moves our through tapings into flexible duct, the delivered into conditioned area. Small Air terminal units are the exit points.



  - Due to High pressure Air is filled in Duct completely leaving no space for fungus to form.

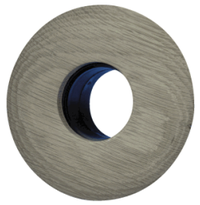
STANDARD DX UNITS VS MINI DUCT UNITS

- STANDARD AC UNITS – TERMINAL UNITS
- The conventional AC system provides similar looking grilles / diffusers taking prominent position in your room décor with identical finish in any premises.
- Any attempt to change the look proves expensive to buy and to maintain later on.



- MINI DUCT UNITS – TERMINAL UNITS
  - Outlets are small, subtle and blend into any décor.
  - For the look that best suits your needs, a variety of styles and finishes are available.
  - Choose from while or black plastic, chrome, brass and several wood species or simply paint or stain the outlet to perfectly match room color scheme.

ORIGINAL
5" Outer Diameter Plastic Outlet
for Ceiling Applications
(Available in white, black, brass
or chrome finishes)



WOODEN
5" Outer Diameter Wood Outlet
for Hardwood Floor Applications
(Available in a variety of
wood species)

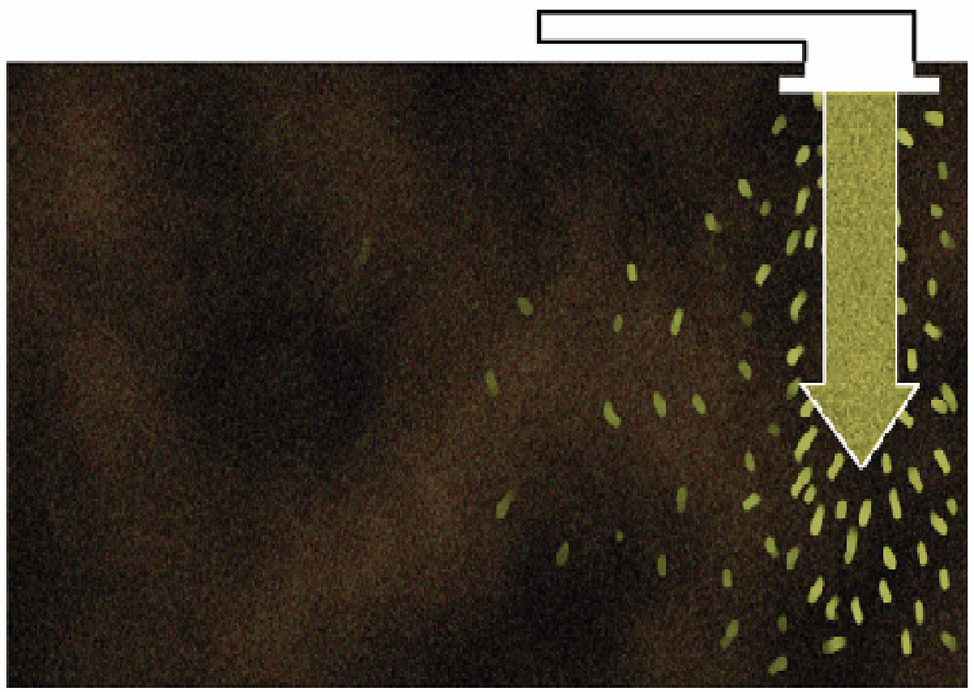
SLOPED
15° and 25° Angled Outlets
for Sloped Ceilings and Walls

SLOTTED
1/2" x 8" Slotted Outlet for Sidewall Applications
(Available in a variety of finishes and wood species)

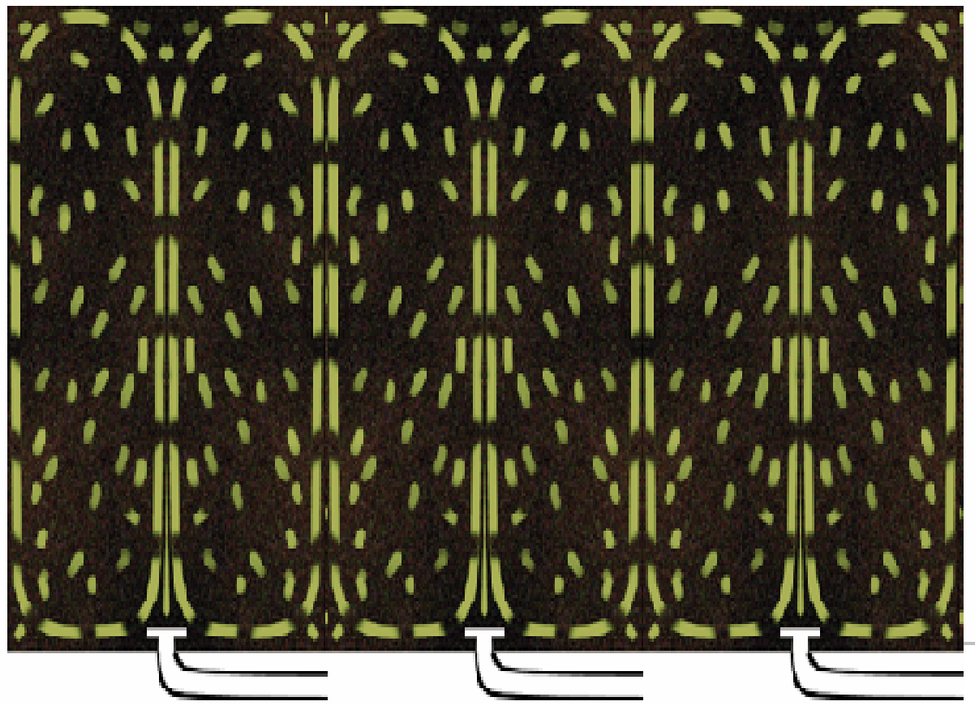
- Fungus from duct, settles on these air outlets which is very difficult to clean as construction of these air outlets are very fragile.

STANDARD DX UNITS VS MINI DUCT UNITS

- STANDARD AC UNITS – AIR DUMPING IN CONDITIONED SPACE
  - The conventional AC system is designed to dump air into the room,causing uncomfortable drafts, hot and cold spots.



- MINI DUCT UNITS – ASPIRATION WAY OF AIR MOVEMENT IN CONDITIONED SPACE
  - The Unico System gently circulates air throughout each room, eliminating drafts, and thermal shocks, providing even temperatures from ceiling to floor and in each room corner.



STANDARD DX UNITS VS MINI DUCT UNITS

- STANDARD AC UNITS – AIR FILTRATION
  - Limited Filtration options.
  - Due to low static fans, filtration ints will increase external static pressure and reduce air volume
  - This will affect cooling and increase power consumption.

- MINI DUCT UNITS – AIR FILTRATION
  - Due to High External Static fans its possible to add any Electrostatic or Electronic filter with out any effect on Air Volume.
  - So no effect on cooling hence power consumption

STANDARD UNITS VS MINI DUCT UNITS

- STANDARD AC UNITS – OPTIONS
  - ---
  - ---
  - ---
  - NA
  - Capillary expansion.
  - Single module.
  - Standard Filtration option
  - Due to dirty ducts, in long run Unhygienic operation
  - Interior design needs to be adjusted based on Air terminal unit design. No design freedom.

- MINI DUCT UNITS – OPTIONS
  - DX – UNITS – R22/407C/410A
  - Matching Single Split / VRV system
  - CHILLED WATER COIL – Chiller / District Cooling Application.
  - MOTOR with Variable speed EC Motor & SMART CONTROL BOX.
  - Thermostatic Expansion valve for precise control.
  - Modular Construction.
  - Multiple Filtration Options
  - Hygienic operation due to pressurized duct
  - Aesthetically pleasant Air terminal units. Interior design freedom get preference
  - Reduced power consumption.