

AHU OPERATION AND MAINTENACE MANUAL

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Foreword

This manual contains the information and instructions for the correct use and maintenance of Air handling Units. It should be noted that this manual does not include a detailed description of the various components nor information about their operation; it does include information and instructions to make the user familiar with the units in order to assist in obtaining the best possible performance while extending the life of the equipment

Unit Identification

An identification plate is fixed to the unit giving the main operation data. This data should always be quoted in the need for service or to obtain spare parts.

1- Receiving of Unit on Arrival / Off-loading and movement to Site

1a - Lifting & Rigging

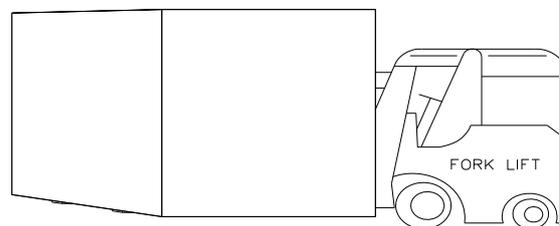
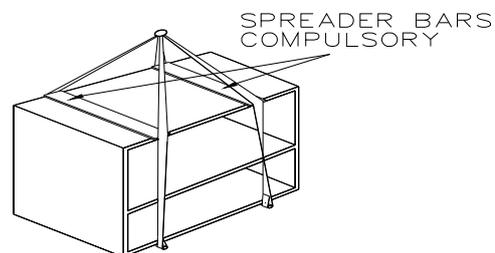
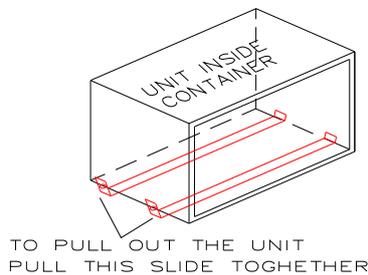
Lifting methods vary and depend on the unit dimensions and shipping/crating arrangements. Each shipment will be marked indicating lifting points special instructions if required.



Heavy Objects! Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements may cause equipment or property-only damage. Failure to properly lift unit could result in death or serious injury.

Improper Unit Lift! Test lift unit approximately 500 mm to verify proper centre of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in damage.

Equipment damage! Do not move unit or sections before preparing the unit for lifting, estimate the approximate centre of gravity for lifting safety. Because of placement of internal components, the unit weight may be unevenly distributed, with more weight in the coil and fan areas. Approximate unit weights are provided in the "Submittal drawings". Test the unit for proper balance before lifting. When hoisting the unit into position, use the proper rigging method such as straps, slings, spreader bars.



1b - Receiving Check List

Upon receipt of the air handling unit, prior to unloading, visually check the components for any damage that may have occurred during shipment. Conduct a thorough inspection immediately before accepting the shipment.

1. Remove any shrink wrap material that may have been used during shipping. Cut all banding loose from the skids (if applicable).

2. Remove the protective film on the double skin panels, immediately, unless the units are store under shade. In any case film must be removed within one month even if hey are stored under shade, otherwise the film will stick to the panel and cannot be removed later.

3. Check all access doors to confirm the latches and hinges are not damaged.

4. Inspect the interior of each module for any internal damage.

5. Inspect the coils for damage to the fin surface and/or coil connections.

Note: Items that cannot be factory-mounted should ship inside the fan section or mixing box section.

6. Manually rotate the fan wheel to ensure free movement of the shaft, bearings, and drive.

7. Inspect the fan housing for any foreign objects.

8. If the unit shipped is subassemblies, locate the assembly hardware, which should be packaged and shipped inside the fan section or the mixing box section.

1c- Assembly Hardware

Air Handling Units and/or field-installed accessories that must be stored for a period of time before installations must be protected from the elements. A controlled indoor environment is recommended for proper storage.

Note: The warranty does not cover any damage to the unit or components due to negligence during storage.

2 - Storage of units

1. Upon receiving the units, store the units in dry place protected from sun light, water and dirt until final installation.

2. Every 15 days please rotate fan and motor shafts manually for few turns until commissioning of the units

2a - Long-Term Storage:

While the unit is in storage:

* Every two weeks, rotate the fan and motor shaft 50 revolutions by hand. Check for free rotation.

* Every six months, check fan shaft bearing and grease lines. Add grease using a manual grease gun following the lubrications recommendations in the "Fan Bearing Lubrication" section.

Check the motor lubrication; refer to the motor manufacturer's lubrication recommendation for proper lubrication.

2b - Outdoor Storage Considerations

Outdoor storage is not recommended, however, when outdoor storage is necessary, several things must be done to prevent damage:

Note: Keep the equipment in the original shipping container for protection and ease of handling.

1. Remove any shrink-wrap material within 48 hours of receiving the unit.

2. Select a well-drained area, preferable a concrete pad.

3. Place the unit on a dry surface or raised off the ground to assure adequate air circulation beneath the unit and to assure no portion of the unit will contact staged water at any time.

4. Loosen the belt tension on the drive belts.

5. Cover the unit securely with a canvas tarp.

3 - Unit Assembly

Note: There are no penetrations into the AHU casing. Consider overall unit serviceability and accessibility before mounting, running wires (cable), making cabinet penetrations, or mounting any components to the section cabinet.

See panel penetration on page no. 11.

3a - Section-to-Section Assembly

Klimak Air Handling Units ship with all necessary assembly hardware and gasket material. The hardware should be packaged in either a clear plastic envelope or cardboard box inside the fan section or mixing box sections.

The number of sections to be assembled often makes it necessary to use more than one section to ship the assembly material; therefore, check all sections thoroughly before proceeding work.

Sections are joined with gasketing applied to one of the mating surfaces and hardware to bolt the sections together. The gasketing for section-to-section joints is a closed cell foam with self-adhesive.

1. Locate the mounting hardware and gasket material.
2. Remove shipping bolts located on the mounting surfaces of the sections.
3. Apply the gasketing to one of the mating surfaces; if unit ships in multiple sections, fasten the quick connects where the modules are bolt together.

3b - Air Handling Units in Separate Sections

The AHUs are produced in a variety of sizes and sections to cater for variations in air volume and air treatment requirements and also to allow for transportation and easy site installation.

4 - Installation of Units

4a - Base Preparation

Ensure that the base is strong enough to accept the total weight of the unit without flexing or deflecting in use.

Ensure that the unit is supported over its entire length and width.

Ensure that base is level, true and constructed to limit deviation to within $\pm 2.5\text{mm}$ over the full length and width.

4b - Unit handling

Ensure that the unit sections are only lifted using the points indicated, spreader bars must be used to avoid damage and care must be taken to exert no pressure on the unit to avoid distortion.

Ensure that slings or strops are not used around the unit section for positioning.

4c - External Service

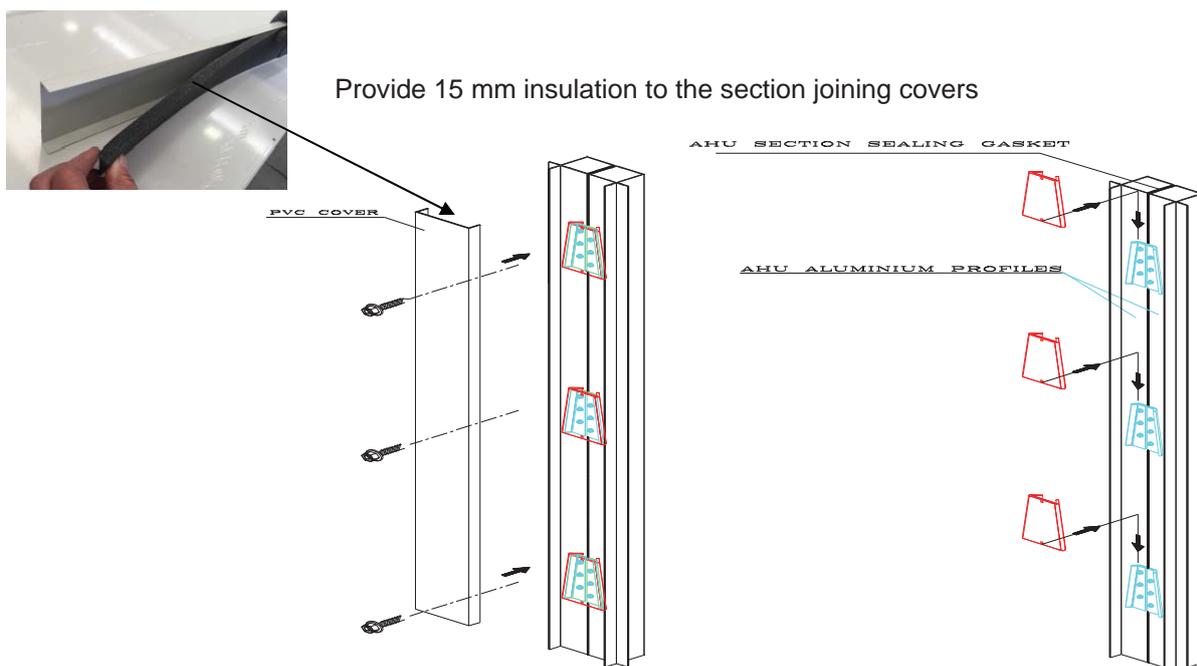
Ensure that weights of service i.e. pipework are independently supported and that no pressure is exerted on the unit.

Service i.e. cable, cable tray etc., are not to be attached to the unit. Necessary penetration into the unit shall be via an approved sleeve and sealed with silicon rubber.

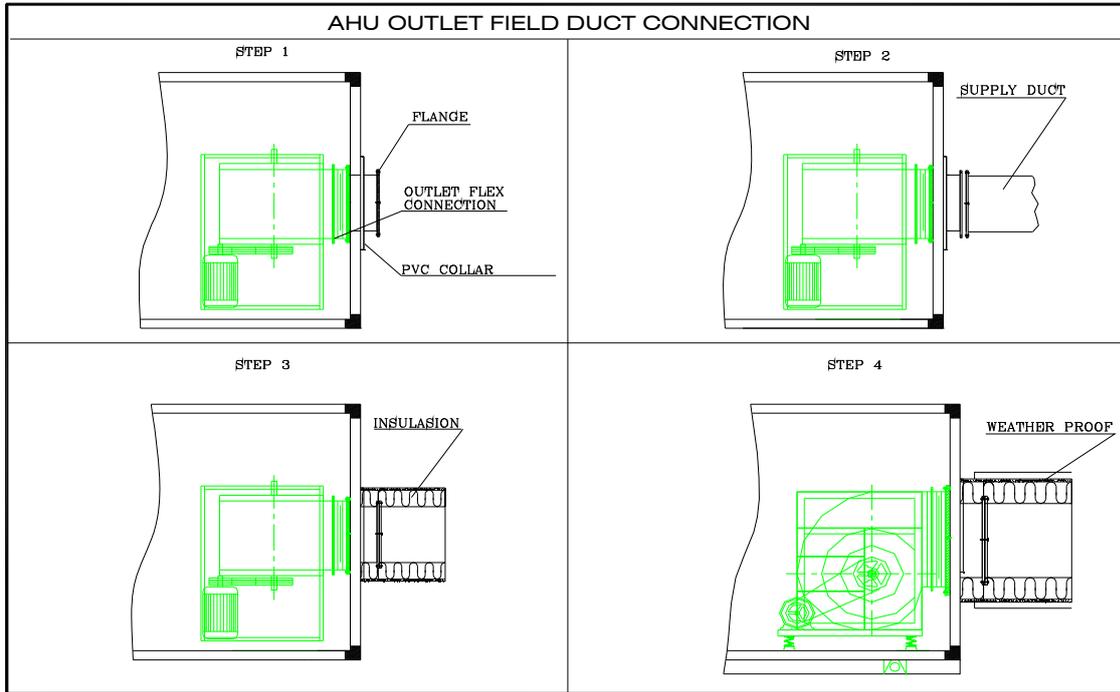
4d - Assembly

The connection of sections and sealing between joints must be carried out in accordance with manufacturers recommendations, utilising the sealing gasket and sealing compound provided to ensure an airtight seal at the static pressures required.

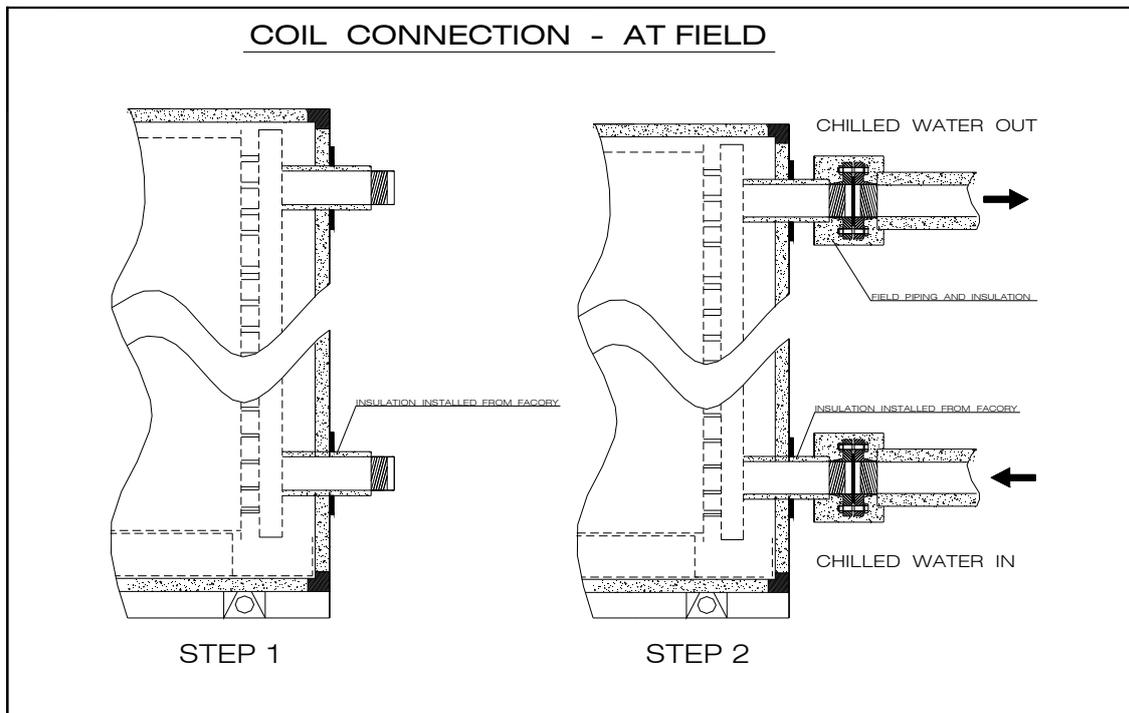
Note: Under any circumstance do not pull the sections using the joining Clamps provided.



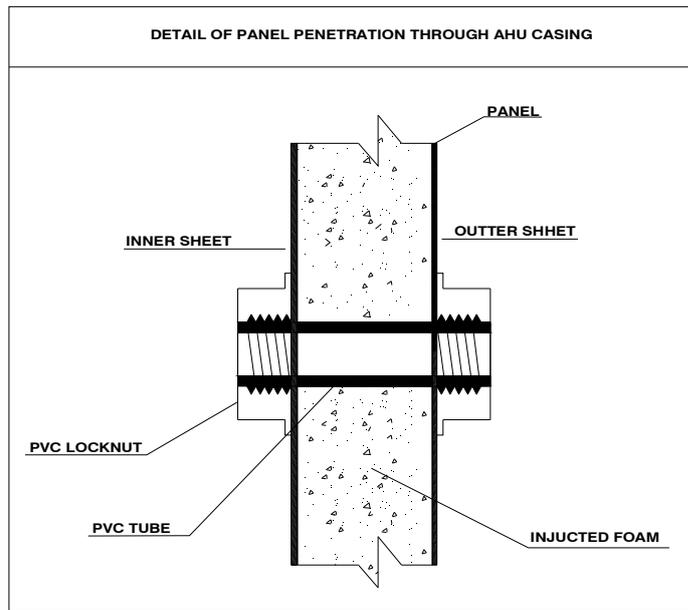
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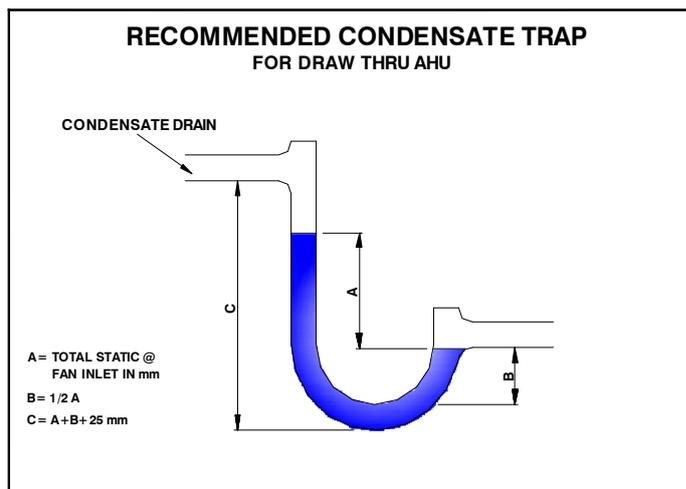
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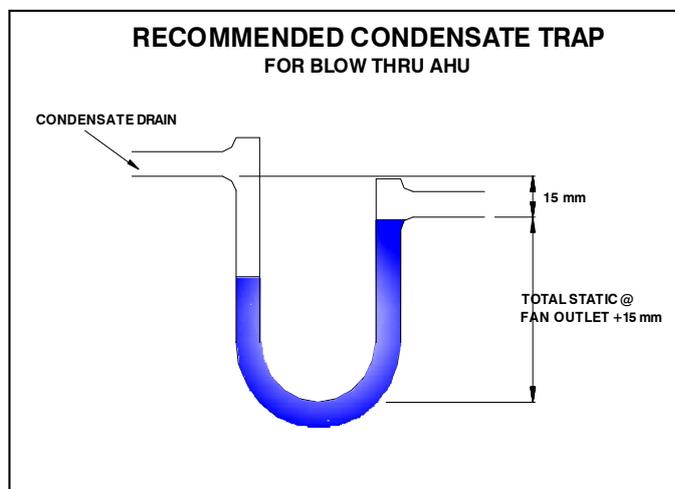
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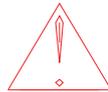
4i



5 - START-UP

5a - Pre-Start-up Checklist

Once the Air handling Unit has been assembled and installed, special care must be taken to individual components for proper operation. Before operating the unit, complete the pre-start-up checklist (Page 12 & 13).



WARNING

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tag out procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Factory or others, refer to the appropriate manufacturer's literature for allowable waiting periods .

5b - Transit Block Removal



Transit block Removal

1. Loosen the four Nuts "A" about Five turns
(Do not remove the nuts)
2. Remove and discard the Transit block "B"

5c - Start-up

1. Check that filters are in place and positioned properly.
2. Remove any debris from the unit interior.
3. Remove all foreign material from the drain pan and check drain pan opening and condensate line for obstructions.
4. Close and secure all unit access doors.
5. If differential pressure switch is provided on filter track, adjust per system requirement.
6. Inspect electrical connections to the unit and unit controllers.
 - ° Connections should be clean and secure.
 - ° Compare the actual wiring with the motor name plate.
 - ° Check piping and valves for leaks. Open or close the valves to check for proper operation.

Drain lines should be completed with U Trap.

Before complete start-up, bump-start the unit and confirm the fan wheel rotates properly, as indicated by the rotation arrow located on the fan housing.

7. Leave this manual with the unit.

5c - Start-up Check List

AHU REF: _____

DATE: _____

NO	ITEM	CHECKED	OK	REMARKS
1	CHECK AND CORRECT ANY VISUAL DAMAGES TO THE UNIT			
2	CHECK AND CONFIRM ALL SECTIONS OF THE AHU ARE ASSEMBLED AS PER THE DRAWING			
3	CHECK AND CONFIRM ALL TRANSIT SHIPPING BRACKETS ARE REMOVED			
4	CHECK AND CORRECT ALL AV SPRING MOUNTS IN THIER LOCATON FOR FAN AND MOTOR FRAMES			
5	CHECK AND MAKE SURE ALL DEBRIS ARE CLEANED FROM INSIDE OF THE UNIT			
6	CHECK AND CONFIRM ALL AIR FILTERS ARE PLACED IN POSITION PROPERLY FITTED WITH GASKETS			
7	CHECK AND MAKE SURE ALL DAMPERS ARE OPEN			
8	CHECK AND CONFIRM THE DUCT WORK IS COMPLETED			
9	CHECK AND CONFIRM THE PIPE CONNECTION WORK IS COMPLETED WITH PROPER INSULATION.			
10	CHECK FOR ALL DRAIN CONNECTION COMPLETED WITH PROPER U TRAP			
11	CHECK FOR V BELT TIGHTNESS, IF NECESSARY CORRECT THE BELT TENSIONS			
12	CHECK FOR ALL POWER AND SAFETY CONTROL(MOTOR THERMISTER) WIRINGS COMPLETED FOR SUPPLY AND RETURN FAN MOTORS			
13	CARRY OUT MEGGER TEST FOR THE SUPPLY / RETURN MOTORS			
14	CHECK TIGHTNESS FOR MOTOR ELECTRICAL TERMINALS IN TERMINAL BOX			
15	CHECK ELECTRICAL SUPPLY VOLTAGE .SHOULD BE WITIN THE LIMITS AS MENTIONED MOTOR NAME PLATES			
16	CHECK THAT ALL ACCESS DOORS/ PANELS ARE CLOSED PROPERLY			
17	BUMP START FAN MOTOR AND CONFIRM CORRECT FAN ROTATION			
18	START THE UNIT AND CKECK FOR ANY UNUSUAL NOISE			
19	RECORD ALL OPERATING DATA			

Wild air statup

It is suggested not to run the units at full speed, in order to avoid any possible of water carryover due to condensation of high humidity built-up inside the units and ducts. Once the humidity levels is maintained, the units can be operated at design conditions as required.

CHECKED BY _____

5d - Air handling unit Start up / Commissioning record

Project:

Unit reference:

Date

System	Design values	Measured values	Remarks
Supply Volts			
Supply motor amperes			
Supply fan RPM			
Supply fan Air qty:			
Supply fan Total static pressure -pa			
Return motor amperes			
Return fan RPM			
Return fan Air qty: - l/s			
Return fan Total static pressure - pa			
Cooling coil air on temperature °C- d/b- w/b			
Cooling coil air off temperature °C- d/b- w/b			
Cooling coil water pressure drop - kpa			
Cooling coil water flow - l/s			
Pre filter pressure drop - pa			
Bag filter pressure drop -pa			

Note;

Attested by	Name	Date	Signature	

5d - Electrical Heater

Commissioning and Maintenance

Please observe local Electric regulation, use only approved electrical components.

WARNING! Do not touch heating elements to avoid any skin burns.

High Temperature cut out:

Make sure the high temperature cut out connected to control circuit of the heater, setting shall be 40°C.



WARNING

An electric heater shall be interlocked with Air flow switch (in the event of no Air flow, Heater power must be disconnected through Safety / control circuit) Damage can cause due to overheating the electric heater casing, AHU casing and other fitted parts if the system is run without sufficient air flow (e.g. system switched off at the main switch when the electric heater is still on) or the event of an emergency system close down triggered by safety devices.

Flow Control:

The air flow is to be monitored by measurement of pressure difference across the fan, using air pressure control switch. Make sure fan deliveries design air quantity Functioning must be checked during commissioning.

Current Consumption:

Current consumption is to be checked at all stages by measuring all phases. For rated data, see heater name plate.

Maintenance Interval:

Every month.

Maintenance Work:

	REGULARLY	WHEN NECESSARY
Check functioning of air flow control; To do this, remove presume measurement tubes from air pressure control. A switching operation must take place.	X	
Check electrical heater for functioning, hygienic condition, fouling, corrosion, and fastening.	X	
Clean electric heater, sealing, remove corrosion, retighten fixing.		X
Check function of safety temperature cut out operate (see commissioning)	X	

5e - Coils



WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acid or highly alkaline. Handle chemical carefully. Proper handling should include goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury

NOTICE:

Microbial Growth!

Wet interior unit insulation can become an amplification site for microbial growth (mold), which may cause odors and damage to the equipment and building materials. If there is evidence of microbial growth on the interior insulation, the insulation should be removed and replaced prior to operating the system.

NOTICE:

Connection Leaks!

Use a backup wrench when connecting piping to coils with copper headers to prevent damage to the coil header.

Over Tightening!

Do not use Teflon-based products for any field connections because their high lubricity may allow connections to be over-tightened, resulting in damage to the coil header.

Drain Pans



WARNING

Hazardous Chemicals!

Cleaning agents can be either acidic or highly alkaline. Handle chemical carefully. Proper handling should include goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

5e

Coil Piping and Connections

Proper installation, piping, and trapping is necessary to ensure satisfactory coil operation and to prevent operational damage.

- ° Support all piping independently of the coils.
- ° Provide flexible joint fittings on coil connections that are adjacent to coils to absorb thermal expansion and contraction strains.

Note: The contractor is responsible for supplying the installation hardware.

Coil Checks.

The use of untreated or improperly treated water in coils may result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Klimak assume no responsibility for equipment failures which result from untreated or improperly treated water, or saline water.

- ° Ensure coil and condensate drain piping connections are complete.
- ° Check the piping and valves for leak.
 - Open or close the valves to check operation
 - The drain lines should be opened.
- ° If unit has a refrigerant coil, ensure that it has been charged and leak-tested according to the instructions provided with the condensing unit.
- ° Remove all foreign material from the drain pan and check the pan opening and condensate line for obstructions.

Drain Pan

NOTICE!

When more than one module has a drain pan, trap each section individually. Threaded condensate drain connections are provided on only one side of the coil section. Pitch the connection lines horizontal or downward toward an open drain, we recommend installing a plug to facilitate cleaning of the trap.

The drain connection size is 1 1/2 inch MPT.

Page no. 11 illustrates the proper trapping, piping, and operating of the trap for negative pressure sections. Use the formula under the figure to determine the correct minimum depth for the condensate trap.

5f - Air Filters

Disconnect all electric power, including remote disconnect switch before servicing. Follow proper lockout / tag out procedures to ensure the power can not be inadvertently energised. Failure to secure drive sheaves or disconnect power servicing could result serious injury.

Throwaway Filters

Wearing the appropriate personal protective equipment, cloths to remove any filters. To replace throwaway filters, install new filters with the directional arrows pointing in the direction of airflow.

Note: Bag and cartridge filters must have an airtight seal to prevent air bypass.

Permanent Filters

To clean permanent filters:

1. Wearing the appropriate personal protective equipment, cloths to remove any filters.
2. Disconnect all electrical power to the unit.
3. Wash the filter under a warm water to remove dirt and lint.
4. Rinse the filter in clean, warm water and allow to dry.
5. Allow to drain and dry for about 12 hours.
6. Reinstall the filters.

Note: it may be preferable to keep extra, clean filters to replace the dirty filters to minimize unit downtime for filter maintenance.

Cartridge or Bag Filters

To replace the cartridge or bag filters:

1. Wearing the appropriate personal protective equipment, cloths to remove any filters.
2. Disconnect all electrical power to the unit.
3. Remove filter retainer vertical frames by removing the knobs top and bottom
4. Remove the dirty filters and discard as per local regulation.
5. Place new bag filters pushing them tightly against the unit.

Note: The filter pleats should be in vertical position.

6. Place the filter retainers tightly.
7. Close and secure the access door.
8. Thoroughly clean any contaminated area(s) with a mild bleach and water specifically designed for HVAC use.
9. Allow the unit to dry completely before putting it back into operation.

6- Maintenance / Planned Maintenance / Planned Operational efficiencies

6a - Routine Maintenance



WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards.

Qualified authorised technician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.



WARNING

Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tag out procedures to ensure the power can not be inadvertently energized. Secure drive sheaves to ensure rotor cannot freewheel. Failure to secure drive sheaves or disconnect power before servicing could result in death or serious injury

6b - Cleaning Maintenance

Cleaning Of Dampers

Cleaning of dampers should be performed before operation. Maintenance personnel must determine when cleaning is necessary based on observation an operation

Hardware Check

Make sure all linkage parts, actuators and, mounting brackets are secure.

Coil Cleaning Procedure

Suggested Tools, Equipment & Materials List

- Pressure washer that does not exceed 200 PSI
- Sprayer (utility garden, etc.) applicator
- Plastic sheeting
- Coil cleaner (safe, commercial grade, disinfecting)
- Garden hose
- Garden hose spray nozzle
- Rags
- Trash bags
- Power cords

Cleaning Procedure

1. Cover electrical components such as fan motors, damper motors, thermostats, etc. with plastic. Care should be taken on interior coil cleaning. Remove filters; cover fan bearings and any insulation to keep these items free of water damage. Condensate drain piping should be screened to allow coil-cleaning water to flow freely. Screening keeps traps and drain lines from clogging with debris washed from the coils.

2. Prior to any application of wet cleaning materials, use a wide soft bristle paint brush to dust off any heavy dust, leaves, bugs or other foreign matter that may be on the coil fin surface.

Safety goggles and gloves should be worn when cleaning coils.

3. When possible, remove dirt lodged in the depth of the coil by using clean oil-free air under pressure. Caution should be taken not to use extreme high-pressure air as this may cause fin surface damage. Direct the air straight at the openings between the fins and never at an angle, which may bend the fins against one another. Always apply the air from the air leaving side of the coil.

4. On heavily soiled coils, use a safe commercial grade coil cleaner.

5. Spray the cleaning agent on both sides of the coil to be cleaned. Allow the cleaning agent to remain in contact with the dirty surface for about 5 minutes or as recommended by the agent instructions. Then flush the coil with clean water from a hose (with spray nozzle or from pressure washer). Flush from the air leaving side of the coil. Caution should be taken, as extreme water pressure may result in fin surface damage. Direct the water straight at the openings between the fins and never at an angle, which may bend the fins against one another. This process will wash away surface dirt on the air entering side of the coil, and prevent it from loading within the depth of the coil.

6. Most cleaners are concentrated detergents and can be diluted with up to 10 parts of water. Dilute as per cleaning agent instructions and coil condition. Re-spray both sides of the coil with cleaner. Allow to stand 5 minutes and flush as described previously. Finish flushing from both sides of the coil.

7. Some extreme oil and dirt conditions may require steam cleaning. Most steam equipment can be adjusted to provide a mixture of water and steam at a moderate pressure. Steam alone without the presence of water does not work well with most cleaning agents. Cleaning the coils with steam should be done as described previously.

8. Comb out any bent or flattened areas of fin surface.

9. Restore equipment to operational.

Condensate Drain Pan, Trap and Drain Line Cleaning Procedure

Clean condensate drain pan, trap, drain line and adjacent wetted surface at least once per year or as often as required to retard growth of microbial substances.

Tools & Material

- Utility cleaning brush.
- Cleaning agent (safe, commercial grade, disinfecting).
- Rags.
- Trash Bags
- Garden hose with spray nozzle or power washer.
- Scraper
- Screening.
- Wet vacuum cleaner.

Cleaning Procedure

1. Cover any nearby components such as motors, control devices or wiring.
2. Sweep, gather and remove debris from drain pan, auxiliary pans and splash guards.
3. Scrape loose and remove any clinging substances.
4. Cover drain pan outlet with screening to prevent drain clogging.
5. Prepare cleaning agent per manufacturer's instructions.
6. Apply cleaning agent with spray applicator or brush.
7. Apply cleaner to ALL surfaces including: under side of coil, header and return bends if in air stream, coil supports, coil wall or bulkhead, auxiliary drain pans, splash guards, any other surfaces subject to wetting by condensation dripping or carried by normal air flow, drain pan and outlet.
8. Add ample amount of cleaning agent to drain line and trap.
9. Allow cleaner to stand for time required by manufacturer's instructions.
10. Flush with clean water from pressure washer or garden hose with spray nozzle.
11. Apply as much water under pressure as possible to drain outlet to clean trap and drain line.
12. Remove water from any puddle areas with wet vacuum.
13. Wipe down if necessary to remove any stubborn material.
14. Restore equipment to operational state.

Safety Notes

Before doing any maintenance operation on the fan it's imperative to ensure that:

- the drive motor is disconnected from all electric isolators.
- the impeller has come to rest
- the surface temperature has been checked to prevent burning
- the impossibility of an uncontrolled running of the fan during the maintenance works
- no debris of damage or dangerous materials are inside the fan.

Only limited works may be carried out while in the operating condition and in observance of the safety and accident prevention regulations (for ex. Measurement of vibration).

The non-observance of these points endangers life for the maintenance personnel.

Fan Housing and Impeller

Depending on air, wear and dirt can be expected inside the housing and on the impeller (corrosion, abrasions, stacked materials). Regular inspection and cleaning must take place. The intervals between them is to be fixed by the operator on accordance with individual operating conditions.

No high pressure cleaners (steam, rod cleaners) are to be used.

Belt drive

It's recommended, depending on the installation site and type of fan-operation, to check regularly the belt tension.

Belt replacement

The axle spacing should be reduced until the new belts can be easily fitted by hand. The tensioning of the belts should be done in a accordance with Belt drive alignment.

Taper lock pulley replacement

To remove the pulley:

1. Unscrew the bolts
2. Tighten the socket head cap screw in the threaded hole
3. Press the clamping bush out of the tapered hole
4. The pulley can now be easily slid of the shaft.

To fix the pulley

1. Pull the pulley wheel and the clamping bush together by means of the socket head cap screw

Ensure that the motor pulley and the fan drive pulley are accurately aligned. Fit and tension the belt in accordance with instructions.

Only electrostatically conductive belts are to be used with spark-proof execution (Ex-version) fans.

6c - Fan & Motor Maintenance

Fans



WARNING

Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tag out procedures to ensure the equipment can not be inadvertently energized.

Failure to secure drive sheaves or disconnect power before servicing could result in death or serious injury.

Motor Bearing Lubrication



WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tag out procedure to ensure the power cannot be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury

NOTICE!

Belt Tension!

Do not over-tension belts. Excessive belt tension will reduce fan and motor bearing life, accelerate belt wear and possibly cause shaft failure. Under tensioning belts is the primary cause of premature belt failure. Belts should not squeal at start-up. Recheck belt tension after 8 hours, 48 hours of operation and monthly thereafter.

6c - Fan & Motor Maintenance

Align Fan and Motor Sheaves

Align the fan and motor sheaves using a straightedge. The straightedge must be long enough to span the distance between the outside edges of sheaves. When the sheaves are aligned, the straightedge will touch both sheaves at points A through D (see below figure) to confirm the shaft is parallel. For uneven width sheaves, place a string in the centre groove of both sheaves and pull tight. Adjust the sheaves and tighten the sheave set screws to the proper torque.

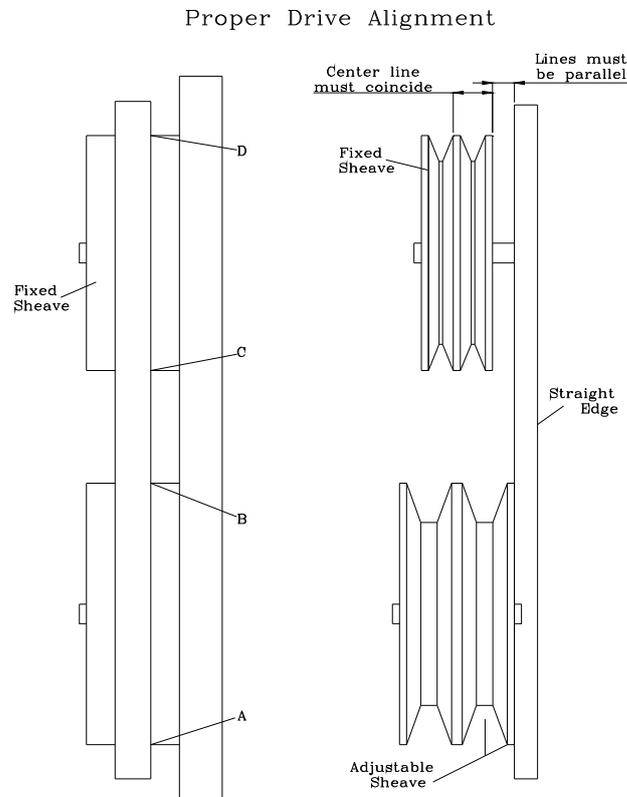
Checking Multiple Belts

Tighten the belts slightly and rotate the drive several times.

On multiple belt drives, ensure the force of deflection is approximately the same on each belt by pushing each belt in an equal distance at a point halfway each sheave (see figure below). If this force is not the same for each belt, the motor and fan shaft are not parallel.

Realign as required.

After realignment, tighten the belts again to the standard belt tensioning specifications. If the force is still not the same for all belts, the belts or sheaves are worn and must be replaced.



6c - Fan & Motor Maintenance

Belts (Every Month)

Belt tension

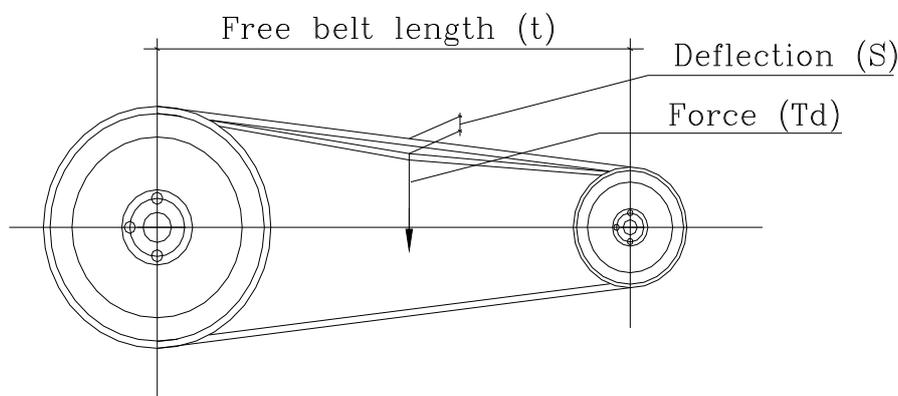
1. The ideal tension is the lowest tension at which the belt will not slip under the maximum load.
2. Check the belt tension within the first 24-48 hours of operation.
3. Excess tension can reduce belt and bearing life.
4. Keep the belts free from material that can cause slipping.
5. Periodically check the belt tension to avoid slipping.

To Check the Belt tension Use the Following Method.

6. Measure the length of the free section 't'

7. At the centre of the free length 't' apply a force 'Td' (perpendicular to the free length, sufficient to cause a deflection $S = 1.6 \text{ mm per } 100 \text{ mm}$ of free length. For example the deflection of a 1000mm free length should be 16mm.

8. Check the applied force with the table values. If it is between the "min" and "max" values the belt tensioning is satisfactory. If it is a lower than the "min" the belt is too loose and if it is more than the "max" the belt is too tight. However a new drive can be set at an initial value double the "min" value to allow for normal stretching during the initial operation.



Belt Deflection		
Belt type	Diameter of smaller Pulley in mm	Force(Td)kg
SPZ	67 ÷ 95	1.0 ÷ 1.5
	> 96	1.5 ÷ 2.0
SPA	100 ÷ 132	2.0 ÷ 2.7
	> 132	2.7 ÷ 3.2
SPB	180 ÷ 224	3.5 ÷ 5.0
	> 225	5.0 ÷ 6.6
SPC	224 ÷ 355	6.0 ÷ 9.0
	> 356	9.0 ÷ 12.0

6c - Fan & Motor Maintenance

Bearings

Like all components, the bearings must be periodically checked and if required cleaned and re-lubricated.

In heavy duty operating conditions (high speed or high humidity and dirt) we recommend to re-lubricate the bearings very often, for ex. Every 2 weeks. The re-lubrication intervals indicated on Appendix. 1 apply for fans with horizontal shaft and with temperature which do not exceed $+60^{\circ}\text{C}$. To consider the accelerated ageing of the grease by high temperatures, it's opportune to reduce by half the re-lubrication interval you can resume from the diagram for each 15°C of operating temperature augmentation of the bearing over $+70^{\circ}\text{C}$ (the max. admissible temperature for the grease mustn't in any case be exceeded). By temperatures below $+70^{\circ}\text{C}$, the re-lubrication interval can be lengthened correspondingly (the re-lubrication interval should never more than double and at least once yearly - see diagram). This instructions are to be considered a general reference and must be adapted to each single fan application.

The bearings mounted on the fans are of different types according to the fans size and the absorbed power. The base and R-version are supplied with pre-greased sealed for life ball bearings. They are guaranteed for a L10 life of 20.000 hours at peak performance. By changing the bearings it's necessary to change the rubber too. The T-version fans are supplied with re-reusable ball bearings with Plummer block. The HLZ fans are supplied with splitted housing ball bearing type. These bearings are regreasble quantity and we recommend to substitute completely the grease after 2 re-lubrications. The grease quantity and regreasing interval depends from bearing type and rpm and are indicated in the tables and figures in appendix.

Bearing replacement

Replacement of a bearings mounted on cross arms:

1. Release the grains and remove the locking rings from the bearings using of punch and hammer. Unthread the locking rings from the shaft. By mean of appropriate tools hold the shaft in order to avoid damages to the wheel and inlet cone.
2. Remove the cross bearings from the side plates and unthread the cross bearings from the shaft. Replace bearings and rubber rings. Mount new rubber rings on cross-arms.
3. Mount the cross-bearings on the side-plates having care to centre the impeller on the inlet cone. Fix the cross-bearings on the side plates tightening the bolts. Thread and tighten the locking rings on the bearings; then tighten the grains on the locking rings too. Turn the wheel in order to check the correct rotation.

Replacement of a bearings mounted into cast-iron pillow block:

1. Release the grains and remove the locking rings from the bearings using a punch and hammer. Remove the pins from the cast-iron pillow block and release the bolts. Unthread the cast-iron pillow blocks from the shaft. By mean of appropriate tools hold the shaft in order to avoid damages to the wheel and inlet cone.
2. Replace bearings mounting the new bearings on the cast-iron blocks.
3. Mount the cast-iron pillow blocks on the frames having care to centre the impeller on the inlet cone. Fix the cast-iron pillow blocks on the frames tightening the bolts. Thread and tighten the locking rings on the bearings then tighten the grains on the locking rings too. Turn the wheel in order to check the correct rotation.

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Replacement of bearings mounted into single cast-iron single blocks SKF mod. SNL:

1. Unlock the block cover releasing the bolts located on both sides. By mean of appropriate tools hold the shaft in order to avoid damages to the wheel and inlet cone.
2. Remove the locking rings from the bearings side (note that only one bearing is equipped with the locking rings) and the half sealing rings from the bottom and upper part of the block housing after have cleaned of the grease.
3. Slide out the bearings straightening the feather key of threaded ring placed on the bush; release the threaded ring from both sides using of punch and hammer. Place the bearings; tighten the bush my mean of the threaded ring and bend the feather key.
4. Mount the new seal ring inside the grooves located on the bottom part of the block. Place the greased group shaft/bearing over the block basement. Mount one of more locating rings on the side of one bearing only (the other bearing will not be locked).

Place the other seal ring inside the upper part of the block. Place the upper part of the block over the bottom part and tighten the bolts.

Fill the bearing with the proper grease.

Turn the wheel in order to check the correct rotation.

Fan Bearing Lubrication tables.

1. M(g) - Grease quantity in grams.
2. \varnothing D (mm) - Fan shaft diameter.

Motor Bearing Lubricant

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions.

Goods results can be obtained if the following recommendations are used in your maintenance program:

- A high-grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Motor Lubrication Procedure

Be sure than the grease you are adding to the motor is compatible with the grease already in the motor.

To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your distributor or an authorized

Service centre for additional information.

- With Grease Relief Plug

1. Clean all grease fittings.
2. Remove grease relief plug.
3. If motor is stopped, add the recommended amount of grease.
4. If motor is to be grease while running, a slightly greater quantity of grease will have to be added. Add grease slowly until new grease appears at shaft hole in the end plate for purge relief plug.
5. Re-install grease relief plug.

- Without Grease Relief plug

1. Disassemble motor.
2. Add recommended amount of grease to bearing and bearing cavity. Inboard Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.

6c - Fan & Motor Maintenance

Replacement Bearings for RDA E / ADH E / RDH E Fans

Fan type	Diam.	Fan version				Type of bearing -INA	Type of bearing -SKF
	mm	L E0	R E2	G2L G2E0	G2R G2E2		
ADH E 160	20	2x	2x	3x	3x	RAE 20 NPPB + rubber	YET / YEL 204 + rubber
ADH-RDH E-0180	20	2x	2x	3x	3x	RAE 20 NPPB + rubber	YET / YEL 204 + rubber
ADH-RDH E-0200	20	2x	2x	3x	3x	RAE 20 NPPB + rubber	YET / YEL 204 + rubber
ADH-RDH E-0225	20	2x	2x	3x	3x	RAE 20 NPPB + rubber	YET / YEL 204 + rubber
ADH-RDH E-0250	20	2x	2x	3x	3x	RAE 20 NPPB + rubber	YET / YEL 204 + rubber
ADH-RDH E-0280	25	2x	2x	3x	3x	RAE 25 NPPB + rubber	YET / YEL 205 + rubber
ADH-RDH E-0315	25	2x	2x	3x	3x	RAE 25 NPPB + rubber	YET / YEL 205 + rubber
ADH-RDH E-0355	30	2x	2x	3x	3x	RAE 30 NPPB + rubber	YET / YEL 206 + rubber
ADH-RDH E-0400	30	2x	2x	3x	3x	RAE 30 NPPB + rubber	YET / YEL 206 + rubber
ADH-RDH E-0450	35	2x	2x	3x	3x	RAE 35 NPPB + rubber	YET / YEL 207 + rubber
ADH-RDH E-0500	35	2x	2x	3x	3x	RAE 35 NPPB + rubber	YET / YEL 207 + rubber
ADH-RDH E-0560	40	2x	2x		3x	RAE 40 NPPB + rubber	YET / YEL 208 + rubber
ADH-RDH 630	40	2x	2x		3x	RAE 40 NPPB + rubber	YET / YEL 208 + rubber
ADH-RDH 710	50	2x	2x			RAE 50 NPPB + rubber	YET / YEL 210 + rubber

Fan type	Diam.	Type of pillow block and bearing INA	Type of pillow block and bearing SKF
	mm		
ADH-RDH E4-0200	20	2 x PASE 20 NPPB	2 x SY 20 FM / WM
ADH-RDH E4-0225	20	2 x PASE 20 NPPB	2 x SY 20 FM / WM
ADH-RDH E4-0250	25	2 x PASE 25 NPPB	2 x SY 25 FM / WM
ADH-RDH E4-0280	30	2 x PASE 30 NPPB	2 x SY 30 FM / WM
ADH-RDH E4-0315	30	2 x PASE 30 NPPB	2 x SY 30 FM / WM
ADH-RDH E4-0355	35	2 x PASE 35 NPPB	2 x SY 35 FM / WM
ADH-RDH E4-0400	35	2 x PASE 35 NPPB	2 x SY 35 FM / WM
ADH-RDH E4-0450	40	2 x PASE 40 NPPB	2 x SY 40 FM / WM
ADH-RDH E4-0500	40	2 x PASE 40 NPPB	2 x SY 40 FM / WM
ADH-RDH E4-0560	50	2 x PASE 50 NPPB	2 x SY 50 FM / WM
ADH-RDH 630 K	50	2 x PASE 50 NPPB	2 x SY 50 FM / WM
ADH-RDH 710 K	50	2 x PASE 50 NPPB	2 x SY 50 FM / WM
ADH-RDH 800 K	50	2 x PASE 50 NPPB	2 x SY 50 FM / WM
ADH-RDH 900 K	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM
ADH-RDH 1000 K	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM

6c - Fan & Motor Maintenance

Replacement Bearings for RDA E / ADH E / RDH E Fans

Fan type	Diam.	Type of pillow block and bearing INA	Type of pillow block and bearing SKF
	mm		
ADH-RDH G2E4-0250	25	3 x PASE 25 NPPB	3 x SY 25 FM / WM
ADH-RDH G2E4-0280	30	3 x PASE 30 NPPB	3 x SY 30 FM / WM
ADH-RDH G2E4-0315	30	3 x PASE 30 NPPB	3 x SY 30 FM / WM
ADH-RDH G2E4-0355	35	3 x PASE 35 NPPB	3 x SY 35 FM / WM
ADH-RDH G2E4-0400	35	3 x PASE 35 NPPB	3 x SY 35 FM / WM
ADH-RDH G2E4-0450	40	3 x PASE 40 NPPB	3 x SY 40 FM / WM
ADH-RDH G2E4-0500	40	3 x PASE 40 NPPB	3 x SY 40 FM / WM
ADH-RDH G2E4-0560	50	3 x PASE 50 NPPB	3 x SY 50 FM / WM
ADH-RDH 630 G2K	50	3 x PASE 50 NPPB	3 x SY 50 FM / WM
ADH-RDH 710 G2K	60	4 x PASE 60 NPPB	4 x SY 60 FM / WM
ADH-RDH 800 G2K	60	4 x PASE 60 NPPB	4 x SY 60 FM / WM
ADH-RDH 900 G2K	60	4 x PASE 60 NPPB	4 x SY 60 FM / WM
ADH-RDH 1000 G2K	60	4 x PASE 60 NPPB	4 x SY 60 FM / WM

Fan type	Diam.	Type of pillow block and bearing INA	Type of pillow block and bearing SKF
	mm		
RDH G2E7-0250	30	3 x PASE 30 NPPB	3 x SY 30 FM / WM
RDH G2E7-0280	35	3 x PASE 35 NPPB	3 x SY 35 FM / WM
RDH G2E7-0315	40	3 x PASE 40 NPPB	3 x SY 40 FM / WM
RDH G2E7-0355	40	3 x PASE 40 NPPB	3 x SY 40 FM / WM
RDH G2E7-0400	50	3 x PASE 50 NPPB	3 x SY 50 FM / WM
RDH G2E7-0450	50	3 x PASE 50 NPPB	3 x SY 50 FM / WM
RDH G2E7-0500	60	3 x PASE 60 NPPB	3 x SY 60 FM / WM
RDH G2E7-0560	60	3 x PASE 60 NPPB	3 x SY 60 FM / WM
RDH 630 G2K2	60	3 x PASE 60 NPPB	3 x SY 60 FM / WM

Fan type	Diam.	Type of pillow block and bearing INA	Type of pillow block and bearing SKF	Bearing only SKF
	mm			
ADH-RDH E6-0315	30	n.a.	2 x SYJ 35 KF	YSA 207-2FK
ADH-RDH E6-0355	35	n.a.	2 x SYJ 40 KF	YSA 208-2FK
ADH-RDH E6-0400	35	n.a.	2 x SYJ 40 KF	YSA 208-2FK
ADH-RDH E6-0450	40	n.a.	2 x SYJ 45 KF	YSA 209-2FK
ADH-RDH E6-0500	40	n.a.	2 x SYJ 45 KF	YSA 209-2FK
ADH-RDH E6-0560	50	n.a.	2 x SYJ 55 KF	YSA 211-2FK
ADH-RDH 630 K1	50	n.a.	2 x SYJ 55 KF	YSA 211-2FK
ADH-RDH 710 K1	60	n.a.	2 x SYJ 65 KF	YSA 213-2FK
ADH-RDH 800 K1	60	n.a.	2 x SYJ 65 KF	YSA 213-2FK
ADH-RDH 900 K1	60	n.a.	2 x SYJ 65 KF	YSA 213-2FK

6c - Fan & Motor Maintenance

Replacement Bearings for RDA E / ADH E / RDH E Fans

Fan type	Diam.	Type of pillow block and bearing INA	Type of pillow block and bearing SKF	Bearing only SKF
	mm			
ADH G2E7-0250	30	n.a.	3 x SYJ 35 KF	YSA 207-2FK
ADH G2E7-0280	35	n.a.	3 x SYJ 40 KF	YSA 208-2FK
ADH G2E7-0315	40	n.a.	3 x SYJ 45 KF	YSA 209-2FK
ADH G2E7-0355	40	n.a.	3 x SYJ 45 KF	YSA 209-2FK
ADH G2E7-0400	50	n.a.	3 x SYJ 55 KF	YSA 211-2FK
ADH G2E7-0450	50	n.a.	3 x SYJ 55 KF	YSA 211-2FK
ADH G2E7-0500	60	n.a.	3 x SYJ 65 KF	YSA 213-2FK
ADH G2E7-0560	60	n.a.	3 x SYJ 65 KF	YSA 213-2FK
ADH 630 G2K2	60	n.a.	3 x SYJ 65 KF	YSA 213-2FK

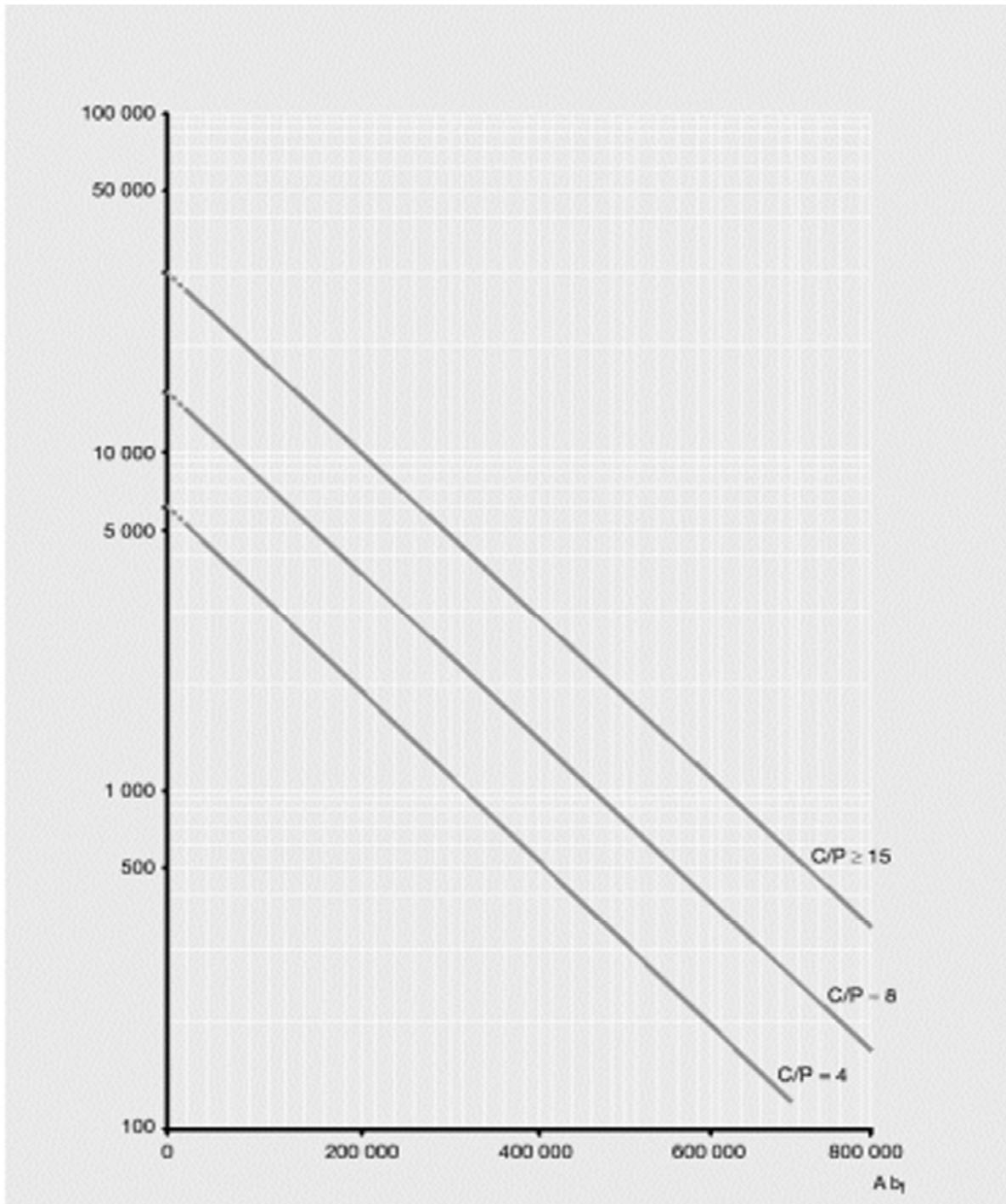
Fan type	Diam.	Type of pillow block and bearing -SKF
	mm	
ADH-RDH E7-0500	50	2 x SYJ 55 KF (YSA 211-2FK)
ADH-RDH E7-0560	50	2 x SKF SNL 611 TG -2311 K
ADH-RDH 630 K2	50	2 x SKF SNL 611 TG -2311 K
ADH-RDH 710 K2	60	2 x SKF SNL 613 TG -2313 K
ADH-RDH 800 K2	60	2 x SKF SNL 613 TG -2313 K
ADH-RDH 900 K2	60	SKF SYT 60 TS (1 x "F" axially locked + 1 x "L" free)
ADH-RDH 1000 K2	60	SKF SYT 60 TS (1 x "F" axially locked + 1 x "L" free)

Fan type	Diam.	Inner side bearings only (on 4-bearings models)	
		Type of pillow block and bearing INA	Type of pillow block and bearing INA
	mm	(inner side)	(inner, altern. to INA)
ADH-RDH 710 G2K2	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM
ADH-RDH 800 G2K2	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM
ADH-RDH 900 G2K2	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM
ADH-RDH 1000 G2K2	60	2 x PASE 60 NPPB	2 x SY 60 FM / WM

Fan type	Diam.	Outer side bearings only (on 4-bearings models)	
		Type of pillow block and bearing SKF	
	mm	(outer bearings only)	
ADH-RDH 710 G2K2	60	2 x SYT 60 TS L/F	
ADH-RDH 800 G2K2	60	2 x SYT 60 TS L/F	
ADH-RDH 900 G2K2	60	2 x SYT 60 TS L/F	
ADH-RDH 1000 G2K2	60	2 x SYT 60 TS L/F	

6c - Fan & Motor Maintenance

Relubrication intervals at operating temperatures of 70°C for RDA E / ADH E / RDH E fans



TF operating hours

Bearings lubrication

Many factors can determine when relubrication of the bearings is required: The type and dimension of bearing, its operating speed, the working temperature, pulleys dimension, installed motors power, type of grease and the working environment. It is therefore only possible to give some indications based on statical data available.

The relubrication intervals t_f , valid for bearings on horizontal shafts and working with clean air, is the time period at the end of which 99% of the bearings are still reliable lubricated and represent L1 grease life (the L10 grease is approximately 2.7 the L1 grease life)

6c - Fan & Motor Maintenance

Bearing Lubrication

Body - Type	Grease quantity		Body - Type	Grease quantity	
	First regressing	Re-lubrication		First Re-regressing	Re-lubrication
g			g		
SNL 205	25	5	SNL 511-609	100	15
SNL 206-305	40	5	SNL 512-610	150	15
SNL 207	50	10	SNL 513-611	180	20
SNL 208-307	60	10	SNL 515-612	230	20
SNL 209	65	10	SNL 516-613	280	25
SNL 210	75	10	SNL 517	330	25
SNL 211	100	15	SNL 518-615	430	40
SNL 212	150	15	SNL 519-616	480	50
SNL 213	180	20	SNL 520-617	630	55
SNL 215	230	20	SNL 522-619	850	70
SNL 216	280	25	SNL 524-620	1000	80
SNL 217	330	25	SNL 526	1100	95
SNL 218	430	40	SNL 528	1400	110
SNL 505	25	5	SNL 530	1700	130
SNL 506-605	40	5	SNL 532	2000	150
SNL 507-606	50	10			
SNL 508-607	60	10			
SNL 509	65	10			
SNL 510-608	75	10			

About Y bearing units, SKF doesn't suggest a quantity of grease to use but the way to carry out the regressing operation. When re-lubricating. Starts to escape from the seal, grease should be pumped slowly into the running bearing until fresh grease To re-lubricate it is necessary to use the same grease as that used at the initial lubrication. Refer to the table below:

LUBRICATING GREASES		
Properties	Grease fills in standard Y-bearings, standard Y-bearing units	Y-bearings YAR 2-2RF/HV and YAR 2-2RF/VE95, Y-bearing units SYKC and FYTBKC
Thickener	Lithium-calcium soap	Aluminium-complex soap
Base oil	Mineral oil	Synthetic hydrocarbon oil
Colour	Yellowish brown	Beige
Operating temperature, (continuous operation)	°C – 20 to + 120 – 45 to + 120	– 45 to + 120
Reference temperature, °C	55	≈ 60
Kinematic viscosity of base oil, mm ² /s at 40°C / 100°C	165/15	150/22
Consistency (to NLGI scale)	2	1
Other	Long life grease	Fulfils the requirements of the "Guidelines of section 21 CFR 178.3570" of the FDA (US Food and drug Administration regulations)

6d - Planned Maintenance

PROCEDURE	MONTHLY	QUARTERLY	YEARLY	OTHER
Clean exterior of AHU casing.			x	
Inspect doors, handles, latches and hinges for proper operation.			x	
Inspect door gaskets for damage and proper seal.			x	
Inspect panels for damage.			x	
Check fan housing, wheel, shaft, frame and bearings for wear, loose parts, dirt and debris.			x	
Check fan base, vibration isolators for loose parts, dirt and debris.			x	
Check flex connector for damage and wear.			x	
Check the cleanliness of the filters and replace as required. Check functionality of DP of filters	x			
Check filter frames and clean as necessary.		x		
Check belt tension.		x		
Lubricate fan bearings.				See IOM Tables
Check adjustable fan motor base and mounting hardware for loose parts.		x		
Check adjustable fan motor base.			x	
Check fan motor.			x	
Clean dampers.		x		
Check for dirt, dust & debris in air vents on fan motor housing.			x	
Clean cooling coils.			x	
Clean condensate drain pan, trap, drain line and adjacent wetted surfaces.			x	
Check controls and re-equilibrate			x	

***Planned Operational Efficiencies**

HVAC Air Handling Equipment, including fans, cooling coils and other components are sized as per the name plates and the technical data sheets.

7 - Troubleshooting

This section is intended to be used as a diagnostic aid only. For detailed repair procedures, contact your KLIMAK service representative.



WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this section of the manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. When possible, disconnect all electrical power including remote disconnect switch before servicing,

Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized.

When necessary to work with live electrical components, have a qualified electrician or other who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury. Including remote disconnects before servicing. Follow proper lockout/tag out procedures to ensure the the power cannot be inadvertently energized. When necessary to work with live electrical components have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

7 - Corrective Maintenance

DRIVE NOISE	<ol style="list-style-type: none"> 1. Sheave(s) not tight on shaft(s) (motor or fan). Tighten sheave(s). 2. Belts hitting belt guard. Adjust or tighten belt guard mounts. 3. Belt loose. Adjust to proper tension. Belts should be checked twice during first days operation and periodically thereafter. 4. Belts too tight. Adjust to proper tension. 5. Belts are wrong cross section to fit sheaves. Install proper belts. 6. Belts not matched in length on multi-belt drive. Install matched belts. 7. Misaligned sheaves. Align sheaves properly. 8. Belts worn. Replace belts. 9. Motor, base or fan not securely anchored. Anchor loose components are required. 10. Belts oily or dirty. Clean or replace belts.
BEARING NOISE	<ol style="list-style-type: none"> 1. Defective bearing. Repair or replace bearing. 2. Bearing needs lubrication. Lubricate bearing as required. 3. Bearing loose on bearing support. Tighten bearing support bolts. 4. Bearing loose on shaft. Tighten bearing to shaft. 5. Bearing misaligned (check alignment binding). Align properly. 6. Foreign material inside bearing. Disassemble, inspect and clean or replace bearing as required. 7. Fretting corrosion between bearing inner race and shaft. Clean or replace bearing as required.
HIGH VELOCITY AIR NOISE	<p>Duct work too small. Increase duct sizes to obtain proper air velocity.</p> <p>Fan running too fast. Check for proper fan RPM.</p> <p>Static pressure lower than expected. Reduce fan speed to obtain desired flow rate.</p> <p>Objects which are installed in a high velocity airstream can generate noise. This includes flow sensors, turning vanes etc.</p> <p>Registers and grilles too small. Install correct registers and grilles as required.</p>
RATTLE OR WHISTLING, NOISE IN AIR STREAM	<ol style="list-style-type: none"> 1. Dampers obstructed. Remove obstruction. 2. Diffusers obstructed. Remove obstruction. 3. Loose dampers or splitters. Tighten as required. 4. Loose grilles. Tighten grilles as required. 5. Sharp elbow(s). Install elbow(s) with larger turning radius. 6. Sudden expansion or contraction of duct work. Install proper duct work transitions. 7. Turning vanes loose or not properly installed. Tighten and/or reinstall as required.
AIR QTY LOWER THAN REQUIRED	<ol style="list-style-type: none"> 1. Fan wheel installed backwards. Install in correct position. 2. Fan wheel rotating backwards. Reverse any two power leads to fan, to change rotation. 3. Fan wheel not centred in inlet cones. Realign fan to centre of inlet cones. 4. Fan speed too slow. Check for proper fan RPM. 5. Actual duct system has more resistance to flow than originally designed. Enlarge duct work or remove restrictions to match design requirements.

7 - Corrective Maintenance

AIR QTY LOWER THAN REQUIRED	<p>6. Dampers closed and/or splitter rod disconnected. Open dampers and connect splitter rod.</p> <p>7. Fire damper(s) closed. Open fire damper(s).</p> <p>8. Registers closed. Open registers.</p> <p>9. Insulating duct liner loose. Reattach loose duct liner.</p> <p>10. Leaks in supply ducts caused by open seams or holes in duct work. Repair seams and/or leaks in duct system.</p> <p>11. Air filters dirty or clogged. Remove clogging debris and /or clean filters.</p> <p>12. Coils dirty or clogged. Remove clogging debris and /or clean coils.</p> <p>13. System not balanced properly. Balance system per design specifications. Pay close attention to External Static Pressure "Design" Vs "Actual".</p> <p>14. Not enough length of straight duct at fan outlet before turn or restriction. Increase length of straight duct at fan outlet or increase fan RPM to offset performance loss. Note: Observe fan RPM limits per manufacturers guidelines.</p> <p>15. Obstructions in fan discharge duct. Remove obstructions.</p>
AIR QTY HIGHER THAN REQUIRED	<p>1. Ove sized duct work. Reduce duct sizes or decrease fan RPM to obtain desired flow.</p> <p>2. Unit access door open. Close all unit access doors.</p> <p>3. System not balanced properly. Balance system per design specifications. Pay close attention to External Static Pressure "Design" Vs "Actual".</p> <p>4. Registers or grilles not installed. Install all registers and grilles per design specifications.</p> <p>5. Unit air filters not in place. Install air filters.</p>
MOTOR-HIGH CURRENT DRAW	<p>1. Take ammeter readings on all three phases of motor to verify accuracy of ammeter.</p> <p>2. High line voltage. Consult power company. Could possibly increase voltage by using lower transformer tap.</p> <p>3. Motor overloaded. Reduce load or use larger kW motor.</p> <p>4. Low in line voltage. Consult power company Could possibly increase voltage by using high transformer tap.</p> <p>5. Re check air distribution system and air balance report for low static pressure or air leaks in the unit or duct work.</p>
MOTOR UNBALANCED CURRENT DRAW	<p>1. Unbalanced line voltage due to power supply, unbalanced electrical system loading in building, high resistance connection or undersized power supply lines. Carefully check voltage across each phase at the motor terminals with a quality, properly calibrated voltmeter. If the voltage per phase is more than 1% out of balance, the current will be out of balance by an even greater percentage.</p> <p>2. If in doubt as to whether the problem is with the motor or incoming power supply lines perform the following test: Rotate all three input power lines to the motor by one position -i.e., move line #1 to motor lead #2 to motor lead #3 and line #3 to motor lead #1. If the unbalanced current draw pattern follows the input power lines the problem is the power supply. Correct the voltage balance of the power supply. If the unbalanced current draw pattern follows the motor leads the problem is defective motor. Replace motor.</p>
MOTOR-RUNS EXCESSIVELY HOT	<p>1. Blocked ventilation. For OIDP motors blow out internal ventilation passages with air pressure and eliminate external interference to motor ventilation. For TEFC motors clean external ventilation system and check motor ventilation fan.</p> <p>2. Unbalanced current draw. Balance supply voltage. Check motor leads for tightness.</p> <p>3. Motor single phase condition. Eliminate single phasing problem.</p>

7- Corrective Maintenance

MOTOR-WILL NOT START	<ol style="list-style-type: none"> 1. Motor single phase condition. Shut power off. Eliminate single phasing condition. Check motor leads for tightness. 2. Rotor or bearing locked or frozen. Shut power on. Check shaft for freeness of operation. Replace bearings. Check overload relay sizing and verify overload relays are in each of the 3 phases of the starter.
MOTOR-RUNS NOISY UNDER LOAD	<ol style="list-style-type: none"> 1. Motor single phase condition. If motor cannot be restarted it is single phased. Eliminate single phasing condition. 2. Motor single phase condition. Check overload relay sizing and verify overload relays are in each of the 3 phases of the starter. 3. Motor shaft bearing damaged. Replace bearing. 4. Supply voltage high or inconsistent supply frequency. Adjustable frequency controllers can generate motor noise.
MOTOR-LOAD SPEED CONSIDERABLY BELOW NAMEPLATE SPEED	<ol style="list-style-type: none"> 1. Motor overloaded. Reduce load or increase voltage. 2. Excessively low voltage. A reasonable overload or voltage drop will reduce motor speed only 1 - 2%. A drop of any greater magnitude would be questionable. 3. Inaccurate method of measuring device or method.
MOTOR-EXCESSIVE VIBRATION	<ol style="list-style-type: none"> 1. Motor mounting loose. Check motor mounting and be sure it is tight and solid. 2. Load unbalanced. Disconnect belt and restart motor. If vibration stops, the load is unbalanced. Balance the load. 3. Remove drive sheave and tape key in shaft keyway and restart motor. If vibration stops the sheave is unbalanced. Replace sheave. 4. If after checking all other options above and motor still has excessive vibration, the motor is unbalanced. Replace motor.
MOTOR-NOISY BEARING	<ol style="list-style-type: none"> 1. Bearing produces smooth mid-range hum. Normal fit, bearing is OK. 2. High whine. Internal fit of bearing too tight. Replace bearing and check it. 3. Low rumble. Internal fit of bearing too loose. Replace bearing, check fit. 4. Rough clatter. Bearing destroyed. Replace bearing. Avoid mechanical damage, excessive greasing, wrong grease, solid contaminants and water running into motor.
MOTOR-MECHANICAL NOISE	<ol style="list-style-type: none"> 1. Determine if noise is from motor or fan. Isolate motor from fan and check difference in noise level. 2. Fan noise transmitted to motor through drive. Reduce fan noise or damper noise transmission to motor. 3. Be sure fan vibration isolator shipping brackets are removed. If still in place remove shipping brackets to allow vibration isolation of fan and motor.
NO ELECTRIC HEAT	<ol style="list-style-type: none"> 1. Manual reset thermal cut out in electric heater control circuit tripped. Check reason for tripping and correct. Reset manual cut out switch. 2. Air flow switch interlock not closed. Check air flow sensing tube for proper location in airstream and for possible damage. Repair or replace air flow switch and/ or sensing tube as required. 3. Broken electric heating element. Replace element. Heat limiters blown. Replace heat limiters. 4. Electric heater circuit fuses blown. Replace fuses. 5. Defective electric heating circuit contactor. Repair or replace contactor as required.

7- Corrective Maintenance

WATER CARRY-OVER FROM WETCOOLING COIL ONTO FLOOR, MOTOR OR FAN HOUSING	<ol style="list-style-type: none"> 1. Airflow too high- See "AIR QTY HIGHER THAN REQUIRED". 2. Drain Pan full- See "DRAIN PAN NOT PROPERLY DRAINING". 3. Water spraying out of Drain Pan- See "DRAIN PAN NOT PROPERLY DRAINING". 4. Coil Bulkhead penetrations- Be sure any field penetrations are sealed. 5. If Intermediate Drain Pans on the coil face are present- Be sure they drain properly, checking for debris and damage. 6. Check Auxiliary Drain Pans under coil headers- Be sure they drain properly into the Main Drain Pan, checking for debris or damage.
WATER INSIDE UNIT	<ol style="list-style-type: none"> 1. If unit shipped in more than one module - Be sure these field reassembly joints are properly sealed against rain water and air leaks. 2. If field piping or electrical conduits penetrate the unit - Be sure they are sealed properly. The electrical conduits must be sealed internally to prevent air flow and moisture condensation.
DRAIN PAN NOT PROPERLY DRAINING	<ol style="list-style-type: none"> 1. Be sure trap is installed and of correct size and construction. 2. Be sure unit is installed level on curb, steel or pad. 3. Check the segment which houses the drain pan. Be sure it is under the correct pressure (positive or negative) and that pressure does not exceeds the design for that segment per the design data sheet in the submittal.
PRE-FILTERS ARE WET	<ol style="list-style-type: none"> 1. If Outside Air hoods are shipped loose- Be sure they are properly installed and sealed at top flange. Some hoods may be shipped with mist eliminators or profilers to be mounted in the hood openings when hoods are being installed. 2.If unit has Outside Air Opening- Be sure air flow does not exceed the design for Outside Air per the design data sheet in the submittal.
FILTERS OUT OF FILTER RACK	<ol style="list-style-type: none"> 1. Check for dirty filters. Filters may load much more rapidly if construction is on going in the immediate area, if certain area vegetation releases airborne substances or if insect swarms are present. 2. Check for wet filters or snow loading- See PRE-FILTERS ARE WET. 3. Check for damage to the filter racks, filter frame, filter headers or filter tracks. 4. Check for missing filter clips or latches when required. 5. Be sure air pressure drop (APD) across the filter does not exceed design
FAN VIBRATION	<ol style="list-style-type: none"> 1. Misalignment of drive components. 2. Loose foundations or mounting structure. (Resonances) 3. Foreign material attached to rotating components. 4. Damage rotating components. (Bearings, shaft, fan, wheel, sheaves). 5. Broken, loose or missing setscrews. 6. Loose belts. 7. Vibration may be coming from a source other than the fan. Stop the fan and determine if the vibration still exists. <p>Disconnect the driver motor from the fan and operate it by itself to determine if it produces vibration.</p> <ol style="list-style-type: none"> 8. Water accumulating in aerofoil blades. 9. Fan is operating in stall or unstable flow region (see fan curve). 10. Loose bolts on bearing, housing, hub or sheaves. 11. Loose locking device on bearing.

8 - Unit Operation & Test Equipment Tools



WARNING

Rotating Components!

During installation, testing, servicing and troubleshooting of this product it may be necessary to measure the speed of rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform these tasks.

Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.



WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

Failure to follow all electrical safety precautions when exposed to live electrical components

8 - Unit Operation & Test Equipment Tools

Test Equipment & Tools

For Checking Air:

1. Inclined manometers with pitot static tube.
2. Vane Anemometer
3. Tachometer
4. Clamp on meter
5. Mercury manometer. For checking pressure drop with in cooling coil

Tools:

1. One set of screw driver. Star.
2. One set of screw driver. Minus
3. Allen key set in mm from 3 mm to 8 mm.
4. Fixed double end spanner from 8 mm to 28 mm.
5. Fin comb
6. Belt Tension Tester
7. Straight Edge
8. Vacuum Cleaner
9. Drill machine forward and reverse type
10. Box spanner set from 8 mm to 28 mm

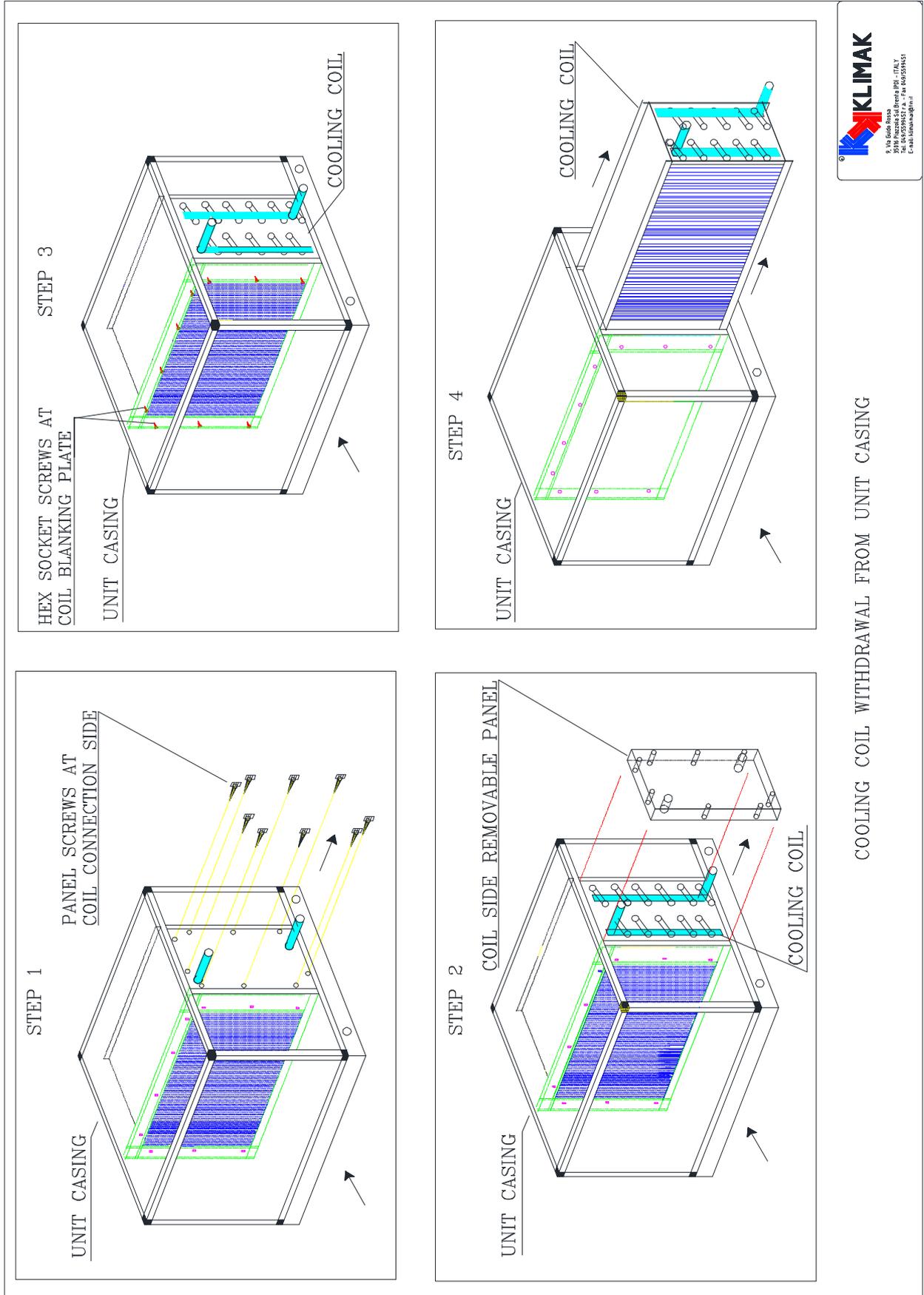
9 - Disposable & Recycling

When using or disposing the Air Handling Units or any of the components it is necessary to observe the respective local environmental and waste disposal regulations. It is, also necessary to follow the policy of sorted waste disposed material; which means to respect differences in material and their composition

It is necessary to hire a provider specialized in sorted waste disposal in accordance with applicable local standards and regulations

Active Carbon filters may contain toxic substances and hence must be disposed in accordance with applicable legal regulations.

10 - Cooling Coil Withdrawal from Standard Unit Casing



11. Maintenance of AHUs Filters

11c - Filters

1. Monthly checks:

- Check the filters for the following.
- Tears and breakage of filter bags
- State of cleanliness of the filter surface.
- Check differential pressure gauge and record the same.

2. Replace filters:

- In the event of visible leakage or damage.
- In the event of saturation of the filter surface with dust.

3. While replacing filters:

- Make sure the spare filters are stored within their original packaging in a dry, clean area.
- Wear protective clothing when replacing filters.
- Carefully pack the used filters to prevent the escape of pollution/contamination.
- Clean the cells, interior of the unit and replace damaged seals, etc.
- Install the new filter with correct sealing, care to avoid causing damage, such as trapped bags, check the zero readings of the pressure differential manometer.
- Record a note of the following on a service card for each filter section:
 1. Resistance reading for new filters
 2. Date of replacement of filters
 3. Due date for the next filter change
 4. Name of the operator replacing the filters.
 5. Disposal of used dirty outdoor air and recirculation filters
 6. Filters containing harmful substances – Pathogens – should be disposed of as chemical waste. This remains subject to the environmental regulations locally applicable. can be safely incinerated, without emitting harmful substances.

11. Maintenance of AHUs

11d - Maintenance Program

Maintenance works shall be carried out by trained and experienced personnel.
Do not attempt to conduct any maintenance unless the power is switched off .

Every Week:

Check the condition of filters. change if necessary.
Check the cleanliness of the cooling coil and wash if necessary.
Please keep in mind that above checks may be required more frequently depending on the climate and environmental conditions.

Every Month:

Carryout all the weekly checks and the below.
Check the operation of the fan and motor; adjust if necessary.
Check the condition of the access door hinges and the gaskets;

Every Six Months:

Carryout all the monthly checks and the below
Check the Motor current.
Check the fan and motor bearings for high temperature and noise.
Check the operation of control instruments.
Check condensate drain pan, siphon and drainage pipe. Clean if necessary.

Every Year:

Carryout all every six month checks and the below
Check the gasket sealing of the filter frame.
Change the panel filters.
Check the cooling coils fins. Wash the coils by pressurised water and combe the fins if necessary.
Check for the fan/motor mountings bolts tightness.
Check lubrication of motor and fan bearings.
Check the doors of the air handling unit for easy opening and closing.
Check all cabling, control and isolating apparatus and terminal connections etc.

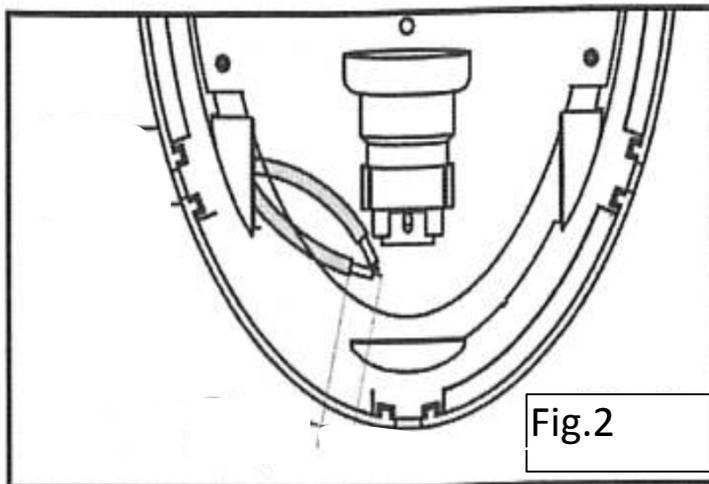
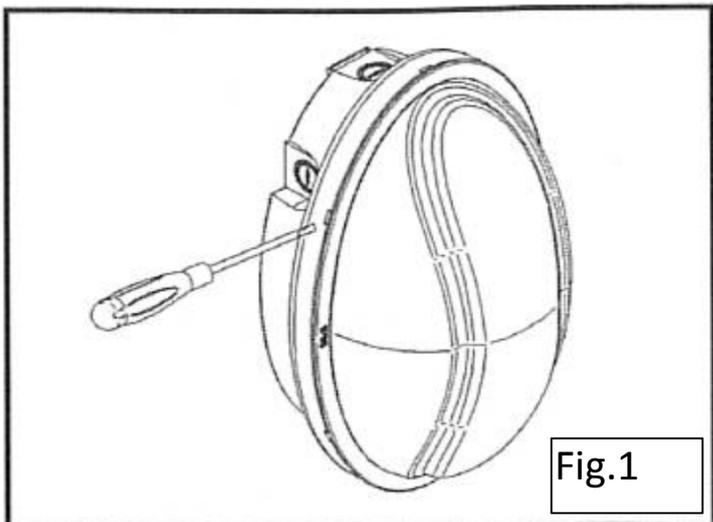
IMPORTANT WARNING

All maintenance instructions and warnings above are essential for smooth Maintenance/operation of the unit.

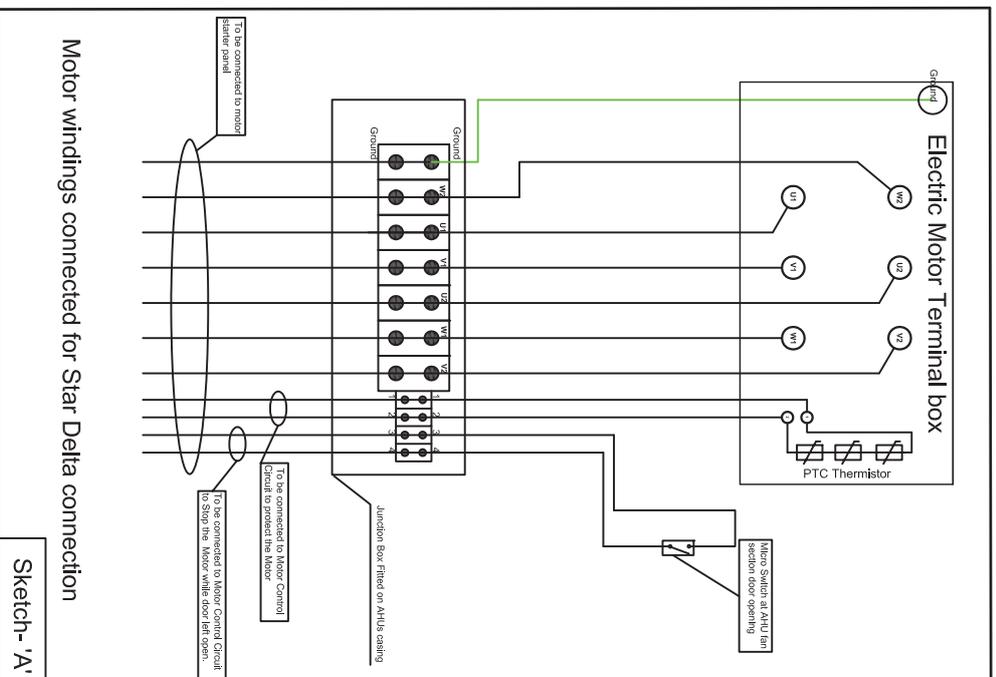
11. Maintenance of AHUs

11 Removal and cleaning of the light fittings

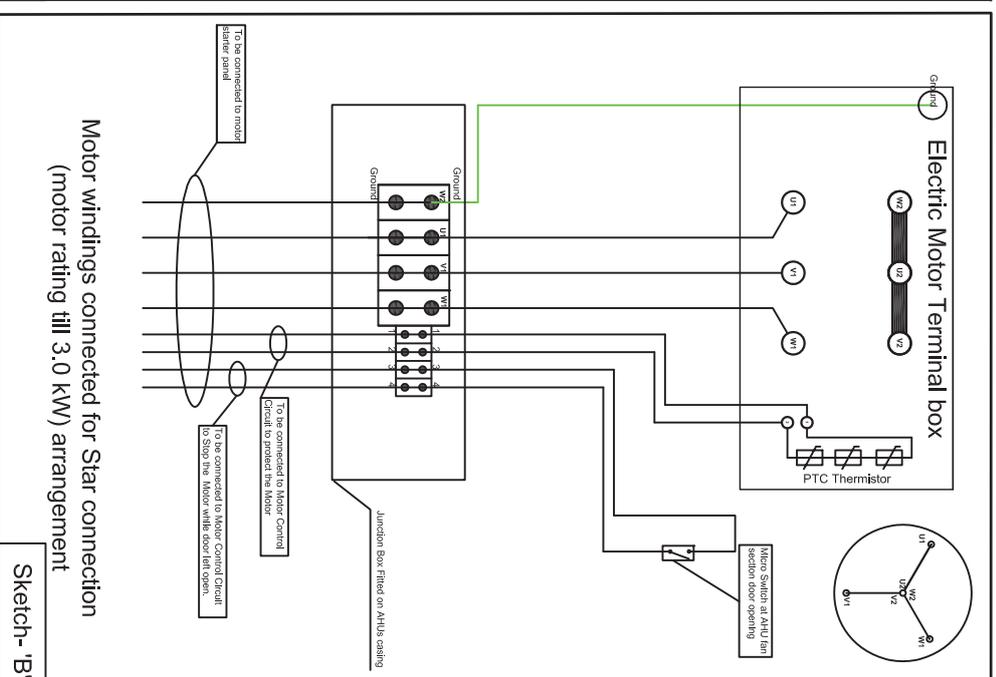
- 1) Disconnect the power supply to the AHU and lighting power.
- 2) Open the light fitting diffuser from base by inserting a screwdriver in the 4 slots and using it as a lever(fig.1)
- 3) Remove the Bulb by unscrewing it.
- 4) Disconnect Electrical wires from the bulb holder(Fig.2)
- 5) Remove the light fitting base assembly by removing 2 screws fitted to the unit wall.
- 6) Clean and wash light fitting with recommended cleaners.
- 7) Before Installing the lighting fitting make sure all parts are completely dry.



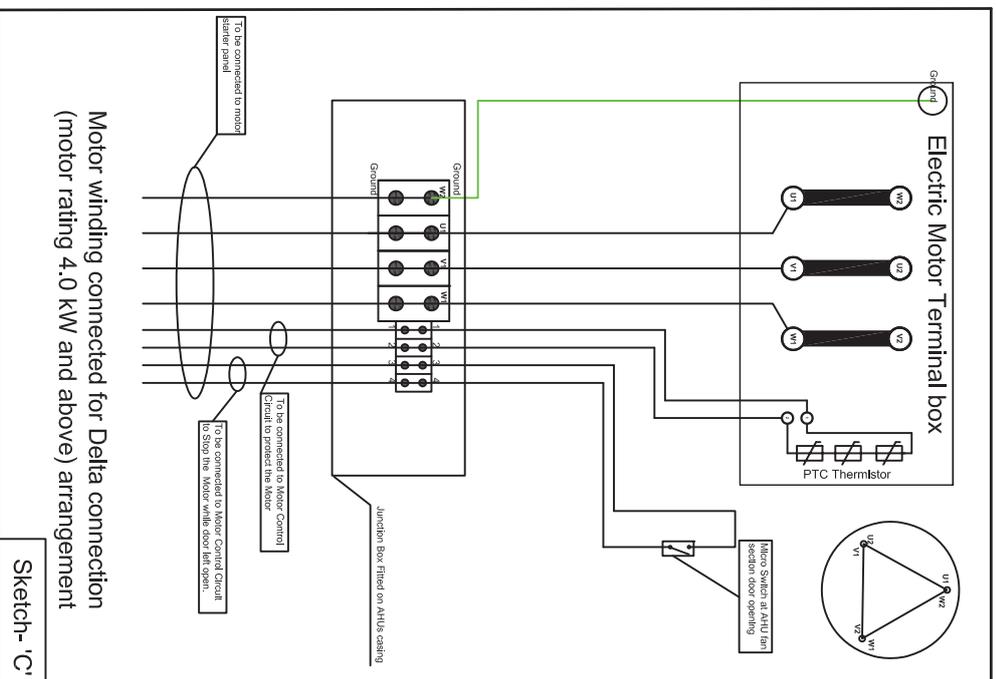
Electrical Connection Arrangement for AHU Fan Motors



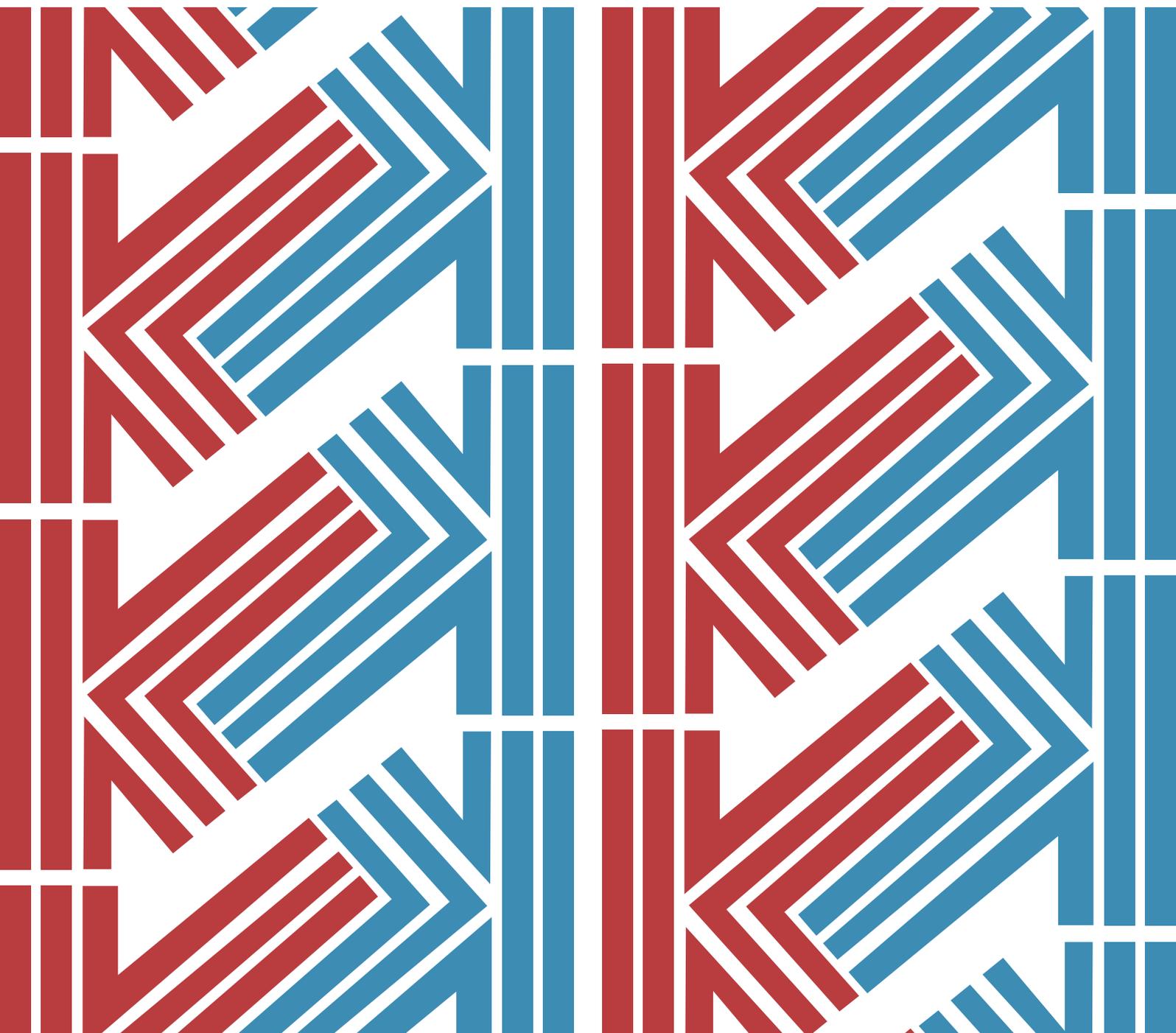
Sketch- 'A'



Sketch- 'B'



Sketch- 'C'



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