



TM: DM-2014



Double Skin Modular Air Handling Unit DDM-AHU

Air Flow From 1,100 To 90,000 m³/h





CONTENTS

1.0 INTRODUCTION	1
2.0 NONMENCLATURE	2
3.0 AHU DESIGN FEATURES	3
3.1 DAIKIN DDM STANDARD FEATURES	3
3.2 CASING / CABINET CONSTRUCTION	3-4
3.3 THERMA BREAK PROFILE	5
3.4 COIL SECTION	6
3.5 DRAIN PAN	6
3.6 FACE AND BY PASS DAMPER	7
3.7 FAN	7-8
3.8 MOTOR	8
3.9 FAN / MOTOR ASSEMBLIES	9
3.10 SPRING ISOLATOR	9
3.11 THERMISTOR	9
3.12 VFD/ FREQUENCY INVERTER	9
3.13 ENERGY RECOVERY	9
3.13.1 HEAT RECOVERY WHEEL	9-10
3.13.2 HEAT PIPE	10-11
3.14 HUMIDIFIER	11
3.15 ELECTRIC HEATER	11
3.16 FILTER SECTION	11-12
3.17 QUICK AIR FILTER SELECTION GUIDE	12
3.18 MIXING BOX	13
3.19 SOUND ATTENUATOR	13
4.0 STANDARD UNITS QUICK SELECTION TABLE	14-15
5.0 OUTLINE AND DIMENSION	16-22
5.1a HORIZONTAL TYPICAL CONFIGURATION TYPE 1 & 2	16
5.1b HORIZONTAL TYPICAL CONFIGURATION TYPE 3 & 4	17
5.1c HORIZONTAL TYPICAL CONFIGURATION TYPE 5 & 6	18
5.1d HORIZONTAL TYPICAL CONFIGURATION TYPE 7 & 8	19
5.1e HORIZONTAL TYPICAL CONFIGURATION TYPE 9	20
5.2a VERTICAL TYPICAL CONFIGURATION TYPE 1 & 2	21
5.2b VERTICAL TYPICAL CONFIGURATION TYPE 3 & 4	22

6.0 APPLICATION CONSIDERATIONS	23-25
6.1 INSTALLATION FLEXIBILITY	23
6.2 MOUNTING AND ACCESS	23
6.3 DUCTWORK	23
6.4 PIPING AND DRAIN PAN TRAPS	24
6.5 AIR SUPPLY SYSTEMS AND FAN LAWS	24-25
7.0 FAN SPECIFICATION	26-28
7.1 FAN DISCHARGE ARRANGEMENT	28
8.0 FAN MOTOR SPECIFICATION	29
9.0 BELT AND PULLEY SPECIFICATION	30-31
9.1 PULLEY ALIGNMENT	30-31
10.0 COIL SPECIFICATION	32-37
10.1 COIL SIZE AND FACE AREA	33
10.2 HEADER SIZE	34
10.3a HEADER DIMENSION- SINGLE COIL	35
10.3b HEADER DIMENSION- 2 LAYER COIL	36
10.3c HEADER DIMENSION- 3 LAYER COIL	37
11.0 HEAT RECOVERY WHEEL SPECIFICATION	38
11.1 HEAT WHEEL SPECIFICATION	38
12.0 FILTER SPECIFICATION	39-40
12.1 STANDARD FILTER SPECIFICATION	39
12.2 HEPA FILTER SPECIFICATION	40

■ 1.0 INTRODUCTION

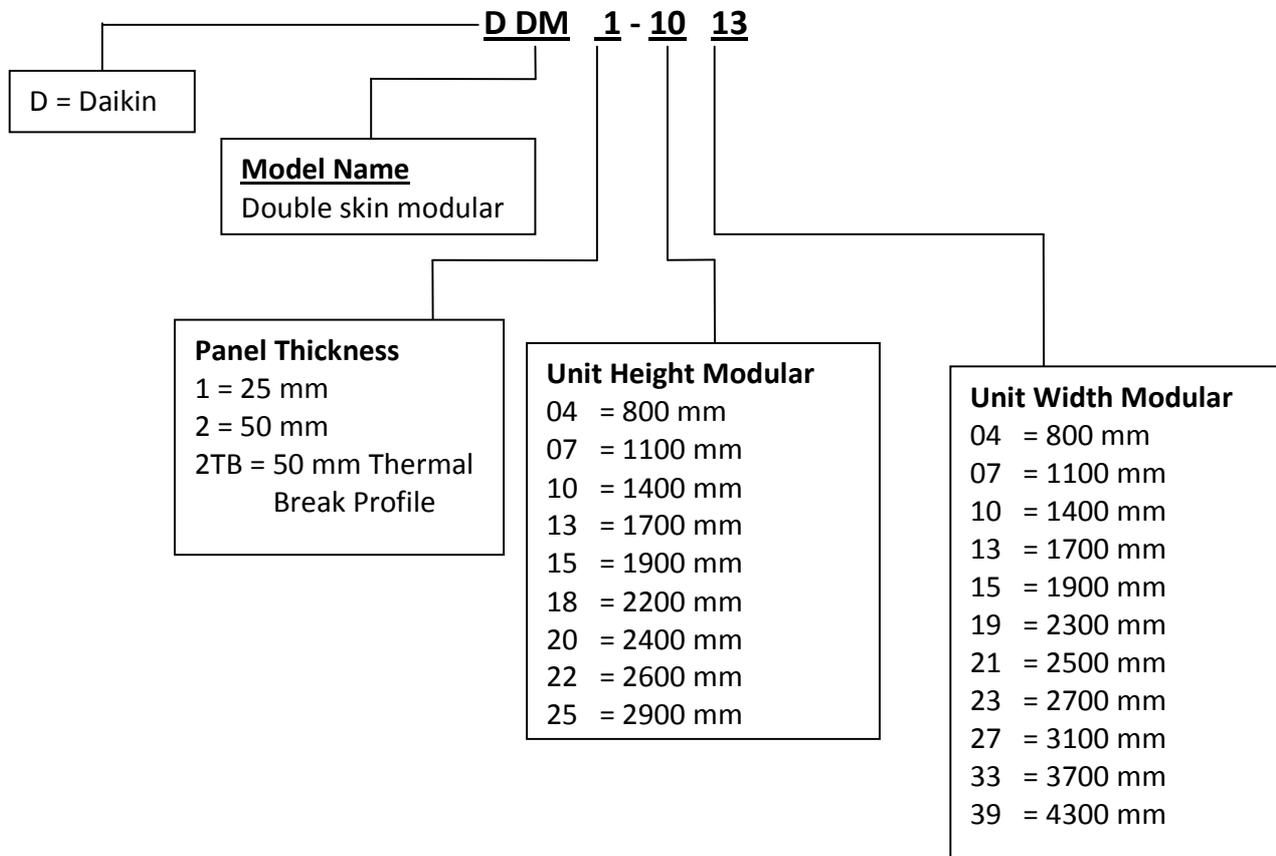
The Double Skin Modular Air Handling Unit is designed based on modular paneling concept to fulfill the indoor air quality requirement. The air flow of DDM AHU is within range of 330 to 20,000 lps (700 to 42379 CFM) and up to a total static pressure of 2000 pa (8" W.G). For special design, the air flow can be reached 25,000 lps (52974 CFM).

The AHU is constructed of high strength extruded Aluminum to form rigid frame. Beside, it is with thermal barrier feature which using three leg-fiber plastic corner pieces, 25 or 50 mm Polyurethane (PU) insulation panel and all frames are insulated with 3.0 mm PE foam to minimize energy heat loss and prevent condensation occurring. The external clip method to hold the double skin PU insulation panel is easily accessible for maintenance while being air tight. The new thermal- break profile can perform better than the original profile in terms of providing better insulation and energy saving.

There is selection software programme available: DDM AHU, to optimize the best arrangement and performance for either chilled water system or DX system. Standard components can be selected and be placed according to customer requirement. Once the unit is defined, optional item and accessories are identified. The programme gives immediate feedback if there is no suitable choice for the units. The programme provides fan curves data, coil performance data, dimension, and shipment weight.

Daikin can produce high quality, flexibility air handling unit which can provide excellent thermal efficiencies and to be airtight. Besides, air handling unit produced is with flexibility features to meet the indoor air quality, operating efficiency, sound level and installation requirement for today's extensive commercial and customize markets. A comfortable environment can enhance human's life quality.

2.0 NONMENCLATURE



NOTE

- * There is special customized design for non standard AHU upon customer request especially low height unit.
- * Width and height are based on the 25mm PU insulation panel.
- * Additional 50mm (Height & Width) for AHU with 50mm PU insulation.
- * The model range DM2 and DM2TB is certified under the number 09.11.441 and presented on www.eurovent-certification.com.

■ 3.0 AHU DESIGN FEATURES

3.1 DAIKIN DDM STANDARD FEATURES

- Variable dimensioning features for flexible cabinet sizing (increment 100mm in height and width)
- External Galvanized and internal painted cabinet
- Multiple section depth
- Variable coil casing and drain pan material
- Mixing boxes
- Low leakage damper
- Face and by pass dampers
- Double sloped drain pan
- Different filter grade
- Variable fan selection include forward-curved, backward curved and airfoil
- Variable frequency drive / Frequency inverter (VFD) and thermistor
- Electric heater
- Sound Attenuator/ silencer
- Energy Recovery Section (Heat Recovery Wheel and Heat Pipe)
- Accessible and maintenance
- Flexibility section for shipment

3.2 CASING / CABINET CONSTRUCTION

Daikin DDM Air Handling Unit is designed in accordance BS EN 1886 and certified by Eurovent. It is constructed of high strength extruded aluminum pentapost and internal post with double modular skin insulation material. The patented frame channel design allows three identical pieces to be bolted together to form a composite corner piece. Both of this features form the rigid frame of the AHU. The unit wall is made up by Double Skin Polyurethane foam (PU) insulation panel with 0.5 mm high strength pre-painted steel as external skin and 0.5 mm galvanized steel (GI) as internal skin. Besides, there are optional thicknesses: 0.8mm, 1.0mm and 1.2mm of skin material. The PU foam insulation thickness can be 25mm or 50mm with density 40 kg/m^3 , which provides an overall thermal conductivity, $k = 0.017 \text{ W/(m}\cdot\text{K)}$.

This cabinet construction reduces significantly the sound level from the fan of an AHU. The cabinet construction is maintenance friendly through easy access to all components. The panels may be removed from all units sections without compromising the unit rigidity which is ensured by the aluminum frame. The AHU Unit is designed to low energy consumption and little condensation due to high thermal insulation and airtight casings to EN 1886.

Access door or service panel can be supplied with a hinged access door with latch or with removable panel with handles and panel block. Gasket around the full perimeter of the access doors frame shall be used to prevent air leakage. Door shall swing outward for unit sections under negative pressure. Module to module assembly shall be accomplished with an overlapping splice joint that is sealed with gasket on both mating modules to minimize on-site labor along with meeting indoor air quality standards. The unit is mounted on galvanized steel base frame for easy handling and positioning.

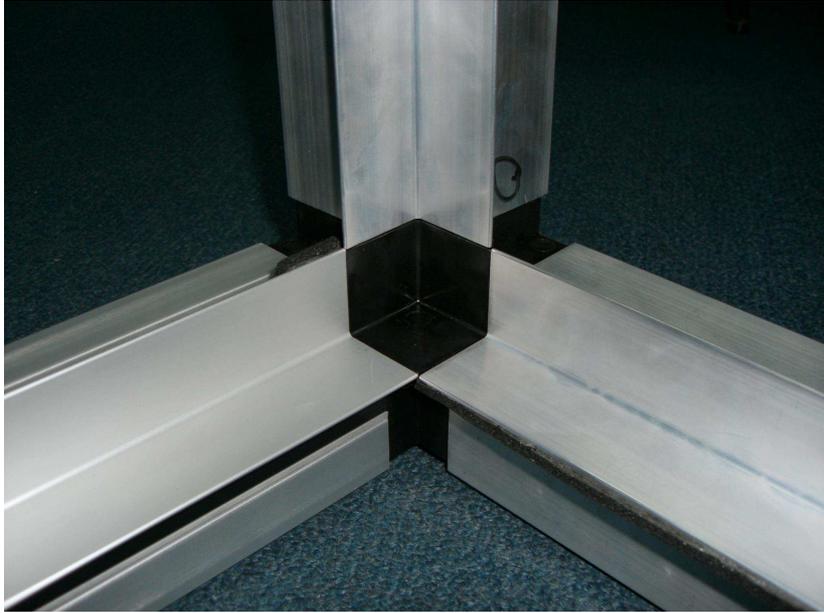


Figure 1: Aluminum pentapost attached to 3-legged injection Nylon corner piece.



Figure 2: Cabinet Appearance

3.3 THERMAL BREAK PROFILE

This is a new and high quality thermal break aluminum profile which can enhance performance of an AHU. It is constructed of two parts of extruded aluminum joint together with thermal barrier made out of nylon. The nylon is sandwiching the inner and outer layers of extruded aluminum. This design could render the formation of an effectively isolated thermal layer between the inner and outer side of the profiles so that the release of thermal energy via AHU could be ultimately minimized.

The thermal bridging factor of the assembled DDM Air Handling Unit is designed to meet BS EN 1886, Class TB2. The thermal break profile only available for cabinet with 50mm thickness. The thermal bridging for Standard DDM AHU are TB3 (50mm) and TB4 (25mm). How to define a good AHU? It can be determined by: no air leakage and minimum heat loss through the AHU. The benefit of thermal break property showed as below increase the life of AHU and also save their operation cost for using long term. In addition, it is an ideal design for high end performance.

Benefit of Thermal Break Profile

- i) Increased Energy Efficiency –System energy efficiency is improved by lowering the heat loss.
- ii) Unit condensation minimized –Exterior condensation is potentially damaging or creating hazardous conditions.
- iii) Probability of moisture migration into panel interior, which can degrade the insulation, is eliminated in this thermal break profile.
- iv) Cut-off in an attempt to achieve energy conservation.
- v) Improve sound insulation.

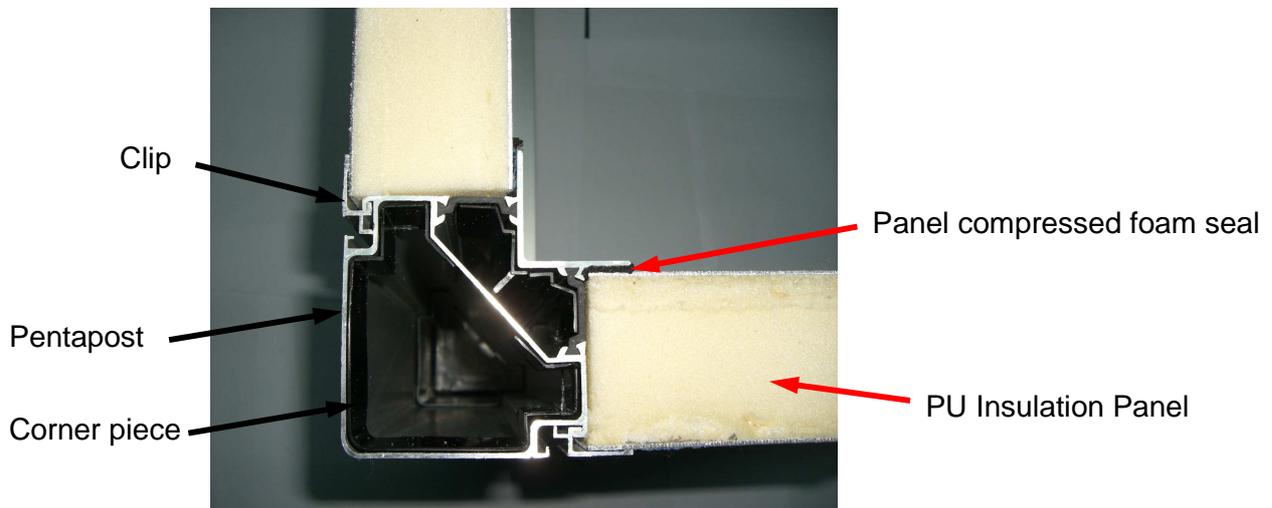


Figure 3: Thermal Break Profile Cross Section

3.4 COIL SECTION

Coil is installed such that unit casing enclose headers and return bends. Coil is designed based on the maximum utilization of available cross section area to achieve the most efficient heat transfer. Coil connections should be factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner where each pipe extends through the unit casing to minimize air leakage and condensation inside panel assembly. Coils shall be removable through side and/ or top panels of unit without the need to remove and disassemble the entire section from the unit.

Coil constructed with aluminum corrugated fins and seamless copper tubes. Copper fins and hydrophilic fins are anti-corrosive materials which are optional. The fins are designed purposely for better heat transfer efficiency and moisture carry-over limit performance. Capacity, water pressure drop and selection procedure is designed in accordance with ARI Standard 410.

Cooling coils can be used when the face velocity does not exceed 2.5 m/s. For higher face velocity, a moisture eliminator is required to prevent condensate water carry over. For stacked coil in the coil section, drip pan is installed at back between coils to drain condensate to the main drain pans without flooding the lower coil section. The optional intermediate drain pan can be supplied for those needs to access for cleaning between the coils. Daikin Air Handling Units can handle both chilled water and direct expansion system.



Figure 4: Direct Expansion System Coil



Figure 5: Stacked Coil

3.5 DRAIN PAN

The deep and sloped drain pan is designed to discharge the condensate water quickly. It is fabricated by galvanized steel sheet protected with powder coating paint or stainless steel as option. Beneath the drain pan, it is covered with 10mm PE insulation to prevent any occurrence of condensation. For stacked coil, additional drip pan or intermediate drain pan fabricated from same material as main drain pan will be installed at back between two coils.

3.6 FACE AND BY PASS DAMPER

It consists of opposed blades varying air volume through the coil and by pass to attain the desired temperature. It provides very low leakage in the face and bypass sections. Face and bypass damper can be provided for temperature modulation by bypassing air around the coil. The damper blades are fabricated of aluminum and continuous Thermoplastic Elastomer (TPE) seals are inserted onto every damper blade. The rotated rod of handle is made of brass and handle is fabricated of aluminum casting. The size of damper is decided by the air flow volume (m^3/s) and air speed (m/s). The air speed go through the damper shall not exceed 7.5 m/s .

3.7 FAN

Fans are used extensively in air-conditioning for circulating air over coils. The fan type includes forward, backward, airfoil wheel fan, twin fans with double width double inlet (DWDI) centrifugal fan. The first low cost option will be forward curved fans which are generally used for low static pressure applications. The blade of fan is constructed of galvanized steel. It consists of blade which has tips curving forward that is in the direction of rotation of fan wheel.

Meanwhile, for backward curve fans, it is run at higher speed and therefore has to be sturdier in construction. The blade of backward curved is made of heavy gauge steel or mild steel, painted after manufacturing. It can handle high static pressure system and able to show higher efficiency over a broader range of higher system resistance.

For airfoil fans, normally it will be the last option due to the costly components. It is constructed of mild steel. However, it shows higher efficiency, generate low noise level and can handle higher static pressures. Daikin housed air foil fans can operate up to 2240pa of static pressure.

Fan performance of all these fans have been tested and measured in accordance to AMCA Standard 210. The sound level is measure and rated in accordance with AMCA Standard 300. The fan bearing provided will have a minimum L50 life of 200,000 hours, and are available as high as 1,000,000 hours. Bearings are selected for minimum noise level and minimal device. The bearing is lubricated for life and maintenance free, lubrication is optional. Fan is dynamically and statically balanced to Standard ISO 1940. The fan shaft is manufactured from C45 carbon steel. It is coated with a layer of anti-corrosion varnish.

Fan discharges direction can be vertical (top & bottom) or horizontal discharge. The fan discharge should be square (for both forward and backward wheel fans) in area and flanged and isolated from the casing by the fire retardant grade flexible connection. Only one fan discharge is provided.

Fan selection requires accurate calculation of the air flow resistance through the whole system consisting of the total of two parts; external and internal static pressure. External static pressure is found in the distribution system, external to the air handler. Internal static pressure is the sum of the resistance of the coils and others component.

Beside, a comprehensive range of AC & EC plenum fans is available to meet different design criteria. These fans are design to operate unhoused inside the AHUs. The flexible fan section provides a wide combination of discharge arrangements. Plenum fans also contribute to lower overall system pressure drop, thereby reducing energy consumption.



Figure 6: Plenum fan & DWDI centrifugal fan

3.8 MOTOR

Motor is internally mounted integral to an isolated fan assembly. Standard motor shall be horizontal foot mounting, induction motor, squirrel cage, totally enclosed fan-cooled (TEFC or TEFV) with IP 55 protection and class F insulation. Motor capacity cannot be undersized but oversized for desired running capacity. For the desired operation speed between fan and motor, different poles (2, 4, 6 and 8 poles) can be consider..

MOTOR OPTION

- 380-415 Volt / 3 phase/ 50 Hz (standard)
- 230/380/440 Volt/ 3 phase/ 60Hz
- Standard efficiency motor (IE1)
- High & Premium efficiency motor (IE2 & IE3)
- Dual speed motor
- Motor with space heater & Thermistor
- Explosion / Flame proof

There are a few components which are able to provide safety, efficiency and flexibility feature for the operation of AHU. It includes thermistor, variable frequency drives (VFD), disconnect switch and others. When operating with VFD, frequency within 30 to 60 Hz is recommended for standard induction motor.



Figure 7: Induction Motor

3.9 FAN / MOTOR ASSEMBLIES

Fan assemblies are easy to service provided with –

- The adjustable motor bases allow for proper tensioning of the belts at all times.
- Two-piece split belt guards
- The belt guard is fastened by bolt and nut via three clamps.

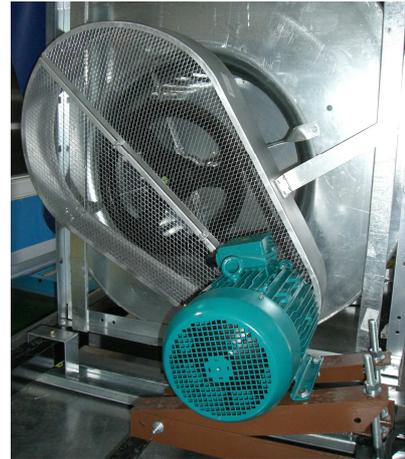


Figure 8: Fan / Motor Assemblies

3.10 SPRING ISOLATOR

The fan in AHU can create substantial vibration that will transform to panels / casing and consequently widespread the generated sound waves. To avoid this, the spring or rubber isolator is mounted between the fan compartment and the rest of the AHU to prevent the transmission of noise and vibration into panels.

There are two types of isolators used:

- Rubber mounting (for blower \leq model 355)
- 25mm deflection spring (for blower $>$ model 355)

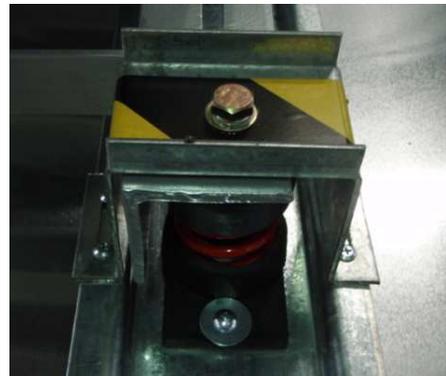


Figure 9. Spring Isolator

3.11 THERMISTOR

A thermistor is a type of resistor used to measure temperature changes in protection of windings in electric motors.

3.12 VFD/ FREQUENCY INVERTER

A VFD provides adjustable speed control of a single fan motor. Normally, an AHU which has been installed by VFD can vary the frequency within 30 to 60 Hz in order to control the motor rotation speed. It also provides protection for the motor operation.

3.13 ENERGY RECOVERY

3.13.1 HEAT RECOVERY WHEEL

Introducing ventilation from outdoors is essential in maintaining desired indoor air quality. Heat wheel is available as the option to match this requirement. These energy components can recover 50% or more of the energy normally exhausted from a building. They are working based on this concept – capture heat from exhaust air as it passes through the air handling unit and transfer it to the supply air stream. Hence,

it is able to reduce the cost of heating or cooling the outside air. During the winter, energy recovery components do this by transferring energy from a warm air stream to a colder air stream. On the other hand, during the summer, it is used to cool the air hot air.

It is constructed of aluminum coated with heat transfer material (silica gel or others) which is rotated by an electric motor at constant or variable speed. It is currently known as the most efficient technology.

There are two sections of fan required: exhaust fan and supply fan. The heat wheel rotates at a constant low speeds, capturing and transferring both sensible (heat) energy and latent (moisture) energy. The ability to transfer both sensible and latent energy gives the heat wheel several advantages. First, it can reduce the capacity of ventilation equipment. Furthermore, heat wheels can work at lower temperature without frosting occurs. The supply air from the heat wheel is not near saturation level, and moisture in the ductwork is not an issue. The benefit includes recover both latent and sensible heat by allowing reduction in system capacity about 30 to 65%. The most significant benefit is to prevent sick building syndrome.

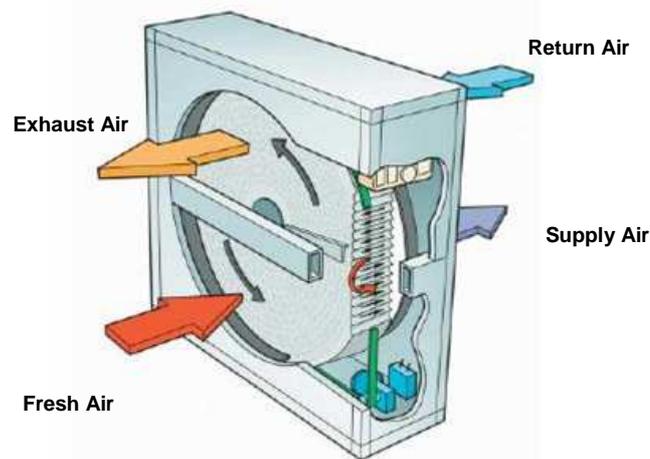


Figure 10: Heat Recover Wheel

3.13.2 HEAT PIPE

Heat pipe technology was founded by president and inventor Khanh Dinh in year 1982. It is a simple device that can transfer heat quickly from one point to another without requisite of energy input. The basic make up of heat pipe is just a metal tube (usually copper) sealed at both ends, evacuated to a vacuum and charged with refrigerant.

When one end of the pipe is exposed to warm air stream, the inside refrigerant absorbs heat and evaporates (as shown in A) and the vapor moves to the cooler end (as shown in B). As the vapor reaches to the condensing area of the cylinder (shown as C), the heat is given off to the environment and the vapor condenses. The liquid returns by gravity or capillary action. This will be a continuous cycle inside the heat pipe.

For conventional air conditioner, it uses up most cooling capacity to cool the air to dew point but less capacity for dehumidification. Meanwhile, air conditioner which is installed with heat pipe enhance air conditioner usage by allowing more cooling capacity to go towards latent cooling by pre-cooling air before it gets to cooling coil session. Only periodical cleaning is required for maintenance.

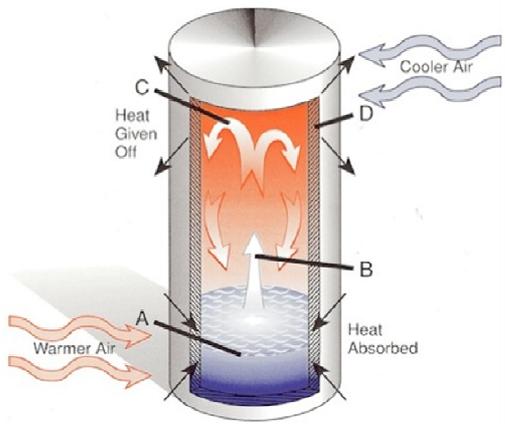


Figure 11: Horse Shoe Heat Pipe

3.14 HUMIDIFIER

There are a few humidifiers are used commercially in AHU. First is electrode steam humidifier, which is categorized as BFDT series, the second generation, high precision, intellectualized electrode humidifier. It requires an empty section to be installed. It is a device which is used to increase the air relative humidity in atmosphere without steam source. It is a constant temperature humidifier. Its principle is the common electrode humidifier regulates the generated steam by the way of controlling water level and electrical current. Electrical loop will be built up through salt minerals in the water. Therefore, water will be heated up and boiled until vapor is generated continuously. Quality of water in the region must be considered because it reduces the steam capacity. (Softened water cannot be used).

3.15 ELECTRIC HEATER

It is used to achieve desired room condition at certain desired relative humidity. With negligible air pressure drop, accurate controllability, light weight, easy serviceability and inherent freeze protection, electrical heater is valuable alternatives to conventional steam and hot water heating coils.

Electric heaters are optional with either single step or multi step of heating process. It depends much on the heating capacity. Heaters are available in 220-230V and the wiring can be in single phase / 3 phase for contractor or thyristor control.

3.16 FILTER SECTION

It plays a major role in maintaining good indoor air quality by filtration. There are a wide range of filter options which are provided by prominent filter manufacturer.

The DDM AHU has been designed to handle primary, secondary & HEPA filtration.

Beside, activated carbon filters are available with designed to improve indoor air quality through the effective removal of indoor and outdoor gaseous contaminants typically found in the urban environment. This includes VOCs, SO_x, NO_x, and Ozone.



3.17 Quick Air Filter Selection Guide

Classification as per EN 779

EN 779 Class	G1	G2	G3	G4
Average Arrestance, Am%	Am < 65	65 ≤ Am ≤ 80	80 ≤ Am ≤ 90	90 ≤ Am
Recommended Filter	-	AmerTex R15	AmerTex R29 Aluminum Mesh	AmAir 300E AmerTex R50

Table 1: Filter Arrestance for Coarse filters in Class G1-G4

EN 779 Class	F5	F6	F7	F8	F9
Average Efficiency, Em%	40 ≤ Em ≤ 60	60 ≤ Em ≤ 80	80 ≤ Em ≤ 90	90 ≤ Em ≤ 95	95 ≤ Em
Recommended Filter	AmAir 500E	DriPak [®] 2000	DriPak [®] 2000 Varicel [®] II	DriPak [®] 2000 Varicel [®] II	DriPak [®] 2000 Varicel [®] VXL

Table 2: Filter Arrestance for fine filters in Class F5-F9

Classification as per EN 1822

EN 1822 Class	H 10	H 11	H 12	H 13	H 14
Efficiency (% at 0.3μm)	> 95	> 98	> 99.99	> 99.997	> 99.999
Efficiency (% at MPPS)	> 85	> 95	> 99.5	> 99.95	> 99.995
Recommended Filter	BioCel [®] I	-	AstroCel [®] I	AstroCel [®] I	AstroCel [®] I

Table 3: Filter Efficiency for HEPA Filters Class H10-H14

In addition, filter section can be enhanced by an optional item – filter pressure gauge to ensure regular filter servicing and prevent clogging. Normally, the filter life span can be indicated by pressure gauge value for dirty filter should not exceed 300 Pa.

3.18 MIXING BOX / DAMPER

It is an air inlet section to mix fresh and return air according to the system designer's requirement. It can regulate the amount of outside and return air supplied to the conditioned space. It consists of damper in parallel blades with opposed rotating blade with driving shaft. The damper blades are fabricated of aluminum and continuous Thermoplastic Elastomer (TPE) seals are inserted onto every damper blade. The rotated rod of handle is made of brass and handle is fabricated of aluminum casting. There are a few type of arrangement: top, rear and combination of top and rear. The mixing box can make use of free cooling by opening outside air dampers when the ambient air will help to condition the supply air stream. In addition, dampers maybe individually sized to provide better mixing effect.



Figure 16. Damper & Mixing Box

3.19 SOUND ATTENUATOR

It has a perimeter galvanized steel frame. Standard pods is supplied 100mm thick in standard lengths of 900 and 1200mm according to the attenuation required. The modular widths available are 275mm or 300mm.

Nowadays, sound level will be an essential factor to be considered as one of the performance of units. Daikin product has been designing to provide the quietest sound level. Different attenuator length can be selected to meet the most stringent sound attenuation requirements. A comfortable surrounding enhances human's working and living life.

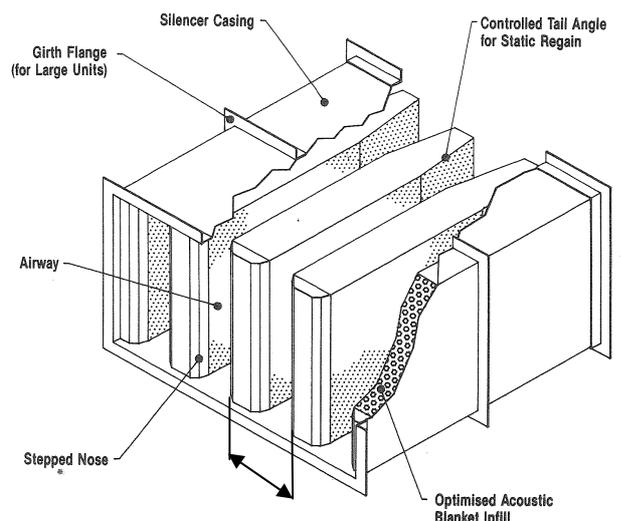


Figure 17. A Typical Cut Away View of sound attenuator

4.0 STANDARD UNITS QUICK SELECTION TABLE

Table 4: Return Air

UNIT SIZE	Air Flow	ESP	4-ROWS COOLING COIL					1-ROW HEATING COIL			MOTOR kW
			S.C	T.C.C	Water flow	WPD	Circuit	T,C	Water flow	WPD	
	LPS	Pa	kW	kW	lps	kPa		kW	lps	kPa	
0404	646	300	7.3	7.7	0.37	0.27	F	4.7	0.11	0.04	0.75
0407	1027	300	12.6	15.0	0.71	1.16	F	8.8	0.21	0.19	1.1
0410	1408	300	18	22.7	1.08	3.04	F	13.1	0.32	0.48	1.5
0413	1789	300	22.7	30.8	1.47	6.25	F	17.3	0.42	0.95	2.2
0707	1670	300	20.4	24.4	1.16	1.16	F	14.3	0.35	0.19	2.2
0710	2289	300	32.1	42.9	2.04	4.82	F	24.8	0.6	0.76	2.2
0713	2908	300	38.4	50	2.38	6.26	F	28.1	0.69	0.95	3
0715	3321	300	44.5	26	2.79	9.21	F	32.8	0.8	1.39	3.7
1010	3169	350	41.9	54.5	2.60	6.98	M	29.5	0.72	0.48	4
1013	4026	350	54.7	72.9	3.47	14.01	M	39.0	0.95	0.95	5.5
1015	4598	350	68.4	96.0	4.57	30.53	M	52.2	1.27	2.16	4
1019	5741	350	80.0	109.3	5.21	38.05	M	58.8	1.43	0.65	7.5
1021	6312	350	88.7	122.1	5.82	50.05	M	65.8	1.60	3.50	7.5
1315	5619	350	75.3	99.2	4.72	9.2	F	55.4	1.35	1.39	7.5
1319	7016	350	95.3	127.1	6.05	17.09	F	71.8	1.75	2.64	7.5
1321	7715	350	106.1	143.3	6.83	22.83	F	81.4	1.96	3.50	11
1519	7654	450	103.9	138.6	6.60	17.09	F	78.3	1.91	2.65	11
1521	8416	450	115.8	156.3	7.45	22.83	F	87.7	2.14	3.50	11
1819	9568	500	129.9	178.8	8.26	17.09	F	97.9	2.39	2.65	15
1821	10520	500	144.7	195.4	9.31	22.83	F	109.6	2.67	3.50	15
1823	11473	500	167.1	232.5	11.07	38.25	F	130.2	3.17	5.88	15
1827	13378	500	187.2	256.7	12.23	45.29	F	141.9	3.46	6.81	18.5
2027	14270	750	188.6	245.3	11.69	5.69	D	151.4	3.69	6.8	22
2033	17300	750	246.1	335.7	16.50	15.90	D	187.2	5.10	18.5	30
2233	19482	750	262.1	356.9	16.52	10.08	D	210.3	5.12	11.71	37
2239	22900	750	395.0	490.0	23.30	25.60	D	252.2	6.85	28.60	55
2539	24800	750	530.6	389.1	25.27	25.61	D	273.3	7.42	28.57	55

For Cooling Coil: EDB = 27deg. C, EWB = 19.5 deg. C, EWT = 7 deg. C, LWT = 12deg. C

For Heating Coil: EDB = 21 deg. C, EWT = 60 deg. C, LWT = 50 deg. C

Table 5. Fresh Air

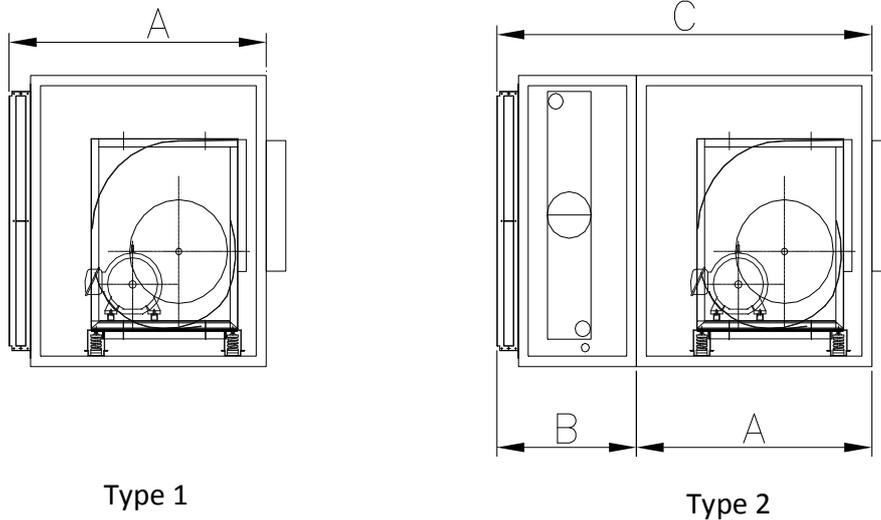
UNIT SIZE.	Air Flow	ESP	6-ROWS COOLING COIL				Circuit	1-ROW HEATING COIL			MOTOR kW
			S.C	T.C.C	Water flow	WPD		T,C	Water flow	WPD	
	LPS	Pa	kW	kW	lps	kPa	kW	lps	kPa		
0404	646	300	11.6	27.8	1.32	1.17	M	9.1	0.22	0.13	1.1
0407	1027	300	20.6	50.6	2.41	4.6	M	15.9	0.39	0.51	1.5
0410	1408	300	29.5	73	3.48	11.07	M	23	0.56	1.24	2.2
0413	1789	300	38.7	96.1	4.58	21.7	M	30.2	0.74	2.45	2.2
0707	1670	300	33.5	82.3	3.92	4.6	M	25.8	0.63	0.51	2.2
0710	2289	300	48	118.6	5.65	11.08	M	37.4	0.91	1.24	3
0713	2908	300	63	156.2	7.44	21.71	M	49.1	1.2	2.45	3
0715	3321	300	72.7	180.5	8.6	31.17	M	57.1	1.39	3.56	3.7
1010	3169	350	69.4	172.2	8.2	36.4	M	51.7	1.26	1.24	4
1013	4026	350	87.2	216.2	10.2	21.7	M	68	1.66	2.45	5.5
1015	4598	350	109.6	273.1	13.01	44.22	M	88.2	2.15	5.27	5.5
1019	5741	350	132	330.1	15.72	66.52	M	105.2	2.56	7.77	5.5
1021	6312	350	142.6	355	16.91	75.25	M	110.2	2.69	8.41	7.5
1315	5619	350	123	305.4	14.54	31.16	M	96.5	2.35	3.56	7.5
1319	7016	350	156.8	390.1	18.58	57.63	M	122.5	2.99	6.56	11
1321	7715	350	174.3	433.9	20.67	75.25	M	134.7	3.28	8.42	11
1519	7654	450	171.7	425.6	20.27	57.63	M	133.7	3.26	6.56	11
1521	8416	450	190.1	473.3	22.54	75.25	M	147	3.58	8.41	11
1819	9568	500	213.9	532	25.34	57.64	M	167.1	4.07	6.56	15
1821	10520	500	237.6	591.6	28.18	75.25	M	183.7	4.48	8.41	15
1823	11473	500	259.1	645.1	30.73	94.35	M	203.6	4.96	10.87	15
1827	13378	500	305.5	769.9	36.25	144	M	237.5	5.79	16.32	18.5
2027	14270	750	325.9	811.5	38.66	144	M	253.3	6.17	16.32	30
2233	19482	750	449.4	1120	53.36	244.2	M	351.4	8.56	28	37

For Cooling Coil: EDB = 34deg. C, EWB = 28 deg. C, EWT = 7 deg. C, LWT = 12deg. C

For Heating Coil: EDB = 0 deg. C, EWT = 60 deg. C, LWT = 50 deg. C

5.0 OUTLINE AND DIMENSION

5.1a HORIZONTAL TYPICAL CONFIGURATION



Model	0404	0407	0410	0413	0707	0710	0713	0715	1010	1013	1015	1019	1021	1315
CMH	2326	3697	5069	6440	6012	8240	10469	11956	11408	14494	16553	20668	22723	20228
LPS	646	1027	1408	1789	1670	2289	2908	3321	3169	4026	4598	5741	6312	5619
Height	800	800	800	800	1100	1100	1100	1100	1400	1400	1400	1400	1400	1700
Width	800	1100	1400	1700	1100	1400	1700	1900	1400	1700	1900	2300	2500	1900

Length

1	A	1000	1000	1100	1100	1100	1100	1300	1300	1300	1300	1500	1500	1500	1500
	2	A	-	-	-	-	-	-	-	-	-	-	-	-	-
B		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		1600	1600	1700	1700	1700	1700	1900	1900	1900	1900	2100	2100	2100	2100

Model	1319	1321	1519	1521	1819	1821	1823	1827	2027	2033	2233	2239	2539
CMH	25258	27774	27554	30298	34445	37872	41303	48161	51372	62343	70135	82485	89406
LPS	7016	7715	7654	8416	9568	10520	11473	13378	14270	17318	19482	22913	24835
Height	1700	1700	1900	1900	2200	2200	2200	2200	2400	2400	2600	2600	2900
Width	2300	2500	2300	2500	2300	2500	2700	3100	3100	3700	3700	4300	4300

Length

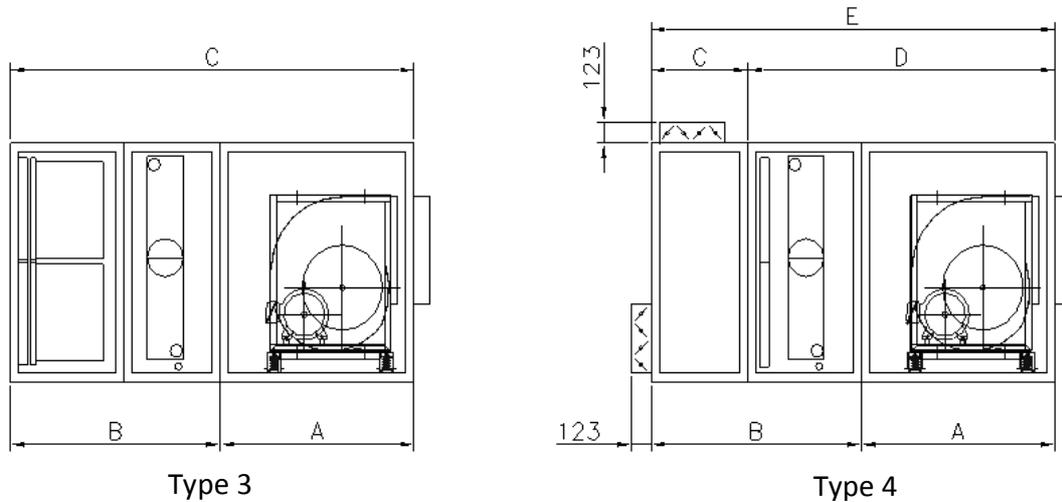
1	A	1500	1700	1700	1700	1700	1900	1900	2100	2100	2300	N/A	N/A	N/A
	2	A	-	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200 ⁵⁾	2200 ⁵⁾
B		-	700	700	700	700	700	700	700	700	700	700	700	
C		2100	2300	2300	2300	2300	2500	2500	2700	2700	2900	2900	2900	

Table 6 : Horizontal Typical Configuration Type 1 & 2

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.
- 5) For blower model 1250, section size will be 2600

5.1b HORIZONTAL TYPICAL CONFIGURATION



Model	0404	0407	0410	0413	0707	0710	0713	0715	1010	1013	1015	1019	1021	1315
CMH	2326	3697	5069	6440	6012	8240	10469	11956	11408	14494	16553	20668	22723	20228
LPS	646.1	1027	1408	1789	1670	2289	2908	3321	3169	4026	4598	5741	6312	5619
Height	800	800	800	800	1100	1100	1100	1100	1400	1400	1400	1400	1400	1700
Width	800	1100	1400	1700	1100	1400	1700	1900	1400	1700	1900	2300	2500	1900

Length

3	A	900	900	1000	1000	1000	1000	1200	1200	1200	1200	1400	1400	1400	1400
	B	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	C	2200	2200	2300	2300	2300	2300	2500	2500	2500	2500	2700	2700	2700	2700
4	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	C	-	-	-	-	500	500	500	500	600	600	600	600	600	600
	D	-	-	-	-	1700	1700	1900	1900	1900	1900	2100	2100	2100	2100
	E	2000	2000	2100	2100	2200	2200	2400	2400	2500	2500	2700	2700	2700	2700

Model	1319	1321	1519	1521	1819	1821	1823	1827	2027	2033	2233	2239	2539
CMH	25258	27774	27554	30298	34445	37872	41303	48161	51372	62343	70135	82485	89406
LPS	7016	7715	7654	8416	9568	10520	11473	13378	14270	17318	19482	22913	24835
Height	1700	1700	1900	1900	2200	2200	2200	2200	2400	2400	2600	2600	2900
Width	2300	2500	2300	2500	2300	2500	2700	3100	3100	3700	3700	4300	4300

Length

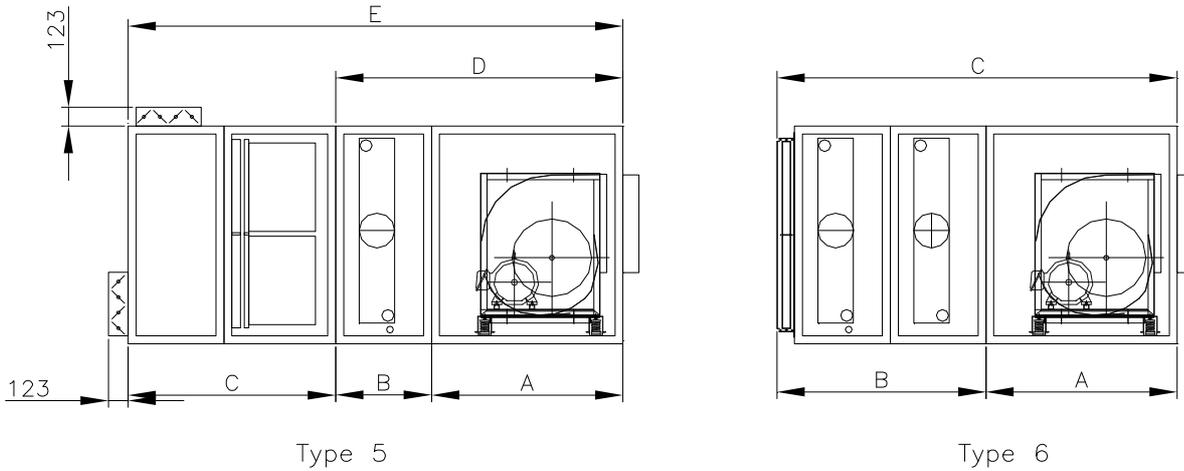
3	A	1400	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200	2200 ⁵⁾	2200 ⁵⁾
	B	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	C	2700	2900	2900	2900	2900	3100	3100	3300	3300	3500	3500	3500	3500
4	A	-	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200	2200 ⁵⁾	2200 ⁵⁾
	B	-	1300	1400	1400	1400	1500	1500	1500	1500	1700	1700	1900	1900
	C	600	-	-	-	-	-	-	-	-	-	-	-	-
	D	2100	-	-	-	-	-	-	-	-	-	-	-	-
	E	2700	2900	3000	3000	3000	3300	3300	3500	3500	3900	3900	4100	4100

Table 7 : Horizontal Typical Configuration Type 3 & 4

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.
- 5) For blower model 1250, section size will be 2600

5.1c HORIZONTAL TYPICAL CONFIGURATION



Model	0404	0407	0410	0413	0707	0710	0713	0715	1010	1013	1015	1019	1021	1315
CMH	2326	3697	5069	6440	6012	8240	10469	11956	11408	14494	16553	20668	22723	20228
LPS	646	1027	1408	1789	1670	2289	2908	3321	3169	4026	4598	5741	6312	5619
Height	800	800	800	800	1100	1100	1100	1100	1400	1400	1400	1400	1400	1700
Width	800	1100	1400	1700	1100	1400	1700	1900	1400	1700	1900	2300	2500	1900

Length		A	B	C	D	E	A	B	C
5	A	-	-	-	-	-	-	-	-
	B	-	-	-	-	-	-	-	-
	C	1100	1100	1100	1100	1200	1200	1200	1200
	D	1500	1500	1600	1600	1600	1600	1800	1800
	E	2600	2600	2700	2700	2800	2800	3000	3000
6	A	-	-	1000	1000	1000	1200	1200	1200
	B	-	-	1300	1300	1300	1300	1300	1300
	C	2100	2100	2300	2300	2300	2300	2500	2500

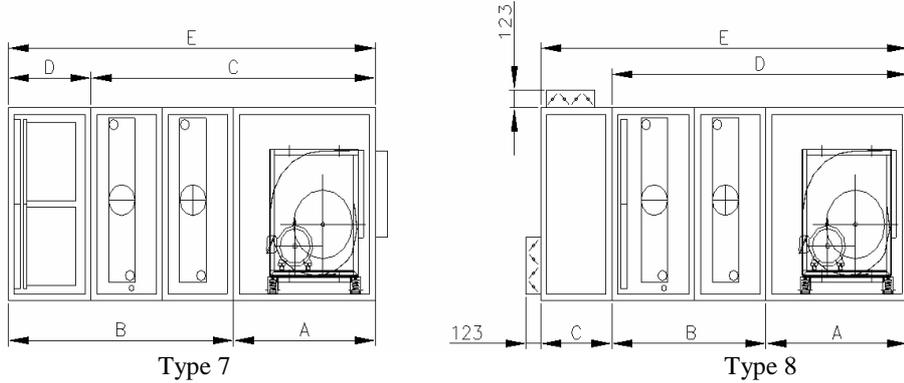
Model	1319	1321	1519	1521	1819	1821	1823	1827	2027	2033	2233	2239	2539
CMH	25258	27774	27554	30298	34445	37872	41303	48161	51372	62343	70135	82485	89406
LPS	7016	7715	7654	8416	9568	10520	11473	13378	14270	17318	19482	22913	24835
Height	1700	1700	1900	1900	2200	2200	2200	2200	2400	2400	2600	2600	2900
Width	2300	2500	2300	2500	2300	2500	2700	3100	3100	3700	3700	4300	4300

Length		A	B	C	D	E	A	B	C
5	A	-	1600	1600	1600	1600	1800	1800	2000
	B	-	600	600	600	600	600	600	600
	C	1300	1300	1400	1400	1400	1500	1500	1500
	D	2000	-	-	-	-	-	-	-
	E	3300	3500	3600	3600	3600	3900	3900	4100
6	A	1400	1600	1600	1600	1600	1800	1800	2000
	B	1300	1300	1300	1300	1300	1300	1300	1300
	C	2700	2900	2900	2900	2900	3100	3100	3300

Table 8 : Horizontal Typical Configuration Type 5 & 6

- Note:
- 1) Please add 100mm for model using coil (8 Row & above)
 - 2) The dimensions are subject to change without any notice for future improvement.
 - 3) Dimensions in mm.
 - 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.
 - 5) For blower model 1250, section size will be 2600

5.1d HORIZONTAL TYPICAL CONFIGURATION



Model	404	407	410	413	707	710	713	715	1010	1013	1015	1019	1021	1315
CMH	2326	3697	5069	6440	6012	8240	10469	11956	11408	14494	16553	20668	22723	20228
LPS	646.1	1027	1408	1789	1670	2289	2908	3321	3169	4026	4598	5741	6312	5619
Height	800	800	800	800	1100	1100	1100	1100	1400	1400	1400	1400	1400	1700
Width	800	1100	1400	1700	1100	1400	1700	1900	1400	1700	1900	2300	2500	1900

Length

7	A	-	-	-	-	-	-	1200	1200	1200	1200	1400	1400	1400	1400
	B	-	-	-	-	-	-	1900	1900	1900	1900	1900	1900	1900	1900
	C	2100	2100	2200	2200	2200	2200	-	-	-	-	-	-	-	-
	D	700	700	700	700	700	700	-	-	-	-	-	-	-	-
	E	2800	2800	2900	2900	2900	2900	3100	3100	3100	3100	3300	3300	3300	3300
8	A	-	-	1000	1000	1000	1000	1200	1200	1200	1200	1400	1400	1400	1400
	B	-	-	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	C	400	400	400	400	500	500	500	500	600	600	600	600	600	600
	D	2200	2200	-	-	-	-	-	-	-	-	-	-	-	-
	E	2600	2600	2700	2700	2800	2800	3000	3000	3100	3100	3300	3300	3300	3300

Model	1319	1321	1519	1521	1819	1821	1823	1827	2027	2033	2233	2239	2539
CMH	25258	27774	27554	30298	34445	37872	41303	48161	51372	62343	70135	82485	89406
LPS	7016	7715	7654	8416	9568	10520	11473	13378	14270	17318	19482	22913	24835
Height	1700	1700	1900	1900	2200	2200	2200	2200	2400	2400	2600	2600	2900
Width	2300	2500	2300	2500	2300	2500	2700	3100	3100	3700	3700	4300	4300

Length

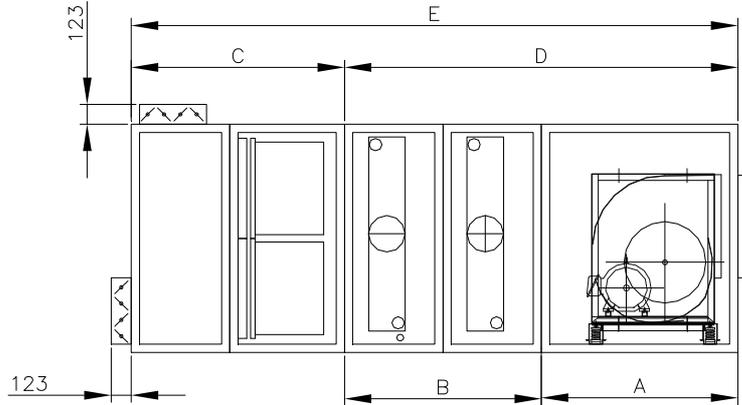
7	A	1400	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200	2200 ⁵⁾	2200 ⁵⁾
	B	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	D	-	-	-	-	-	-	-	-	-	-	-	-	-
	E	3300	3500	3500	3500	3500	3700	3700	3900	3900	4100	4100	4100	4100
8	A	1400	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200	2200 ⁵⁾	2200 ⁵⁾
	B	1200	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
	C	600	600	700	700	700	800	800	800	800	1000	1000	1200	1200
	D	-	-	-	-	-	-	-	-	-	-	-	-	-
	E	3300	3500	3600	3600	3600	3900	3900	4100	4100	4500	4500	4700	4700

Table 9 : Horizontal Typical Configuration Type 7 & 8

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.
- 5) For blower model 1250, section size will be 2600

5.1e HORIZONTAL TYPICAL CONFIGURATION



Type 9

Model	0404	0407	0410	0413	0707	0710	0713	0715	1010	1013	1015	1019	1021	1315
CMH	2326	3697	5069	6440	6012	8240	10469	11956	11408	14494	16553	20668	22723	20228
LPS	646.1	1027	1408	1789	1670	2289	2908	3321	3169	4026	4598	5741	6312	5619
Height	800	800	800	800	1100	1100	1100	1100	1400	1400	1400	1400	1400	1700
Width	800	1100	1400	1700	1100	1400	1700	1900	1400	1700	1900	2300	2500	1900

Length

9	A	-	-	-	-	-	-	1200	1200	1200	1200	1400	1400	1400	1400	
	B	-	-	-	-	-	-	1200	1200	1200	1200	1200	1200	1200	1200	1200
	C	1100	1100	1100	1100	1200	1200	1200	1200	1300	1300	1300	1300	1300	1300	1300
	D	2100	2100	2200	2200	2200	2200	-	-	-	-	-	-	-	-	-
	E	3200	3200	3300	3300	3400	3400	3600	3600	3700	3700	3900	3900	3900	3900	3900

Model	1319	1321	1519	1521	1819	1821	1823	1827	2027	2033	2233	2239	2539
CMH	25258	27774	27554	30298	34445	37872	41303	48161	51372	62343	70135	82485	89406
LPS	7016	7715	7654	8416	9568	10520	11473	13378	14270	17318	19482	22913	24835
Height	1700	1700	1900	1900	2200	2200	2200	2200	2400	2400	2600	2600	2900
Width	2300	2500	2300	2500	2300	2500	2700	3100	3100	3700	3700	4300	4300

Length

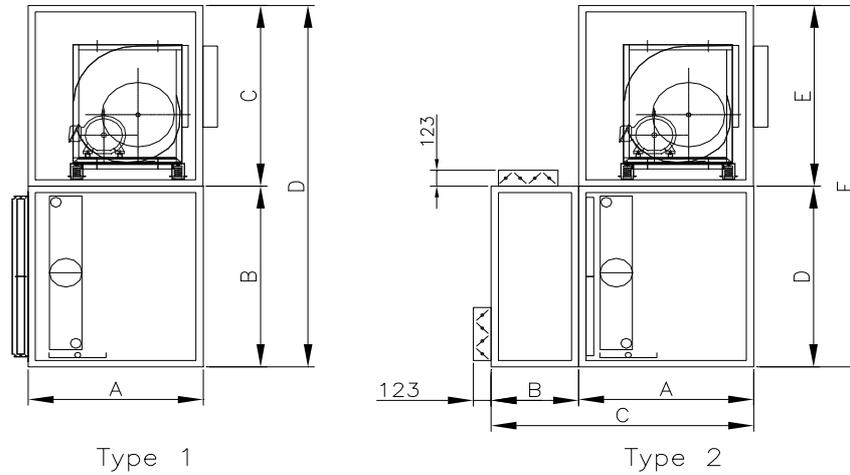
9	A	1400	1600	1600	1600	1600	1800	1800	2000	2000	2200	2200	2200 ⁵⁾	2200 ⁵⁾
	B	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
	C	1300	1300	1400	1400	1400	1500	1500	1500	1500	1700	1700	1900	1900
	D	-	-	-	-	-	-	-	-	-	-	-	-	-
	E	3900	4100	4200	4200	4200	4500	4500	4700	4700	5100	5100	5300	5300

Table 10 : Horizontal Typical Configuration Type 9

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.
- 5) For blower model 1250, section size will be 2600

5.2a VERTICAL TYPICAL CONFIGURATION



Model	0404	0407	0410	0413	0707	0710	0713	0715
CMH	2326	3697	5069	6440	6012	8240	10469	11956
LPS	646	1027	1408	1789	1670	2288	2908	3321
Width	800	1100	1400	1700	1100	1400	1700	1900

Length									
1	A	900	900	1000	1000	1000	1000	1200	1200
	B	-	-	-	-	-	1100	1100	1100
	C	-	-	-	-	-	1100	1100	1100
	D	1600	1600	1600	1600	1900	2200	2200	2200
2	A	900	900	1000	1000	1000	1000	1200	1200
	B	400	400	400	400	500	500	500	500
	C	1300	1300	1400	1400	1500	1500	1700	1700
	D	800	800	800	800	1100	1100	1100	1100
	E	-	-	-	-	-	1100	1100	1100
F	1600	1600	1600	1600	1900	2200	2200	2200	

Model	1010	1013	1015	1019	1021	1315	1319	1321
CMH	11408	14494	16553	20668	22723	20228	25258	27774
LPS	3169	4026	4598	5741	6312	5619	7016	7715
Width	1400	1700	1900	2300	2500	1900	2300	2500

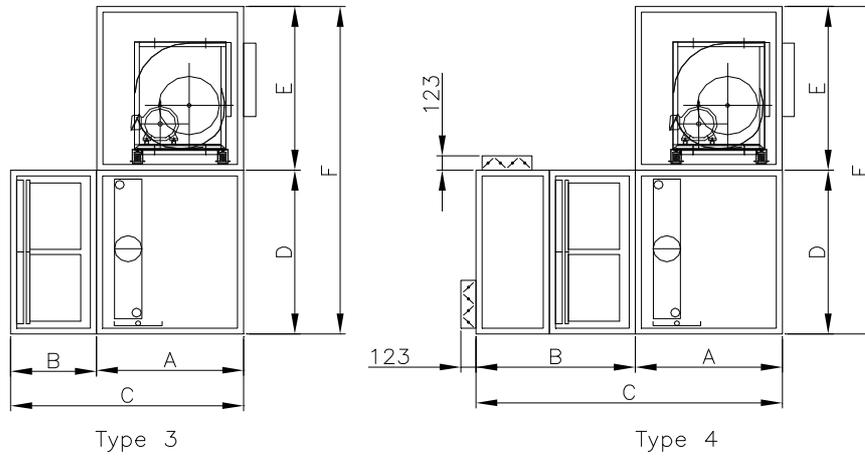
Length									
1	A	1200	1200	1400	1400	1400	1400	1400	1600
	B	1400	1400	1400	1400	1400	1700	1700	1700
	C	1100	1200	1200	1400	1400	1400	1600	1600
	D	2500	2600	2800	2800	2800	3100	3300	3300
2	A	1200	1200	1400	1400	1400	1400	1400	1600
	B	600	600	600	600	600	600	600	600
	C	1800	1800	2000	2000	2000	2000	2000	2200
	D	1400	1400	1400	1400	1400	1700	1700	1700
	E	1100	1200	1400	1400	1400	1400	1600	1600
F	2500	2600	2800	2800	2800	3100	3300	3300	

Table 11 : Vertical Typical Configuration Type 1 & 2

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.

5.2b VERTICAL TYPICAL CONFIGURATION



Model	0404	0407	0410	0413	0707	0710	0713	0715
CMH	2326	3697	5069	6440	6012	8240	10469	11956
LPS	646	1027	1408	1789	1670	2289	2908	3321
Width	800	1100	1400	1700	1100	1400	1700	1900

Length									
3	A	900	900	1000	1000	1000	1000	1200	1200
	B	700	700	700	700	700	700	700	700
	C	1600	1600	1700	1700	1700	1700	1900	1900
	D	800	800	800	800	1100	1100	1100	1100
	E	-	-	-	-	-	1100	1100	1100
	F	1600	1600	1600	1600	1900	2200	2200	2200
4	A	900	900	1000	1000	1000	1000	1200	1200
	B	1100	1100	1100	1100	1200	1200	1200	1200
	C	2000	2000	2100	2100	2200	2200	2400	2400
	D	800	800	800	800	1100	1100	1100	1100
	E	-	-	-	-	-	1100	1100	1100
	F	1600	1600	1600	1600	1900	2200	2200	2200

Model	1010	1013	1015	1019	1021	1315	1319	1321
CMH	11408	14494	16553	20668	22723	20228	25258	27774
LPS	3169	4026	4598	5741	6312	5619	7016	7715
Width	1400	1700	1900	2300	2500	1900	2300	2500

Length									
3	A	1200	1200	1400	1400	1400	1400	1400	1600
	B	700	700	700	700	700	700	700	700
	C	1900	1900	2100	2100	2100	2100	2100	2300
	D	1400	1400	1400	1400	1400	1700	1700	1700
	E	1100	1200	1400	1400	1400	1400	1600	1600
	F	2500	2600	2800	2800	2800	3100	3300	3300
4	A	1200	1200	1400	1400	1400	1400	1400	1600
	B	1300	1300	1300	1300	1400	1400	1400	1500
	C	2500	2500	2700	2700	2800	2800	2800	3100
	D	1400	1400	1400	1400	1400	1700	1700	1700
	E	1100	1200	1400	1400	1400	1400	1600	1600
	F	2500	2600	2800	2800	2800	3100	3300	3300

Table 12 : Vertical Typical Configuration Type 3 & 4

Note:

- 1) Please add 100mm for model using coil (8 Row & above)
- 2) The dimensions are subject to change without any notice for future improvement.
- 3) Dimensions in mm.
- 4) Please add 50mm length on the individual section width, depth and height if using the 50mm insulation panel.

6.0 APPLICATION CONSIDERATIONS

6.1 Installation Flexibility

Daikin AHU feature sectionalized design to provide maximum installation flexibility. Mixing box, filter, coil, fan and access components permit the design flexibility of built-up systems with the cost-effective of factory fabricated units. Every section is fabricated of heavy-gauge continuous galvanized steel or extruded aluminum with exacting assembly procedures and rigid quality control standards.

6.2 Mounting and Access

Whether units are floor or ceiling mounted, care should be taken to ensure that the supporting structure is level and rigid enough for satisfactory unit operation. Ideally, a heavy concrete slab should be used for bottom mounted units, and main support beams for top hung units. Long floor or ceiling spans should be avoided.

Unit should be located so as to provide proper access for routine service. Clearance for filter removal on both sides of the filter section is usually necessary. Clearance should be provided as required for access panels. Room should be allowed for coil removal. Cooling units require clearance for a trap in the drain pan line.

Access to the interior of Daikin air handlers is provided by hinged access doors or removable panels wherever possible. For access between components, a versatile access section features hinged access doors at both ends.

6.3 Ductwork

Good ductwork layout will minimize system resistance and sound generation. Duct connections to and from units should allow straight, smooth airflow. Sharp turns in the fan discharge should be avoided, particularly turns opposed to wheel rotation. Turning vanes should be used. Discharge plenums or any abrupt change in duct should be avoided.

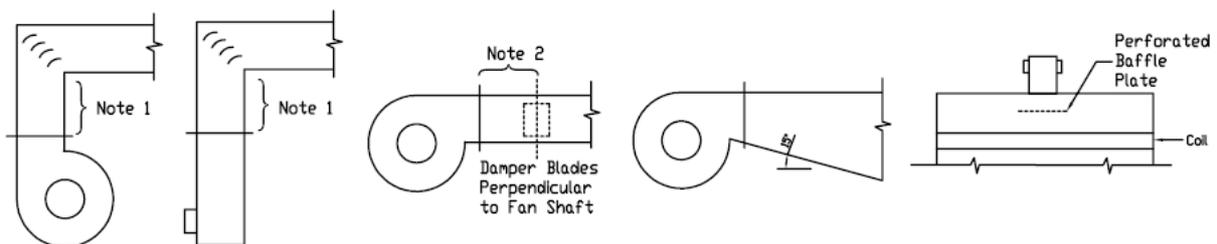


Figure 18: Discharge duct layout

- Notes: 1. Elbows should not be closer than $1\frac{1}{2}$ to $2\frac{1}{2}$ times the largest dimension of fan discharge opening.
2. Dampers should be placed at least fan diameters downstream of the fan discharge.

FIGURES REPRINTED WITH PERMISSION FROM THE 1979 ASHRAE GUIDE AND DATA BOOK (EQUIPMENT).

6.4 Piping and Drain Fan Traps

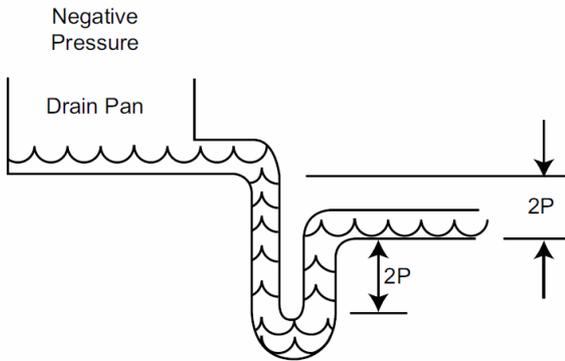


Figure 19: Drain pan traps

Piping should be in accordance with accepted industry standards. Undue stress should not be applied at the connection to coil headers. Pipe work should be supported independently of the coils with adequate piping flexibility for thermal expansion. Drain lines and traps should be run full size from the drain pan connection. Drain pans should have traps to permit the condensate from the coils to drain freely. On a draw-through unit, the trap depth and the distance between the trap outlet and the drain pan outlet should be twice the negative static pressure under normal unit operation.

6.5 Air Supply Systems and Fan Laws

An air supply system consists of an AHU cabinet, heat exchanger, filters, ductwork, grilles and register used to distribute air throughout the building. The system is independent of the fan used to supply the system. The resistance of the system, referred to as static pressure (SP), is dependent upon the quantity of air (CFM) that is moved through it. The air quantity is determined by the cooling, heating and ventilating requirements.

For any system, the static pressure will vary directly as the square of the air quantity. This relationship between CFM and SP establishes the system curve for that system and may be expressed as follows:

$$\left(\frac{CFM_1}{CFM_2}\right)^2 = \frac{SP_1}{SP_2} \quad \text{or} \quad SP_2 = SP_1 \left(\frac{CFM_2}{CFM_1}\right)^2$$

The system curve is unique for a particular system configuration. Any change to the system caused by dirty filters, damper change, etc., will result in new system curve.

For fans operating at low pressures (less than 10" W.G.), the effects of air compression allows fan operation in a fixed system to be expressed by simple relationships. These relationships are known as fan laws and may be used to calculate the effects of fan speed and air density changes on this system.

1. The flow rate varies directly with the change in fan speed:

$$\frac{CFM_1}{CFM_2} = \frac{RPM_1}{RPM_2} \quad \text{or} \quad CFM_2 = CFM_1 \left(\frac{RPM_2}{RPM_1}\right)$$

A 10% increase in fan speed will give a 10% increase in air quantity.

2. The static pressure varies as the square of the change in fan speed:

$$\frac{SP_1}{SP_2} = \left(\frac{RPM_1}{RPM_2} \right)^2 \text{ or } SP_2 = SP_1 \left(\frac{RPM_2}{RPM_1} \right)^2$$

A 10% increase in fan speed will give a 21% increase in air static pressure.

3. The fan brake horsepower varies as the cube of the change in fan speed:

$$\frac{HP_1}{HP_2} = \left(\frac{RPM_1}{RPM_2} \right)^3 \text{ or } HP_2 = HP_1 \left(\frac{RPM_2}{RPM_1} \right)^3$$

A 10% increase in fan speed will give a 33% increase in fan horsepower.

4. System static pressure and brake horsepower are directly proportional to the air density:

$$SP_2 = SP_1 \left(\frac{Density_2}{Density_1} \right) \left(\frac{RPM_2}{RPM_1} \right)^2$$

$$HP_2 = HP_1 \left(\frac{Density_2}{Density_1} \right) \left(\frac{RPM_2}{RPM_1} \right)^3$$

Consequently, the static pressure and brake horsepower decrease with an increase in air temperature or higher altitude, and increase with a decrease in air temperature or lower altitude.

To determine fan performance for temperatures and altitudes other than standard (70°F, 0 ft. altitude), the static pressure must be adjusted by the density ratio before the fan RPM and BHP requirement can be determined. Density ratios are expressed as temperature and altitude conversion factors in Table 13.

AIR TEMP (°F)	ALTITUDE (FEET)								
	0	1000	2000	3000	4000	5000	6000	7000	8000
-20	1.20	1.16	1.12	1.08	1.04	1.00	0.97	0.93	0.89
0	1.15	1.10	1.08	1.02	0.99	0.95	0.92	0.88	0.85
20	1.11	1.06	1.02	0.98	0.95	0.92	0.88	0.85	0.82
40	1.06	1.02	0.98	0.94	0.91	0.88	0.84	0.81	0.78
60	1.02	0.98	0.94	0.91	0.88	0.85	0.81	0.79	0.76
70	1.00	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74
80	0.98	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72
100	0.94	0.91	0.88	0.84	0.81	0.78	0.75	0.72	0.70
120	0.92	0.88	0.85	0.81	0.78	0.76	0.72	0.70	0.67
140	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.68	0.65
160	0.85	0.82	0.79	0.76	0.74	0.70	0.68	0.65	0.63
200	0.80	0.77	0.75	0.72	0.69	0.67	0.64	0.62	0.60
250	0.75	0.72	0.69	0.67	0.65	0.62	0.60	0.58	0.56

Table 13: Temperature and altitude conversion

7.0 FAN SPECIFICATION

Model	Fan Section				Arrangement Units
	Available Fan Size	Discharge Size (mm)	Maximum Motor Size (kW)	Motor Mounting Position	R/Rl/T/TI Discharge
					Depth (mm)
0404	180	230x230	3	Rear	900
	200	260x260	3	Rear	900
	225	295x295	4	Rear	900
0407	225	295x295	4	Rear	900
	250	330x330	4	Side	900
0410	250	330x330	7.5	Side	1000
	280	370x370	7.5	Side	1000
	315	410x410	7.5	Side	1000
0413	315	410x410	7.5	Side	1000
	355	460x460	7.5	Side	1000
0707	280	370x370	4	Side	1000
	315	410x410	2.2	Side	1000
0710	315	410x410	7.5	Side	1000
	355	460x460	7.5	Side	1000
0713	400	515x515	15	Side	1200
	450	575x575	11	Side	1200
0715	400	515x515	18.5	Side	1200
	450	575x575	18.5	Side	1200
1010	355	460x460	7.5	Side	1200
	400	515x515	7.5	Side	1200
1013	450	575x575	11	Side	1200
	500	645x645	7.5	Side	1200
1015	450	575x575	18.5	Side	1400
	500	645x645	30	Side	1400
1019	500	645x645	55	Side	1400
	560	720x720	55	Side	1400
	630	810x810	45	Side	1400
1021	560	720x720	55	Side	1400
	630	810x810	55	Side	1400
1315	500	645x645	30	Side	1400
	560	720x720	11	Side	1400
1319	560	720x720	35	Side	1400
	630	810x810	45	Side	1400
1321	560	720x720	55	Side	1600
	630	810x810	55	Side	1600
	710	910x910	55	Side	1600
1519	560	720x720	55	Side	1600
	630	810x810	45	Side	1600
1521	630	810x810	55	Side	1600
	710	910x910	55	Side	1600
1819	630	810x810	45	Side	1600
	710	910x910	22	Side	1600
1821	710	910x910	55	Side	1800
	800	1010x1010	30	Side	1800
1823	710	910x910	55	Side	1800
	800	1010x1010	55	Side	1800
1827	800	1010x1010	55	Side	2000
	900	1200x1200	55	Side	2000
	1000	1300x1300	55	Side	2000

Model	Fan Section				Arrangement Units
	Available Fan Size	Discharge Size mm	Maximum Motor Size kW	Motor Mounting Position	R/Rl/T/Tl Discharge
					Depth mm
2027	800	1010x1010	55	Side	2000
	900	1200x1200	55	Side	2000
	1000	1300x1300	55	Side	2000
2033	900	1200x1200	55	Side	2200
	1000	1300x1300	55	Side	2200
	1120	1430x1430	55	Side	2200
2233	900	1200x1200	55	Side	2200
	1000	1300x1300	55	Side	2200
	1120	1430x1430	55	Side	2200
2239	1000	1300x1300	55	Side	2200
	1120	1430x1430	55	Side	2200
	1250	1530x1530	55	Side	2600
2539	1120	1430x1430	55	Side	2200
	1250	1530x1530	55	Side	2600

Table 14.

7.1 FAN DISCHARGE ARRANGEMENT

Horizontal Arrangement Unit.

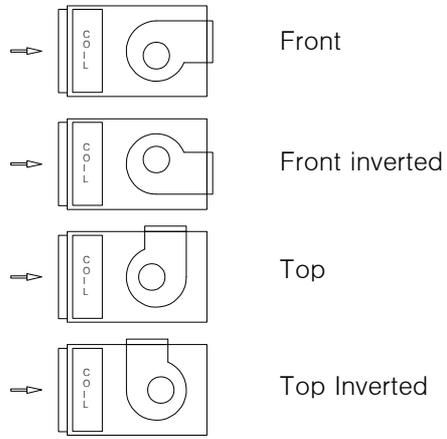


Figure 20.

Vertical Arrangement Unit.

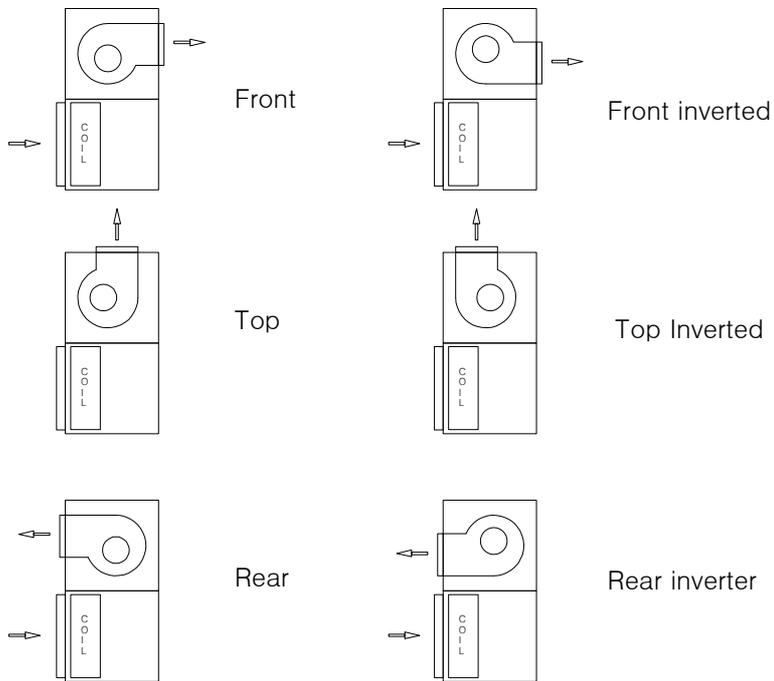
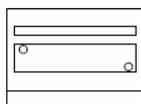


Figure 21.



8.0 FAN MOTOR SPECIFICATION

- Squirrel case induction motor is used for the DDM Air Handling Unit. Motor is horizontal foot mounted, single speed and has a die case steel body.
- The motor shaft material is C-40 steel and the motor has Class F insulation with temperature limit of 145°C
- For motor below 3 kW, direct on line starting with 3 wire terminals only.
For motor above 3 kW, star-delta starting with 6 wire terminals.
- Terminal box location is illustrated in Figure 22.

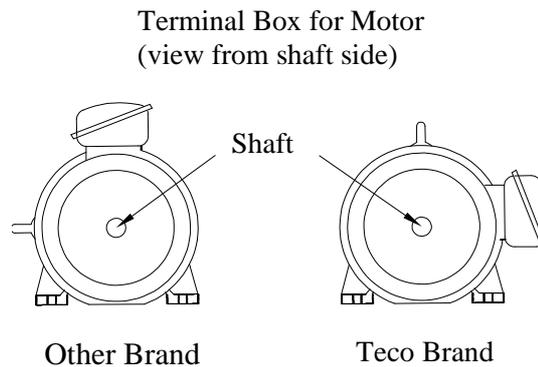


Figure 22.

4 POLES

Rated Power		Full Load Speed rev/min	Full Load Current at Rated	
kW	hp		415V	380V
0.37	0.5	1340	1.01	1.1
0.55	0.75	1390	1.37	1.5
0.75	1	1380	1.83	2
1.1	1.5	1390	2.75	3
1.5	2	1390	3.57	3.9
2.2	3	1410	4.76	5.2
3	4	1410	6.23	6.8
4	5.5	1440	7.97	8.7
5.5	7.5	1445	10.99	12
7.5	10	1445	14.65	16
11	15	1460	21.06	23
15	20	1460	27.47	30
18.5	25	1470	32.96	36
22	30	1470	38.46	42
30	40	1470	53.11	58
37	50	1475	64.10	70
45	60	1475	77.83	85
55	75	1475	94.31	103
75	100	1485	128.20	140

Table 16.

6 POLES

Rated Power		Full Load Speed rev/min	Full Load Current at Rated	
kW	hp		415V	380V
0.37	0.5	1340	1.10	1.2
0.55	0.75	1390	1.57	1.7
0.75	1	1380	2.20	2.4
1.1	1.5	1390	3.02	3.3
1.5	2	1390	3.66	4
2.2	3	1410	5.04	5.5
3	4	1410	6.87	7.5
4	5.5	1440	9.16	10
5.5	7.5	1445	11.90	13
7.5	10	1445	15.57	17
11	15	1460	21.98	24
15	20	1460	28.39	31
18.5	25	1470	34.80	38
22	30	1470	41.20	45
30	40	1470	53.11	58
37	50	1475	65.01	71
45	60	1475	78.75	86
55	75	1475	96.14	105
75	100	1485	130.00	142

Table 17.

9.0 BELT AND PULLEY SPECIFICATION

- DDM Air Handling Unit comes standard with taper lock pulley and wedge belt with optional adjustable pulley and belt.
- Standard service factor of 1.5 suitable for 24 hours operation.

9.1 PULLEY ALIGNMENT

- Adjust the motor pulley to align with the fan pulley with the use of a straight edge.
- Do not force belts on the pulleys groove.
- Firstly, loosen the bolts at motor base until belt can slide smoothly over pulleys edge.
- When all the belts are in place, proceed to adjust belt tension using the adjusting nuts on the motor mount.
- Figure 23 illustrates the pulleys alignment.

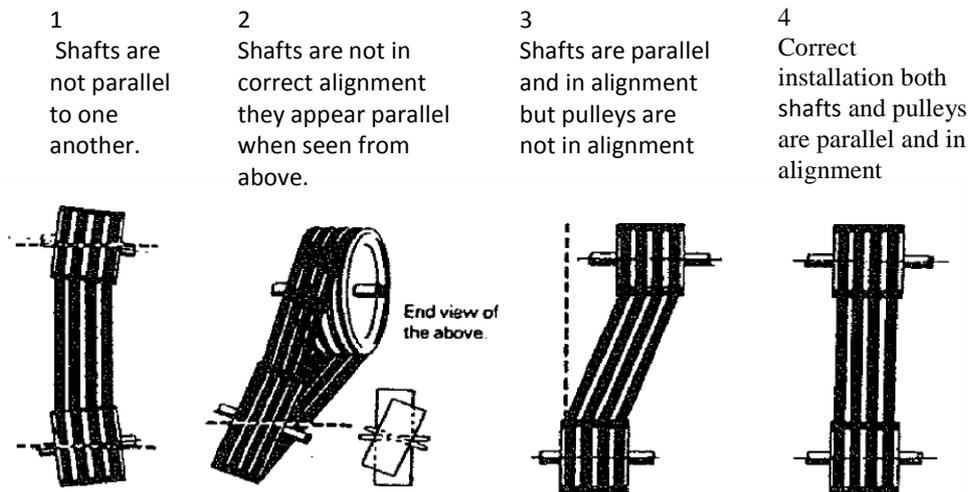


Figure 23

- To check the belt tension, apply a force K large enough at the centre of the belt to deflect the belt 15mm per meter. The deflection force for any belt should be within the minimum and maximum force shown in Table 18.
- When the tension drops to the minimum value, readjust to the maximum value.
- During normal operation a belt seat itself in pulleys grooves and require periodical checks to maintain tension.

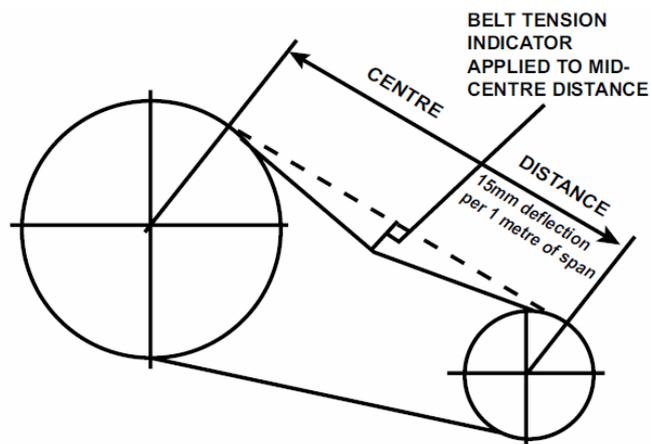


Figure 24

WARNING: Improper pulleys alignment and belt tension are the most frequent causes of excessive vibration as well as shortened belt and bearing life. It is important to install the pulleys as close as practical to the bearing.

CAUTION: Do not over tighten the belts or the bearings may become damaged.

10.0 COIL SPECIFICATION

The DDM Air Handling Units can be used for both chilled water system and direct expansion system application. Coils are designed based on application to best meet the requirements.

- Standard Aluminum fins are maximum 12 FPI (fin per inch). Copper fins are also available as option. Fin thickness is 0.115mm and fin hardness is H0 and H22 for standard aluminum fin and others fins respectively. Fins can be coated by Heresite or Hydrophilic fin material as a corrosion protective layer.
- Standard coil frame is in 1.5mm thick galvanized steel (GI) while stainless steel (SSTL) is available as an option when copper fin is used to avoid galvanization effect. Coil casing is designed to have drain holes at the bottom channels to ensure condensate drainage.
- For water system, the coil is available in 1, 2, 3, 4, 5, 6, 8, 10 and 12 rows. Header and collar is constructed of steel with copper material as the option. Its size is either 42 or 76 mm. Piping connection is only one sided, either “left” or “right”, viewing from return air side. The connection for steel header is by Male Pitch Threaded (MPT) joint. Copper header connection will be brazed joint type and optional for Male Pitch Threaded (MPT).

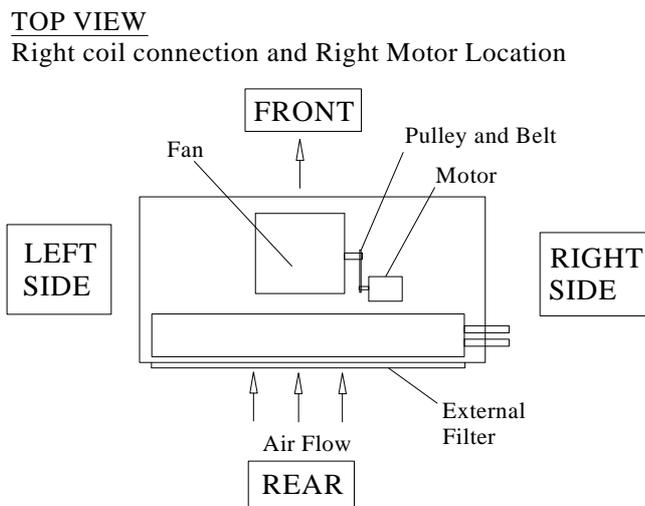


Figure 25

- For a direct expansion system, the coil is available in 2, 3, 4, 5, 6 and 8 rows. TXV valve is optional item. Header is only available in copper materials. Pipe connection is by brazing joint.
- The standard working pressure of the coil is 250 psig (17 bar). During fabrication, coil leak test are perform at pressure of 350 psig (24 bar).
- Coil surface area is standard size for each model and it is common for chilled water and direct expansion coil type. (Please refer Table 19.)

10.1 COIL SIZE AND FACE AREA

Model	Coil Size (1/2" copper tube)				Face Area	
	Fin Height		Fin Length		ft ²	m ²
	in	mm	in	mm		
0404	20	508	20.04	509	2.78	0.259
0407	20	508	31.85	809	4.42	0.411
0410	20	508	43.66	1109	6.06	0.563
0413	20	508	55.47	1409	7.70	0.716
0707	32.5	825.5	31.85	809	7.19	0.668
0710	32.5	825.5	43.66	1109	9.85	0.915
0713	32.5	825.5	55.47	1409	12.52	1.163
0715	32.5	825.5	63.35	1609	14.30	1.328
1010	45	1143	43.66	1109	13.64	1.268
1013	45	1143	55.47	1409	17.34	1.610
1015	45	1143	63.35	1609	19.80	1.839
1019	45	1143	79.09	2009	24.72	2.296
1021	45	1143	86.97	2209	27.18	2.525
1315	55	1397	63.35	1609	24.19	2.248
1319	55	1397	79.09	2009	30.21	2.807
1321	55	1397	86.97	2209	33.22	3.086
1519	60	1524	79.09	2009	32.96	3.062
1521	60	1524	86.97	2209	36.24	3.367
1819	75	1905	79.09	2009	41.20	3.827
1821	75	1905	86.97	2209	45.30	4.208
1823	75	1905	94.84	2409	49.40	4.589
1827	75	1905	110.59	2809	57.60	5.351
2027	80	2032	110.59	2809	61.44	5.708
2033	80	2032	134.21	3409	74.56	6.927
2233	90	2286	134.21	3409	83.88	7.793
2239	90	2286	157.83	4009	98.65	9.165
2539	97.5	2478	157.83	4009	106.93	9.934

Table 19

10.2 HEADER SIZE

Model	0404	0407	0410	0413	0707	0710	0713	0715	1010
Row									
1	42	42	42	42	42	42	42	42	42
2	42	42	42	42	42	42	42	42	42
3	42	42	42	42	42	42	42	42	42
4	42	42	42	42	42	42	42	42	42
5	42	42	42	42	42	42	42	42	42
6	42	42	42	42	42	42	42	42	76
8	42	42	42	42	42	42	42	42	76
10	76	76	76	76	76	76	76	76	76
12	76	76	76	76	76	76	76	76	76

Table 20a: dimension in mm

Model	1013	1015	1019	1021	1315	1319	1321	1519	1521
Row									
1	42	42	42	42	42	42	42	42	42
2	42	42	42	42	42	42	42	42	42
3	42	42	42	76	42	42	42	42	42
4	42	76	76	76	42	42	76	76	76
5	42	76	76	76	42	42	76	76	76
6	76	76	76	76	76	76	76	76	76
8	76	76	76	76	76	76	76	76	76
10	76	76	76	76	76	76	76	76	76
12	76	76	76	76	76	76	76	76	76

Table 20b: dimension in mm

Model	1819	1821	1823	1827	2027	2033	2233	2239	2539
Row									
1	42	42	42	42	42	42	42	42	42
2	42	42	42	42	42	42	42	42	42
3	76	76	76	76	76	76	76	76	76
4	76	76	76	76	76	76	76	76	76
5	76	76	76	76	76	76	76	76	76
6	76	76	76	76	76	76	76	76	76
8	76	76	76	76	76	76	76	76	76
10	76	76	76	76	76	76	76	76	76
12	76	76	76	76	76	76	76	76	76

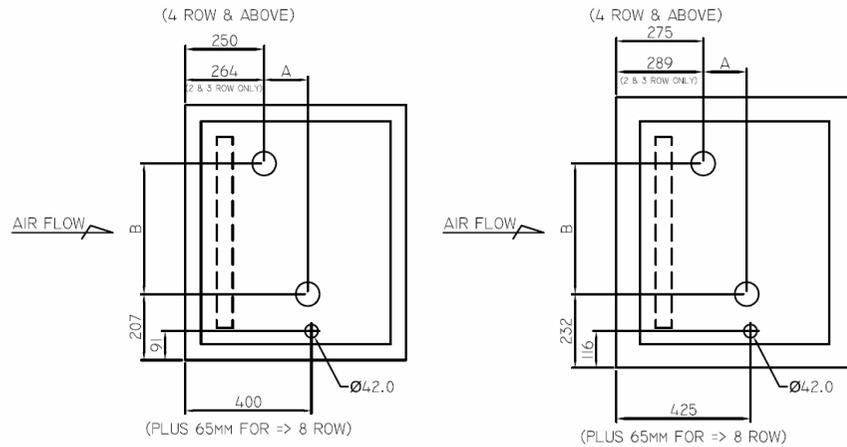
Table 20c: dimension in mm

Above header size is selected base on condition of

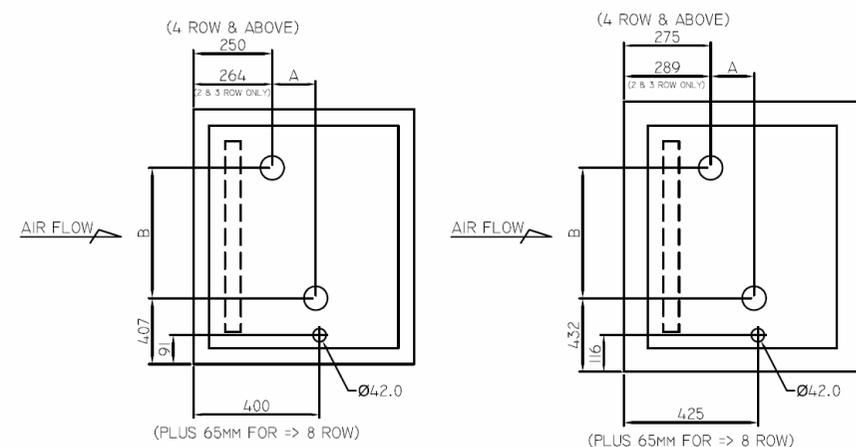
EDB/EWB 26.7/19.4°C
 EWT/LWT 7/12°C

10.3a HEADER DIMENSION – SINGLE COIL

04x AHU MODEL ONLY



07x & 10x AHU MODEL



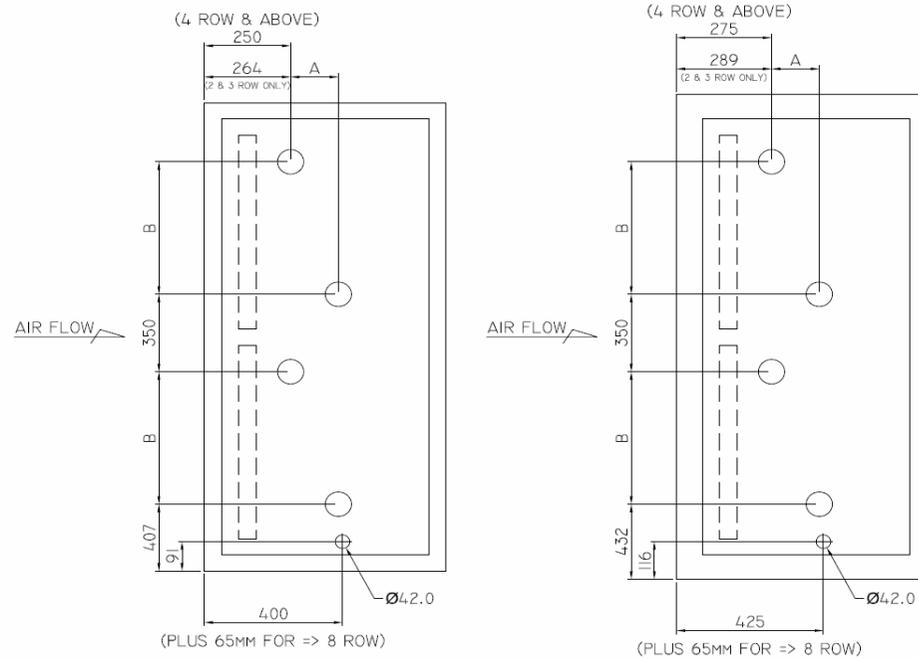
35

HEADER DIMENSION - SINGLE COIL

Model	2 row		3 row		4 row		5 row		6 row		8 row		10 row		12 row	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
0404	55	410	55	410	83	410	110	410	138	410	198	410	248	410	303	410
0407	55	410	55	410	83	410	110	410	138	410	198	410	248	410	303	410
0410	55	410	55	410	83	410	110	410	138	410	198	410	248	410	303	410
0413	55	410	55	410	83	410	110	410	138	410	198	410	248	410	303	410
0707	55	527	55	527	83	527	110	527	138	527	198	527	248	527	303	527
0710	55	527	55	527	83	527	110	527	138	527	198	527	248	527	303	527
0713	55	527	55	527	83	527	110	527	138	527	198	527	248	527	303	527
0715	55	527	55	527	83	527	110	527	138	527	198	527	248	527	303	527
1010	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845
1013	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845
1015	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845
1019	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845
1021	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845

Table 21a: Dimension in mm.

10.3b HEADER DIMENSION – 2 LAYER COIL



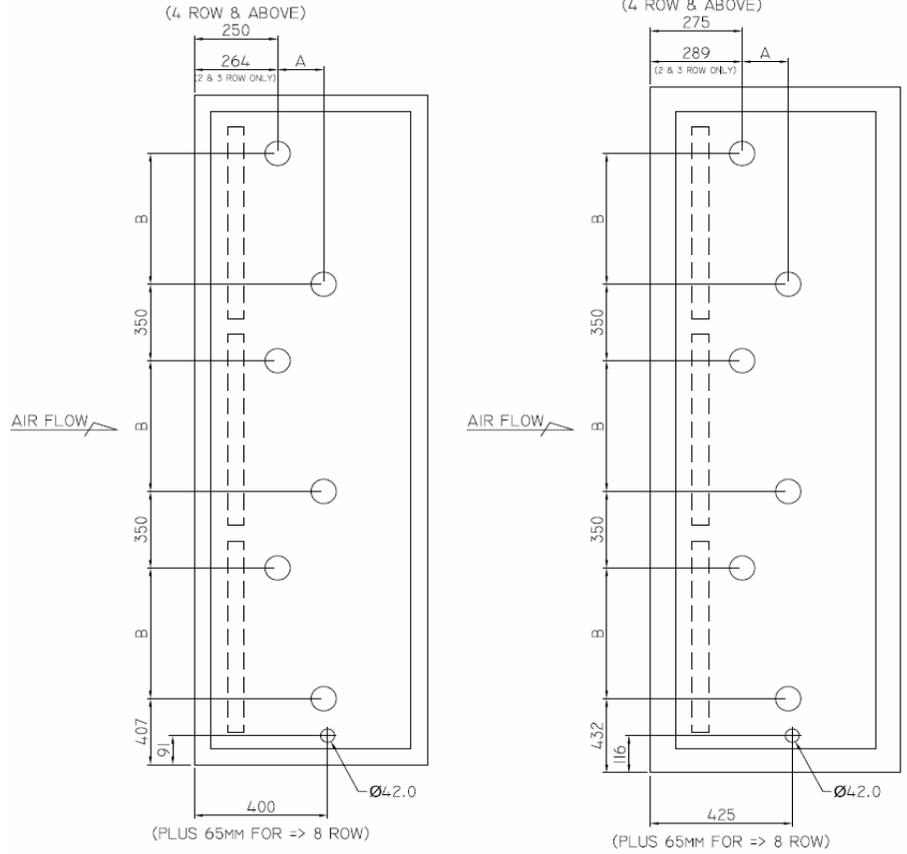
36

HEADER DIMENSION - 2 LAYER COIL

Model	2 row		3 row		4 row		5 row		6 row		8 row		10 row		12 row	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1315	55	400	55	400	83	400	110	400	138	400	198	400	248	400	303	400
1319	55	400	55	400	83	400	110	400	138	400	198	400	248	400	303	400
1321	55	400	55	400	83	400	110	400	138	400	198	400	248	400	303	400
1519	55	464	55	464	83	464	110	464	138	464	198	464	248	464	303	464
1521	55	464	55	464	83	464	110	464	138	464	198	464	248	464	303	464
1819	55	654	55	654	83	654	110	654	138	654	198	654	248	654	303	654
1821	55	654	55	654	83	654	110	654	138	654	198	654	248	654	303	654
1823	55	654	55	654	83	654	110	654	138	654	198	654	248	654	303	654
1827	55	654	55	654	83	654	110	654	138	654	198	654	248	654	303	654
2027	55	718	55	718	83	718	110	718	138	718	198	718	248	718	303	718
2033	55	718	55	718	83	718	110	718	138	718	198	718	248	718	303	718
2233	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845
2239	55	845	55	845	83	845	110	845	138	845	198	845	248	845	303	845

Table 21b: Dimension in mm.

10.3c HEADER DIMENSION – 3 LAYER COIL



37

HEADER DIMENSION - 3 LAYER COIL

Model	2 row		3 row		4 row		5 row		6 row		8 row		10 row		12 row	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
2539	55	527	55	527	83	527	110	527	138	527	198	527	248	527	303	527

Table 21c: Dimension in mm.

11.0 HEAT RECOVERY WHEEL SPECIFICATION

Heat recovery wheel is available in DDM AHU selection software. AHU with HRW consists of two sections: return air side and supply air side. The arrangement is as below. To install the heat wheel in air handling unit, an empty section is required. The size of heat wheel has to be considered for the specification drawing. Besides, spaces between heat wheel section and the coil section must be considered to ensure the most efficient heat transfer between air flow and coil medium at the coil section beside the access for maintenance.

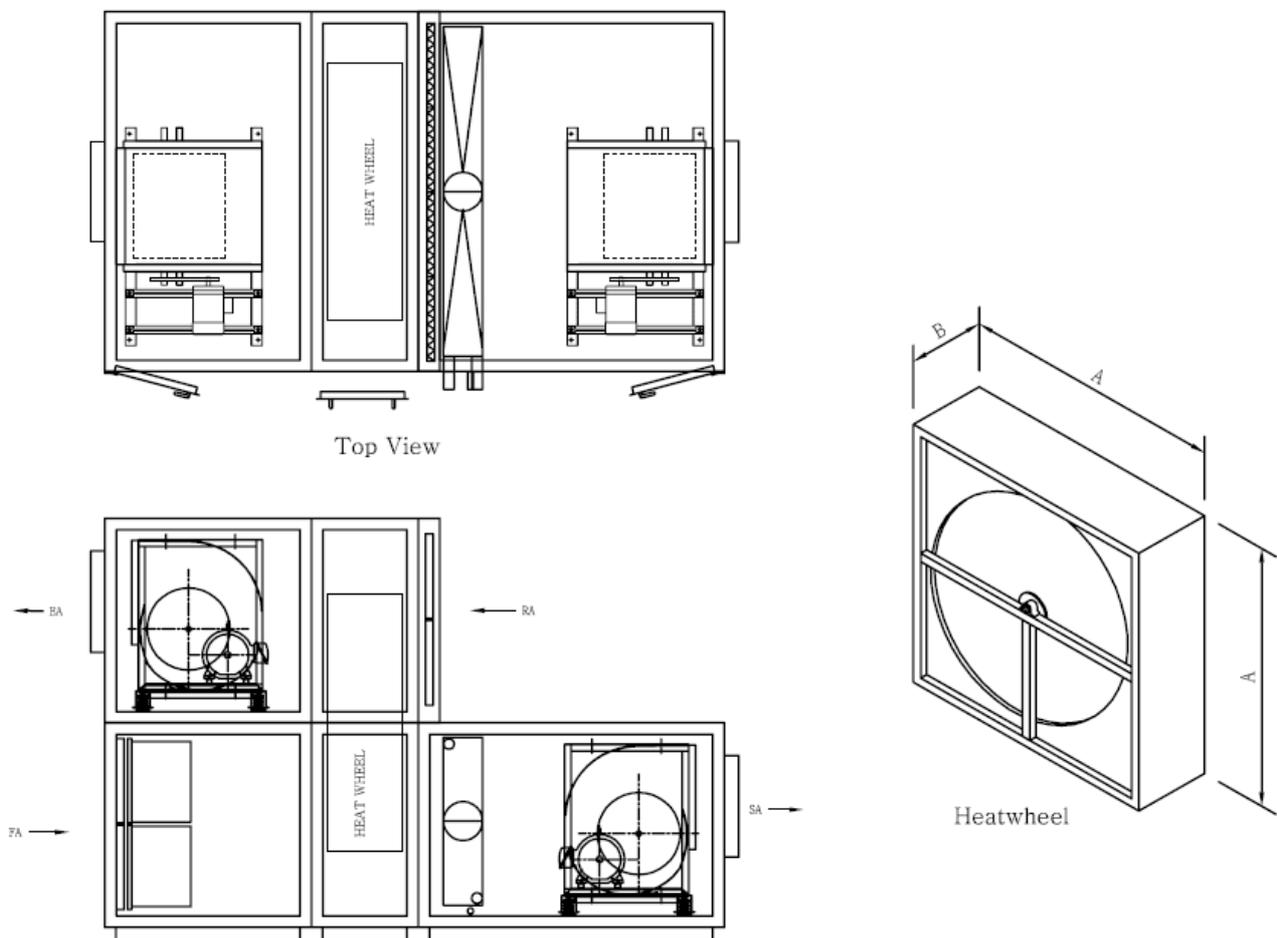


Figure 26

12.0 FILTER

12.1 Standard Filter Specification

Model	Filter Media Size and Quantity									
	Sliding Filter Frame					Universal Filter Frame				
	24" x 24"		24" x 12"		Total Area(m ²)	24" x 24"		24" x 12"		Total Area (m ²)
	Qty	Area (m ²)	Qty	Area (m ²)		Qty	Area (m ²)	Qty	Area (m ²)	
0404	1	0.37	0	0.00	0.37	1	0.37	0	0.00	0.37
0407	1	0.37	1	0.19	0.56	1	0.37	1	0.19	0.56
0410	2	0.74	0	0.00	0.74	2	0.74	0	0.00	0.74
0413	2	0.74	1	0.19	0.93	2	0.74	1	0.19	0.93
0707	1	0.37	2	0.00	0.74	1	0.37	2	0.00	0.74
0710	2	0.74	2	0.19	1.11	2	0.74	2	0.19	1.11
0713	2	0.74	3	0.37	1.3	2	0.74	3	0.37	1.30
0715	3	1.11	3	0.37	1.67	3	1.11	3	0.37	1.67
1010	4	1.49	0	0.56	1.49	4	1.49	0	0.56	1.49
1013	4	1.49	2	0.56	1.86	4	1.49	2	0.56	1.86
1015	6	2.23	0	0.00	2.23	6	2.23	0	0.00	2.23
1019	6	2.23	2	0.37	2.6	6	2.23	2	0.37	2.60
1021	8	2.97	0	0.00	2.97	8	2.97	0	0.00	2.97
1315	6	2.23	3	0.37	2.79	6	2.23	3	0.37	2.79
1319	6	2.23	5	0.00	3.16	6	2.23	5	0.00	3.16
1321	8	2.97	4	0.56	3.71	8	2.97	4	0.56	3.71
1519	6	2.23	5	0.93	3.16	6	2.23	5	0.93	3.16
1521	8	2.97	4	0.74	3.71	8	2.97	4	0.74	3.71
1819	9	3.34	3	0.56	3.9	9	3.34	3	0.56	3.90
1821	12	4.46	0	0	4.46	12	4.46	0	0	4.46
1823	12	4.46	0	0	4.46	12	4.46	0	0	4.46
1827	15	5.58	0	0	5.58	12	4.46	3	0.56	5.02
2027	15	5.58	5	0.93	6.51	12	4.46	7	1.30	5.76
2033	18	6.69	6	1.11	7.80	15	5.58	8	1.49	7.06
2233	24	8.93	0	0	8.93	20	7.43	4	0.74	8.18
2239	28	10.41	0	0	10.41	24	8.93	4	0.74	9.66
2539	28	10.41	7	1.3	11.71	24	8.93	10	1.86	10.78

Table 28.

12.2 HEPA FILTER SPECIFICATION

Model	HEPA Filter Size c/w Frame and Quantity/unit					
	Size : 24" x 24"		Size : 24" x 12"		Total	
	Qty	Area (m ²)	Qty	Area (m ²)	Qty	Area (m ²)
0404	1	0.37	0	0.00	1	0.37
0407	1	0.37	1	0.19	2	0.56
0410	2	0.74	0	0.00	2	0.74
0413	2	0.74	0	0.00	2	0.74
0707	1	0.37	2	0.37	3	0.74
0710	2	0.74	2	0.37	4	1.11
0713	2	0.74	2	0.37	4	1.11
0715	2	0.74	3	0.56	5	1.30
1010	4	1.49	0	0.00	4	1.49
1013	4	1.49	0	0.00	4	1.49
1015	4	1.49	2	0.37	6	1.86
1019	6	2.23	0	0.00	6	2.23
1021	6	2.23	2	0.37	8	2.60
1315	4	1.49	2	0.37	6	1.86
1319	6	2.23	0	0.00	6	2.23
1321	6	2.23	2	0.37	8	2.60
1519	6	2.23	3	0.56	9	2.79
1521	6	2.23	5	0.93	11	3.16
1819	9	3.34	0	0.00	9	3.34
1821	9	3.34	3	0.56	12	3.90
1823	12	4.46	0	0.00	12	4.46
1827	12	4.46	3	0.56	15	5.02
2027	12	4.46	7	1.30	19	5.76
2033	15	5.57	8	1.49	23	7.06
2233	15	5.57	8	1.49	23	7.06
2239	18	6.69	6	1.11	24	7.80
2539	24	8.92	0	0.00	24	8.92

Table 30.



Daikin Refrigeration Malaysia Sdn. Bhd. participates in the ECP Programme for Air Handling Units.
Check ongoing validity of certificate:
www.eurovent-certification.com or
www.certiflash.com