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## 1. General

### 1.1 Foreword

This installation, operation and maintenance manual is given as a guide to user of e-AHU. The manual do not limit the users to add other necessary procedures or services for the continuous successful operation of this equipment.

### 1.2 Warning Notes

Warning and Important notes are appearing at appropriate places in this instruction manual. Follow the warning notes carefully to ensure correct operation of the equipment and personal safety. The manufacturer assumes no liability for installation, operation and maintenance undertaken by unqualified personnel.

### 1.3 Occupational, Health and Safety Practices

Connection and start-up of the unit should be done in conditions, which are in conformity with Local Codes and Regulations, especially in the field of operation of electrical devices.

The mains voltage must not be turned on before the unit is connected to the protective system.

It is forbidden to make any repair and maintenance activities if the power supply of the unit is not turned off

Servicing person, who makes repair or maintenance of the unit must have proper qualifications resulting from the qualification certificate, which is determined by International, National or Local Codes and Regulation.

Place of service should be equipped with the necessary protective equipment, which provide safe maintenance.

### 1.4 Unit Decommissioning and Disposal

At the end of the unit's useful life, a suitably qualified engineer should decommission it. The parts/materials must be disposed of in a correct manner and comply with the local laws and regulations. The unit components shall be disposed of or recycled as appropriate in the correct manner.

## 2. Shipment

The items should be carefully checked against the bills of lading to ensure all crates have been received. All units should be carefully inspected for damage when received. Visible or concealed damage should be reported immediately to the carrier and filed damage claims.

Double skin e-AHU is constructed with heavy-gauge steel or extruded aluminum while single skin e-AHU is constructed with heavy galvanized steel (GI) with painting finishing. All parts are thoroughly inspected before leaving the factory. Care must be taken during installation to prevent damage to units.

All fans are dynamically balanced before leaving the factory. Rough handling can cause misalignment or sprung shaft. Therefore, blower fan and shaft should be carefully checked before commissioning to avoid more damage cause by unbalance fan.

### CAUTION

*DAMAGE OR LOSS OF PARTS IN SHIPMENT OR AT THE JOB SITE IS NOT THE RESPONSIBILITY OF MANUFACTURER.*

### 3. Handling / Rigging

e-AHU is delivered as completely assembled unit. Transportation at the building site should be done using forklift truck. The forks must only be applied under the unit base frame or wooden pallet and not against the panel.

### 4. Storage

For external storage prior to installation, the units must be protected from dust, rain, constant sun exposure and rodents. Although covered in shrink-wrapped plastic sheeting, this is not intended for long-term storage and should be removed as soon as it is offloaded. Unit therefore should be more protected by tarpaulins or similar. Avoid exposing the units for coil connection damages by transient load. The fan impeller or motor drive must be rotated once every month. Should the units be stored for a period of exceeding 6 months, then it is recommended that the drive belts be removed and stored separately.

### IMPORTANT

*INSTALLATION AND MAINTENANCE ARE TO BE PERFORMED ONLY BY QUALIFIED AND EXPERIENCED PERSONNEL WHO ARE FAMILIAR WITH NATIONAL AND LOCAL CODES AND REGULATION.*

### 5. Assembly and installation

#### 5.1 General

The system design and installation should follow accepted industrial practice, such as described in the ASHRAE Handbook. These units are not designed to be weatherproof (unless equipped with canopy) and therefore should not be installed outdoors. Flexible connections should be used on the outlet and inlet

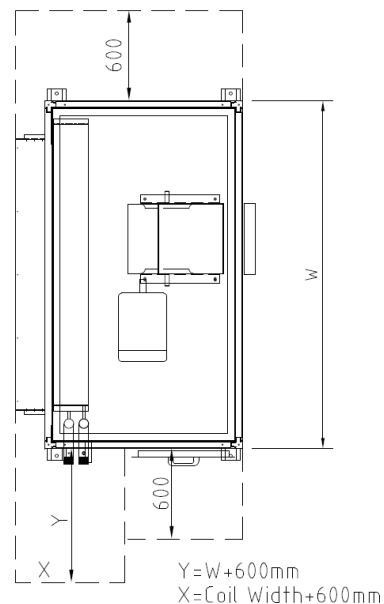
duct connections for all units. A minimal amount of air leakage is normal on the cabinet and it will not affect unit performance. The e-AHU is not designed to be suspended from the top of the unit. Therefore, when the unit is ceiling hung, make sure unit is supported with a base rail of channel. Adequate space should be left around the unit for coils & drainage piping, filter replacement, and maintenance. Sufficient space should be provided on the side of the unit for shaft removal and coil removal should that become necessary.

### IMPORTANT

*HIGH VELOCITY SPOTS ON THE COIL MAY CAUSE MOISTURE CARRY OVER. THEREFORE, UNIFORM AIRFLOW ACROSS COIL SURFACE IS CRUCIAL.*

#### 5.2 Foundation

Adequate space should be left around the unit for coils & drainage piping, filter replacement, and maintenance. (See Figure 1). If site access space for coil is not followed, AHU needs to be dismantled for coil replacement. The unit is installed at a height that allows the installation of condensate drain trap.



**Figure 1** - Recommended minimum service clearances

For single skin e-AHUs, it is recommended to install a condensate drain pan wide enough to cover the entire unit beneath the e-AHU.

### 5.3 Vibration Isolator

Due to the unit design is no internal isolator the external isolator must be fix to absorbed the vibration. For hanging mounting type, use 'rubber hanger' and floor mounting type use 'rubber pad' at 4 corners. (See Figure 2)

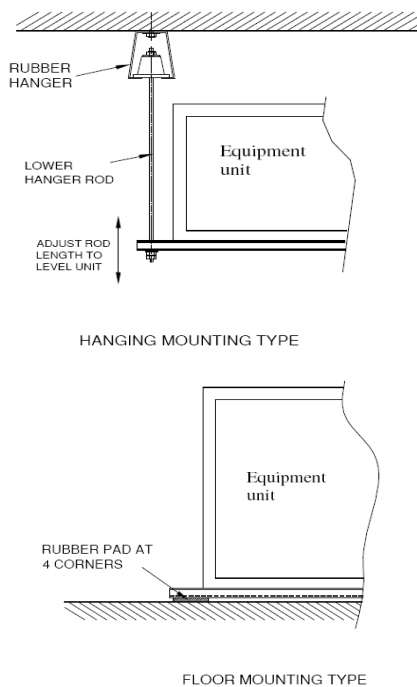


Figure 2 – Vibration Isolator

### 5.4 Coil Installation/ Pipe Connection

The coil will performed as per rating only if the airflow is uniformly pass-through the coil surface. **External pipe-work must be adequately supported to ensure load-free towards coil connections.** Swing joints or flexible fittings are to be provided in all piping connections, particularly those adjacent to heating source, to absorb expansion and contraction strains. Failure to comply will result in damage to the coils & headers. Water supply, water return, drains and vents connections are extend through the end panel of the coil section. All connections are labeled on the end panel. For control equipment, follow

recommendations from the manufacturer regarding the types, sizing and installation of equipment.

### IMPORTANT

*TO AVOID DAMAGING THE COIL CONNECTIONS AT COIL HEADER, IT IS ESSENTIAL TO HOLD THE HEXAGONAL CONNECTOR WITH TOOLS WHILST APPLYING COUNTER FORCE TO TIGHTEN THE JOINT. (SEE Figure 3)*

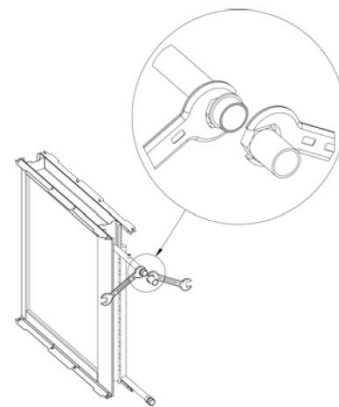


Figure 3 – Coil header connection method

Figure Note:  
 A = 25mm for each 250Pa maximum static pressure + 50mm  
 B = 25mm for each 250Pa maximum static pressure

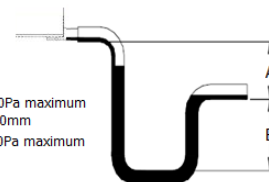


Figure 4 – Drain Trap Arrangement

### 5.5 Drain Pan Trap

Drain pipes and traps must be at least same diameter as the drain pan connection. Drain pan must be level to permit condensation from coil drain freely. See figure 4 for the recommended depth and distance of drain trap installation.

### 5.6 Electrical Installation

The electric supply to the motor must correspond to the rated voltage stated in motor nameplate and be in conformance with the National and Local Electric Code and Regulations. Motor supplied able to operate within 10% tolerance from the nameplate voltage. Motor connection

details are contained in the cover of the motor terminal box (See Figure 5). The fan section metal frame must be grounded. Suitable electrical protection isolator should be installed to protect the motor and other electrical equipment. Cables passing through panels must be made with gland or grommet.

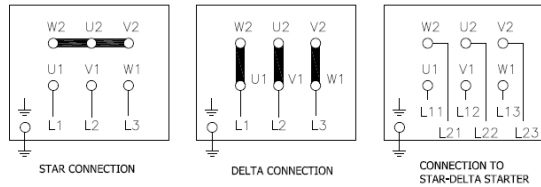


Figure 5 – 3 phases motor connection diagram

### 5.7 Drive Belt & Sheave

Improper sheave alignment and belt tension can cause excessive vibration,

premature failure of belts and bearings. See Figure 6 for correct motor sheave and fan sheave alignment.

Tensioning of the drive belt is achieved by moving the motor in relation to the fan (See Figure 7). When inserting new belts, do not force belts over grooves, Loosen the adjusting screw at motor base until belt can slide smoothly over the grooves. When all belts are in position, proceed to adjust belt tension using the adjusting screw and nuts on the motor base.

Use recognized belt tension gauge to check the belt tension by apply a force large enough at the center of the belt to deflect the belt by 16mm per meter (See Figure 8). The deflection force for any belt should be within the min. and max force shown in Table 1. Readjust the tension to max value when it drop to min. value.

Table 1 – Belt Tensioning Force

Belt Section	Pulley Diameter	Deflection Force (N)			
		Initial Fitting		Retension	
		Min	Max	Min	Max
SPZ	<70	12	17	12	16
	71-90	15	22	15	19
	91-125	19	27	19	24
SPA	<100	20	29	20	25
	101-140	27	39	27	34
	141-200	32	47	32	40
SPB	<160	36	54	36	46
	161-224	46	67	46	58
	225-355	53	79	53	69

Refer to factory specifications for tension values that are not included

Refer to the diameter of smaller pulley

### WARNING

OVER TENSION TOWARD DRIVE BELT WILL CAUSE PREMATURE FAILURE OF BELT AND BEARING DAMAGE.

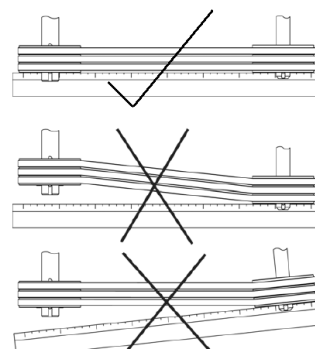


Figure 6 – Alignment of belt pulley

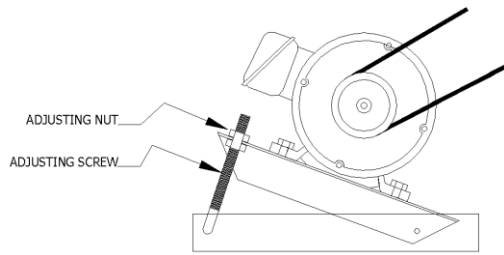


Figure 7 – Belt tensioning

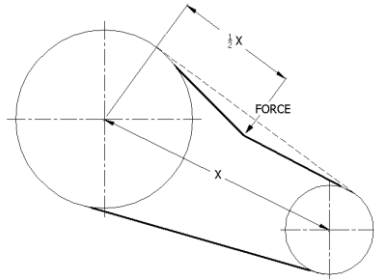


Figure 8 – Belt deflection distance

## 5.8 Filter

e-AHU is supplied with washable flat filters on external sliding type filter frame.

## 5.9 Ductwork

Connections to unit cabinet are made by site drilling into the frame on the unit inlet or fan discharge collar. This should be load-free toward cabinet collar when initial positioned.

Compliance with the Codes of Practice in duct assembly and acoustic layout are necessary to ensure the best possible performance of the unit whilst avoiding excessive pressure loss in the duct system and minimize undue air stream noise.

## 5.10 Component Removal and Replacement

### 5.10.1 Panel Removal

To remove side or top panel of double skin e-AHU, simply unscrew the fasteners located along the aluminum clip on the frame of cabinet. Once the aluminum clips are removed, lift the panel off.

To remove side or top panel of single skin e-AHU, simply unscrew the fasteners located along the access panel of e-AHU cabinet. The casing is insulated with 10mm thick polyethylene foam (P.E), ensure that all the sealing and insulation

are not damaged when remove the access panel.

### 5.10.2 Fan / Motor

The fan shaft, motor and drive components can be removed and replace through the access door/panel opening or side panel removal if additional access required for e-AHU.

For fan replacement, dismantle the intermediate fan supports and discharge collar follow by loosening bolts & nuts at motor and drive belts. Then remove the belts and nuts from fan mounting frame. Take out the fan and replace with new fan with care.

### 5.10.3 Coil

The coil can be pulled out from side or top of cabinet. The coil is fastened with bolts and nuts on the coil support bracket at the end plate and baffle plate. Before removal of coil, ensure the piping connections at header are disconnected.

## 6. Commissioning and Operation

### 6.1 Pre-run Check

#### 6.1.1 Preparation

The complete e-AHU and all accessory components should be thoroughly cleaned and all dust & debris completely removed. Ensure that all bolts & nuts, panel and belt drive setting are secure due to change during shipment or installation.

#### 6.1.2 Fan / Motor

Check the fan impeller can rotate freely by hand. Check the tension and alignment of the belt drive. Check motor connections and make sure correct voltage is supplied. It is recommended that the fan speed does not exceed the speed specified in the technical report. If ramp up fan speed beyond specification, make sure it does not cause any issues such as water carry over.

### WARNING

1. ISOLATE THE ELECTRICAL & MECHANICAL ENERGY SOURCES AND PADLOCK THE SWITCH BEFORE SERVICING THE FANS.

2. *FAILURE TO PROVIDE MOTOR OVERLOAD PROTECTION COULD RESULT IN MOTOR DAMAGE. CONNECT THE MOTOR TO AN OVERLOAD PROTECTIVE DEVICE THAT IS RATED IN COMPLIANCE WITH THE APPLICABLE CODE.*

### 6.1.3 EC Fan Array

Some models may come with multiple EC fans. Ensure both fans are control to run simultaneously and with same speed. Fans running at different speeds can result uneven airflow that cause performance, sound, vibration problems that lead to failure.

In case one of the fan is down, blank off plate shall be temporarily installed on the nonfunctional fan to prevent air re-circulation while waiting fan replacement (See Figure 9)

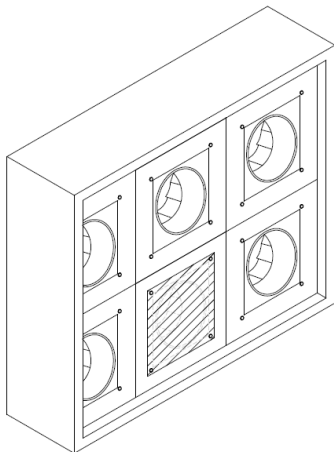


Figure 9 - Fan Array with Blank-off Plate

### 6.1.4 Coils

Check the pipe-work to coil is correctly connected and the fins are free from foreign matter or damage. Check that the condensate drain is trap.

### 6.1.5 Filters

Make sure all filter media are installed.

### 6.2 Start-up Check

Competent, well-trained personnel must be employed in the following operations to ensure Safety Rules and Regulation being adhered to at all time.

- a. Check the rotation of the fan impeller. If the fan rotate in

opposite direction from desire, reverse any two phase connection at motor terminal.

- b. Check that there is no unusual noise or vibration. Stop and investigate if found. (refer to section 8)
- c. Measure the voltage and drawn current of the motor. The drawn current must not exceed the full load current mentioned at motor nameplate.

### 6.3 After first 48 hours of operation

- a. Make sure complete isolate the Electrical source.
- b. Re-check and Re-tension the drive belts due to stretch.
- c. Check and adjust the pulley alignment to ensure the motor fixing is properly secure.
- d. Check all bearing, wheel bolts & nuts and sheave set screws (or cap screw) are in secure position.

### CAUTION

*FIN EDGES ARE VERY SHARP, TOUGH INDUSTRIAL GLOVES MUST BE WORN.*

## 7. Maintenance

### 7.1 Fan / Motor

Check for soiling, corrosion, damage and tendency of excessive vibration. Check that all bolts and nuts and flexible connections are securely fixed. Inspect for any obstructions or blockages at air intakes and discharges. Check fan bearings are secured and no undue noise by observe/listen using metal bar as a conductor. If there is any undue noise or knocking from bearing, replace both bearings.

### 7.2 Drive Belt

Belts that are split or have frayed edges or any other sign of damage (rubber shred on floor) must be replaced in full set. Check the belt tension and alignment, re-tension and re-align if necessary. Refer to Section 5.6 for belt tensioning procedure.

New belt drive must be re-tensioned after the first 48 hours of operation. For replacement of belts, first loosen the adjusting screw and move the motor towards the fan to enable old belts to be taken off and put on of new belts. (Matched belts must be used) Tension the belts by following instruction at Section 5.6.

### 7.3 Coil Section

Periodic cleaning of coils is required. Dirty coils have tendency to increase airside pressure drops and reduce cooling efficiency. Dry cleaning is done by using a powerful vacuum cleaner on the dust-accumulated side. If coil is very dirty, coils need to be removed for wet cleaning by trained personnel. Ensure coil fins are not damage when performing dry/wet cleaning.

In the event that fin edges have been bent, treat with aid of a coil comb.

### 7.4 Filter Section

During system start up, filter are likely to become rapidly blocked. Washable filters must be cleaned periodically.

### 7.9 Maintenance Plan for e-AHU

The schedule provided in Table 2 gives recommended maintenance intervals for the e-AHU unit (Guideline only). Intervals are based upon normal running conditions, in a moderate climate and assuming 12-hour running. Units operating outside these guidelines may require shorter or longer maintenance intervals.

*Table 2 – Recommended Maintenance Intervals*

Component	Description	Action	Maintenance interval				
			Weekly	Monthly	3 Monthly	6 Monthly	Yearly
Fan / Motor	Fan in general	Check / Clean	●				
	Fan bearing	Check / Replace / Greasing				●	
	Motor in general	Check / Clean		●			
	Motor bearing	Check				●	
	Motor temperature	Check / Repair / Replace fan				●	
	Belt drive tension	Check / Re-tension		●			
	V-Belt condition	Check / Replace		●			
	Corrosion	Check / Treat / Repair		●			
	Bolt & nut secure	Check / Tighten				●	
	Excessive vibration	Check / Resolve	●				
	Flexible connection	Check / Tighten	●				
	Vibration isolator	Check / Tighten			●		
	Intake air not obstruct	Check / Clear				●	
Coil Section	Fin block	Check / Clean					●
	Drain trap clog	Check / Clear			●		
	Corrosion	Check / Treat / Repair					●
	Leakage	Check / Repair				●	
	Bolts & nuts secure	Check / Tighten				●	
Filter	Resistance(Washable)	Check / Clean		●			
Electrical Control	Control box & wiring	Check / Repair / Replace					●
	Protection breaker	Check / Calibrate					●

Use the Table 3 to assist in trouble-shoot the malfunction in e-AHU operation.

## 8. Trouble Shooting

*Table 3– Trouble Shooting Analysis*

<b>Symptom</b>	<b>Probable Cause</b>	<b>Recommended Action</b>
Motor fail to start	a) Blown fuse or open circuit breaker. b) Improper wiring. c) Mechanical Failure.	a) Replace fuse or reset circuit breaker. b) Check wiring with diagram supplied. c) Check motor & drive rotate freely & bearing lubricant.
Motor stall	a) Short circuit or phase to earth. b) Overload motor. c) Low line voltage. d) Over tensioned belts. e) Misalign drive.	a) Check line phases and terminal block connection. b) Reduce system load. c) Check supplied voltage within motor voltage range. d) Adjust belt tension. e) Re-align drive.
Motor overheats	a) Overloaded motor. b) Motor Fan dirty/ damage.	a) Reduce load or replace larger motor. b) Clean/ replace motor fan.
Low air volume after start up	a) Fan rotating in wrong direction. b) Pressure drop by filter above recommended level.	a) Reverse any two phase connection at motor terminal. b) Change filters – (complete bank).
Excessive motor noise	a) Motor mounting bolt loosen. b) Worn motor bearing.	a) Tighten motor mounting bolt. b) Replace bearing and seals.
Excessive noise from unit	a) Worn fan or motor bearing. b) Fan impeller rubbing on inlet cone or cover. c) Incorrect drive belts tension.	a) Replace bearing and seals. b) Check clearance or remove for repair. c) Check tension.
Excessive vibration	a) Fan impeller out of balance. b) Improper pulley alignment. c) Over-tensioned belts. d) Vibration isolator damaged. e) Motor shaft bend. f) Bad bearings. g) Loosen bearing hold down bolt h) Fan & motor section not evenly supported on foundation.	a) Consult manufacturer. b) Check pulley alignment. c) Re-tension belts. d) Replace vibration isolator. e) Send the motor for repair. f) Replace bearing and seals. g) Tighten hold down bolt. h) Re-adjust and tighten.
Bearing excessively hot	a) Over-tensioned belts. b) Misaligned bearing.	a) Re-tension belts. b) Check & re-align shaft.
Water present in cooling coil drain pan or overflow	a) Drain trap clog. b) Incorrect hydraulic trapping.	a) Clean & clear clog. b) Resize trap and check air break arrangement.
Premature drive belts failure	a) Improper tension or alignment. b) Incorrect belt being fitted. c) Dirt or grease on belts. d) Belt rubbing. e) Worn sheaves.	a) Check tension and alignment. b) Replace with full set. c) Clean belt & pulley, check for grease leak. d) Remove obstruction. e) Replace sheaves.
Belt swelling or softening	a) Excessive contamination by oil, certain cutting fluids or rubber solvent.	a) Replace with full set. Isolate the source of contaminate.
Belt whipping during running	a) Incorrect tensioning.	a) Re-tension belts.
Filter collapsing	a) Filter block with dirt. b) Air velocity too high.	a) Clean filter periodically. b) Check unit running conditions.

Note: The table is intended as a diagnostic aid.