



# Installation & Maintenance Service Manual For Air Handling Equipment

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# 1 USER INSTRUCTIONS

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## 1.1 AVAILABILITY OF THE OPERATION MANUAL

This manual contains important instructions regarding the safe and proper operation of the equipment.

This manual applies to installation companies, operators, building technicians, technical personnel or instructed persons, and electricians.

This manual, along with the safety information from the manufacturer of the individual components, must always be available at the unit's installation site.

When working on the equipment, observe all instructions and precautions as detailed in this manual.

## 1.2 SCOPE OF THE OPERATION MANUAL

This operation manual, together with the instructions of the manufacturer of the individual components, provides you with the necessary information on the areas:

- Shipping, Offloading and Storage
- Tracking to Position
- Installation
- Electrical Connection
- Commissioning
- Maintenance
- Disassembly and Disposal

## 1.3 LABELLING OF SAFETY INSTRUCTIONS

The following symbols are used to highlight specific sections of text in this operation manual:



**Notes** are intended to clarify or emphasise additional information.



**Caution** identifies hazards that could lead to damage to the equipment.



**Warning** indicates potentially hazardous situations, which could result in serious personal injury or death.



**Danger** indicates imminently hazardous situations, which could result in serious personal injury or even death.



## 1.4 HEALTH & SAFETY CONSCIOUS WORK PROCEDURES

Before commencing any installation, adjustment or repair activity/operation, please ensure that:

- The appropriate method statements and risk assessments have been raised, served, approved, are in place and adhered to.
- The appropriate Personal Protective Equipment (PPE) is worn relative to the task being carried out.
- Adequate site plant, lifting and moving gear are available to lift and position the unit.
- Electrical equipment is rated, connected and earthed in accordance with IEE Regulations and local by-laws where appropriate.
- The plant is fully isolated from the mains electrical supply and allowed to run down for a minimum of five minutes before opening any access door before the commencement of any maintenance work.
- Heat exchangers have cooled down to reach ambient temperature before opening any access door before the commencement of any maintenance work.
- Personnel do not enter the unit whilst the fan is running.
- Upon conclusion of maintenance work, the unit is left in a clean state with all access doors and panels correctly fastened and locked.

## 1.5 USAGE

Dalair units are intended only for handling air with the following functions.

- Filtering air.
- Filtering air in cleanroom applications (Special designs).
- Heating and cooling.
- Humidifying and dehumidifying of air.
- Low temperature and humidity.
- Heat rejection or heat recovery.
- Filtering and treating air with high moisture content and levels of contamination. (Special models, e.g., swimming pool or kitchen/toilet extract units.)
- High-temperature applications.
- Any combination of the functions mentioned above.

Use in explosion risk areas is permissible, provided the units are certified and meet the special explosion-protection requirements specified in the ATEX Guideline 94/9/EG.

Units must be installed, operated, regularly inspected and maintained in strict accordance with this operation manual and the instructions of the individual components.



### 1.6 INCORRECT USE

Any use other than that described above is considered incorrect. If you are unsure, then please check with Dalair.

Dalair and individual component manufacturers are not liable for any damages arising from incorrect use/operation.

Misuse particularly includes:

- Conveying anything other than air.
- Conveying of an abrasive-containing medium.



### 1.7 SAFETY DEVICES

Depending on the unit equipment and component sections, the following are secured when provided:

- All electrical components can be individually isolated.
- Controls and power panels are fitted with locks.
- Door guards secure fan sections.
- Guards protect fan intakes and discharges.
- Belt guards protect V-belt drives.
- Warning labels are fitted where appropriate.
- All guarding complies with statutory requirements.



### 1.8 CHANGES/MODIFICATIONS

Changes, alterations or modifications of the unit are not permitted under any circumstances. Tampering with the unit or its misapplication will invalidate any conformity and void the warranty.

### 1.9 MANUFACTURER'S WARRANTY

Dalair's warranty is only valid when the units are assembled or disassembled by Dalair on-site. The warranty will be rendered invalid if the unit is assembled or disassembled by others.

Any claim for inaccuracies in duty should be substantiated with a full commissioning report. Proof of correct commissioning may be requested in the event of a warranty claim.



### 1.10 SPARE PARTS

We recommend that spare parts/components are procured from Dalair's Service & Maintenance division (DSM).

Third-party spare parts will invalidate the warranty.



### 1.11 DISPOSAL

#### ***Risk of Environmental Damage***

Dispose of materials in an environmentally friendly manner and in accordance with local codes, practices and environmental regulations.

Individual components must be separated according to material types

Operating materials must be separated according to their respective properties.

Please refer to section 11. Dismantling and Disposal, for further information

### 1.12 QUALIFIED PERSONNEL

This manual is intended for authorised operating and service personnel, who should possess the appropriate training and skills to enable the operatives to perform their tasks competently and safely.

It is essential that before performing any task, the operative shall have read and understood this manual, together with any other documents referenced. (Typically Risk and COSHH assessments, in accordance with the method statements.)

The operative should also be familiar with and comply with all government standards and regulations relating to the task intended.

All tasks and operations must only be carried out by qualified individuals with professional training and experience in the following areas: -

- Occupational health and safety regulations.
- Accident prevention regulations.
- Directives and recognised codes of practice.

All electrical, gas and refrigeration projects shall be performed only by certified and licensed personnel.



All skilled personnel must be able to assess the entrusted work and must be able to recognise and avoid all associated perils, risks and dangers.

## 2 TECHNICAL DESCRIPTION

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### 2.1 INTRODUCTION

Dalair units are used for comfort ventilation and air conditioning in commercial and industrial premises for the movement and treatment of air.

- They are designed to meet the customer's specifications regarding the required air volume and conditions.
- Dalair units are generally used for energy-saving, supply and extract air, indoor ventilation.
- Due to their modular and bespoke design, units can be configured to meet individual project requirements and specifications.
- Air can be filtered, heated, cooled, cleaned, humidified or dehumidified, depending on the application for each case.
- The units are custom-made and can also be adapted for cleanroom, hygiene, pharmaceutical and other specialist applications.
- Units are available in varied sizes and have various capacities. Units can be installed both internally and externally.
- Depending on the application, units can be designed for vertical or horizontal airflow and can be arranged as multiple decks, (stacked or side-by-side), and inline models.
- The modular and bespoke design of Dalair units allows for them to be manufactured and transported as a complete, single section unit or split down into several sub-sections, making them suitable for upgrading and retrofitting existing buildings.

### 2.2 UNIT PERFORMANCE SPECIFICATION

Please refer to the specific contract technical data/drawing provided.

### 2.3 OPERATING RANGE & LIMITS

Please refer to the contract technical data/drawing for specific operating limits or related restrictions of the Air Handling Unit and individual components.

The unit warranty is only valid if the specified materials and static/operational maintenance guidelines are adhered to.

#### 2.3.1 Ambient conditions

The temperature/humidity of the ambient air is critical. Please consider the following limits:

**Table 1. Temperature and humidity limits**

	Temperature Limits		Humidity Limit
	From	To	
Outdoor air	-10 °C	+40 °C	Up to 95% RH
Supply air	+10 °C	+60 °C	Up to 95% RH
Return air	+10 °C	+40 °C	Up to 95% RH
Process air	+10 °C	+140 °C	Up to 95% RH

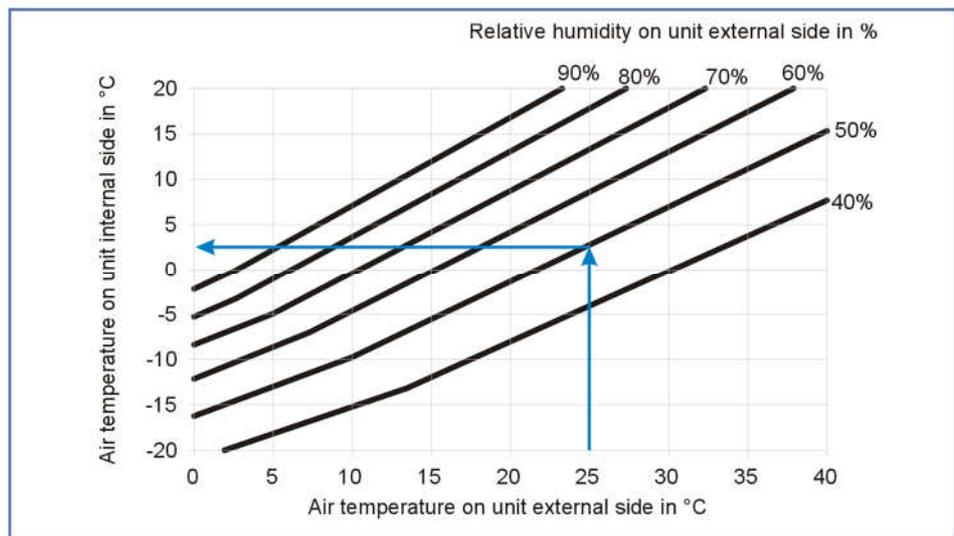


## 2.4 CONDENSATION CONSIDERATIONS

There are instances whereby, under certain operating conditions, the unit casing may produce condensation on the outer surfaces of the casing panels and framework

The following diagram illustrates typical condensation limits depending on temperature and relative humidity.

**Diagram 1: Condensation diagram**



The diagram is based on average air values and calculated using a simple model casing box.

Following the example, with ambient air conditions of 25°C/50%, the internal temperature limit to avoid condensation forming is 2.5°C. However, specific site installation and operating conditions may cause deviations.

**NOTE**

The given values from the chart are approximate and cannot be used as a guarantee for avoiding condensation.

## 3 SHIPPING AND STORAGE

### 3.1 ON RECEIPT OF PLANT

The unit should be inspected upon receipt to ensure no visible damage occurred during transit. Additionally, the advice note should be checked to ensure that all items have been received.

- If damage or delivery shortages are discovered, the haulier should be immediately informed of any damage and photographs taken where possible.
- Dalair must also be notified of any damage or delivery shortages in writing within three days of receipt.
- Dalair can accept no responsibility for damage caused by unloading from the haulier.
- The customer's representative must sign for the equipment.

### 3.2 OFFLOADING

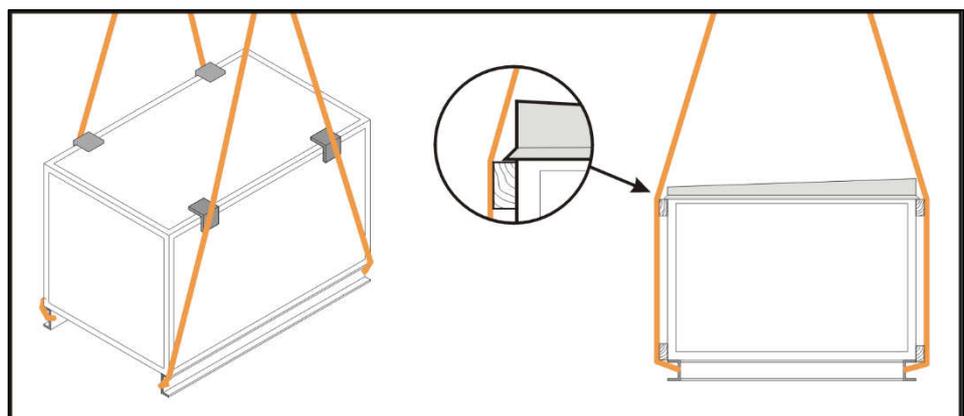
Dalair should be notified of the method of offloading in advance, as this may affect how the unit sections are loaded onto the delivery vehicle.

The preferred method of offloading is by forklift truck.

If this is not possible, unit sections should be lifted by crane, using the lifting holes or lugs provided in the structural base frame. These are provided for inserting lifting shackles and nylon, web-type slings.

Heavy-duty, moulded edge protectors or timber packs should be used to avoid abrasion. Spacer bars should also be fitted, where necessary, to prevent the slings from slipping.

**Diagram 2: Unit edge/roof protection using moulded edge protectors and timber packing**



Where sections are fitted with a roof, additional timber packing or heavy-duty moulded edge protectors must be used to ensure that the slings do not bear on the roof structure and that all forces are transferred to the section framework.

Failure to use additional timber packing/correct edge angle protection will damage the roof.



Protrusions, (such as coil connections, isolators, inverters, etc.,) that extend beyond the unit casework are vulnerable to accidental damage. Ensure that all necessary precautions are taken so as not to cause damage whilst offloading and tracking into position.

**To prevent damage, it is recommended that the recipient obtain expert advice from a plant movement specialist.**

Refer to the specific contract drawings for the total unit and section weights.

All lifting equipment and fall protection systems are to be supplied by others in consideration of the RAMS of the plant movement contractor.



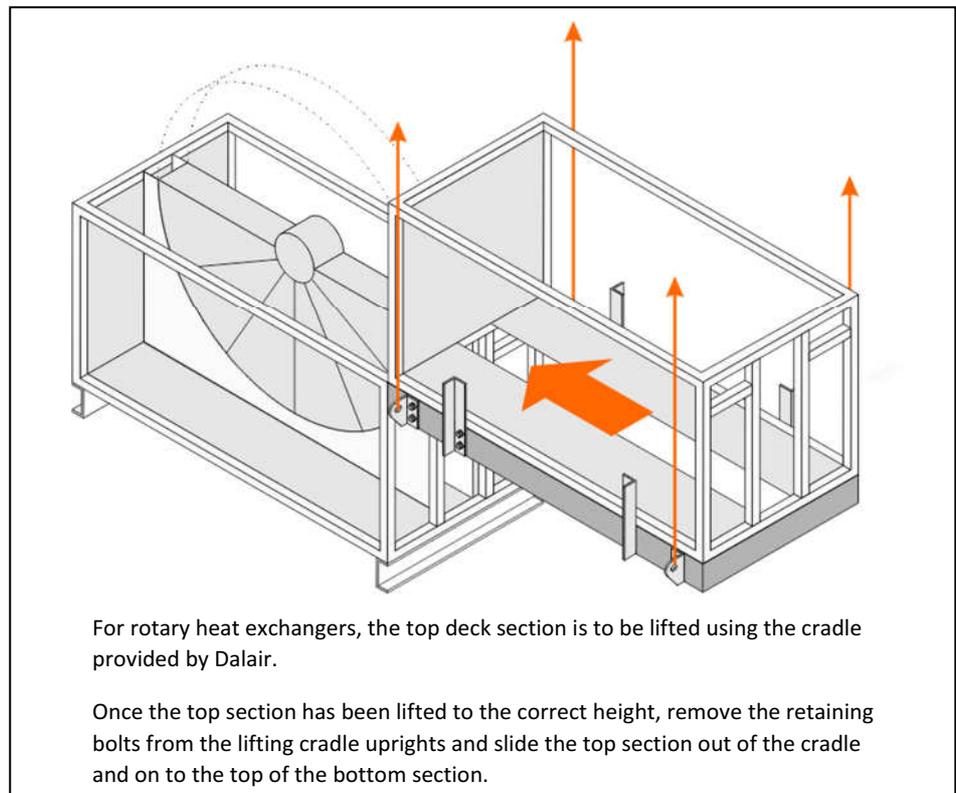
It is paramount that the unit sections are always kept upright; under no circumstances TILT or TURN the sections/unit.



Should a section or unit be dropped, it MUST be reported to Dalair. Dalair will then arrange for an assessment of the condition of the casing and internal component parts and advise of any remedial measures required.

For units with large rotary heat exchangers (thermal wheels), the air handling unit casework will be delivered as separate top and bottom sections. The top-deck section may be fitted with a lifting cradle supplied by Dalair. The lifting cradle enables the top-deck section to be lifted to the correct height and slid onto the top of the bottom section of the thermal wheel casing.

**Diagram 3: Rotary heat exchanger lifting cradle**



## 4.2.1 SUGGESTED METHODS OF OFFLOADING

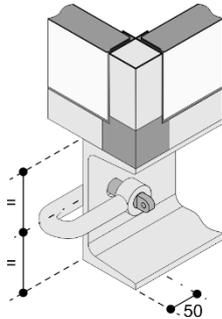
### IMPORTANT NOTES

- We recommended that the recipient obtains expert advice from a crane specialist.
- Refer to Dalair's drawings for AHU section weights and dimensions.
- All lifting equipment (chains, slings, D-shackles, lifting beams, etc.) is to be provided by others.
- To achieve a balanced lift, the slinger must adjust individual chain/sling lengths.
- Spacers must be used where sections are fitted with a roof to prevent the slings from bearing on the roof structure. All forces must be transferred to the section framework. **Failure to utilise spacers will result in damage to the roof.**
- Where AHU sections with open base stands are not fitted with lifting lugs, the slings must pass through the framework. (Refer to method 3c.)

### LIFTING HOLES

#### Unit sections with channel base frames

- To facilitate offloading, unit sections with channel supports are supplied with lifting holes at the four corners of the base frame
- The diameter of the hole and size of the associated D-shackle vary with the width of the unit section.



#### Unit sections up to 2.2 m wide

- Unit sections up to a maximum width of 2.2 m are provided with 25 mm diameter holes suitable for 22 mm diameter D-shackles with a rating of 2 Tonne SWL (by others).

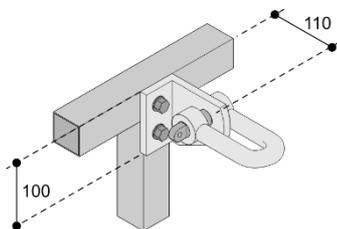
#### Unit sections over 2.2 m wide

- Unit sections over of 2.2 m wide are provided with 28 mm diameter holes suitable for 25 mm diameter D-shackles with a rating of 3 Tonne SWL (by others).

### REMOVABLE LIFTING LUGS

#### Unit sections with open base stands

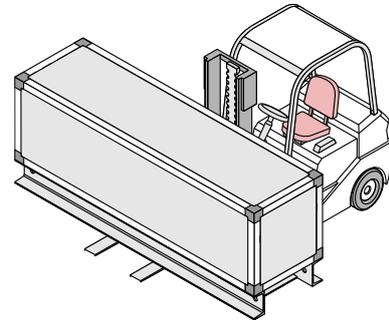
- To facilitate offloading, unit sections with RHS open base frames may be supplied with removable lifting lugs.
- The lugs are provided with 25 mm diameter holes suitable for 22 mm diameter D-shackles with a rating of 2 Tonne SWL (by others).



### METHOD 1

#### Forklift Truck

- The forks must extend to the full width/length of the AHU section.
- Use extensions if necessary.

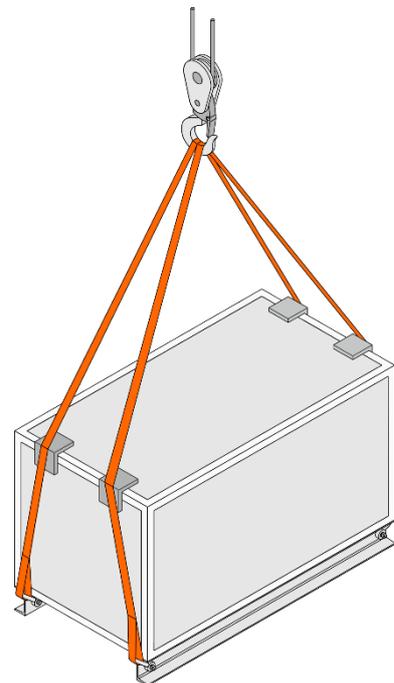


### METHOD 2

#### D-shackles and slings (by others).

#### Unit sections up to 2.2 m wide

- This method is only suitable for lifting smaller AHU sections, up to a maximum width of 2.2 m.
- Ensure all chains/slides clear AHU sides or fit protectors/timber packs to avoid abrasion.



## 4.2.1 SUGGESTED METHODS OF OFFLOADING

### IMPORTANT NOTES

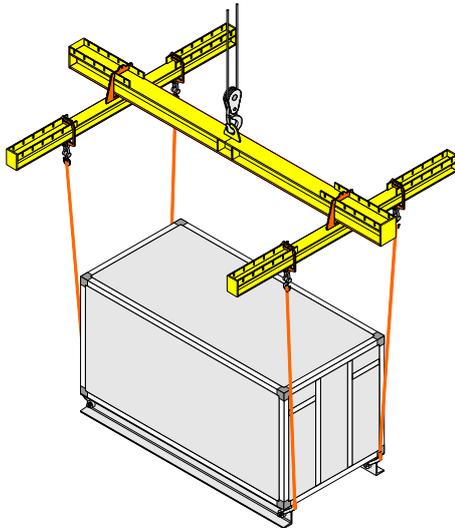
- All lifting equipment (chains, slings, D-shackles, lifting beams, etc.,) is to be provided by others
- Spreader/lifting beams to be section width/length plus 300 to 400 mm
- Ensure all chains/slides clear AHU sides or fit protectors/timber packs to avoid abrasion

**Method 3a, b or c must be adopted for all unit sections greater than 2.2m wide**

### METHOD 3a

Modular, adjustable or purpose made spreader/lifting beam complete with D-shackles and chains/slides (by others).

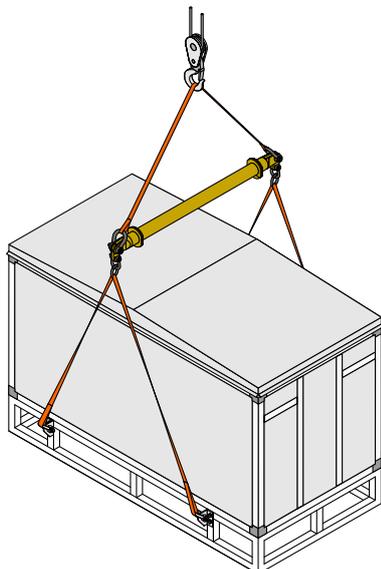
- Suitable for unit sections with base channels fitted.



### METHOD 3b

Modular, adjustable or purpose made spreader/lifting beam complete with D-shackles and chains/slides (by others).

- Suitable for unit sections with open base stand with lifting lugs fitted.

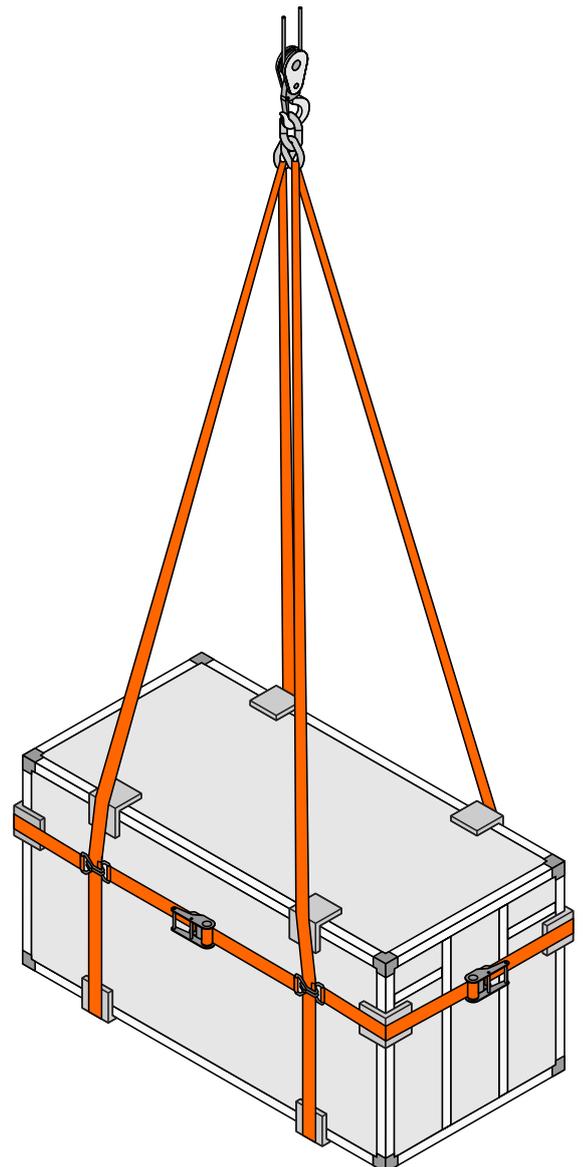


### METHOD 3c

D-shackles and chains/slides with additional containing restraints or spacer bars to prevent slings from slipping (by others).

Modular, adjustable or purpose made spreader/lifting beams may also be utilised.

- Suitable for unit sections without base channels fitted or open base stand where lifting lugs are not fitted
- Slings pass beneath the unit section
- The example below shows how ratchet straps can be used to provide the containing restraint by "belly banding" the unit section to prevent the slings from slipping





### 3.3 UNIT PROTECTION

Unless otherwise specified, unit sections will be delivered to the site covered in “shrink wrap” polythene, providing a more than adequate level of protection against dust and rain.

- Should alternative methods of unit protection be required (i.e., timber or Corex), Dalair should be notified of the specific requirements at the pre-contract stage.
- The removal and disposal of all protective coverings is the responsibility of others. Materials should be recycled wherever possible.

### 3.4 STORAGE

Observe the permissible storage conditions when storing the unit/sections.

- Always place units on a flat and even surface.
- Remove the original packaging only before the actual installation, not for storage.
- Protect units from bumps and knocks, which may damage the casing and protruding components.

Before the unit is put into operation, the grease in bearings should be checked for oxidation, a condition indicated by the grease hardening and taking on the appearance of varnish.

### 3.5 STATIC MAINTENANCE

If commissioning is not carried out within three months following the delivery date, static maintenance regimes must be completed. Refer to the following section. (This is a service Dalair can offer.)



#### 3.5.1 Static maintenance when in storage

- Fan belt drives must be slackened.
- Rotate the motor and fan shaft through at least two complete revolutions every three months.
- As a rust preventative, fan and motor pulleys should be checked periodically for rust and sprayed with penetrating oil.
- In addition, all dampers should be rotated and lubricated, as necessary.

#### 3.5.2 Prolonged storage

Direct drive fans, specifically those fitted with EC motors, require a specific procedure to be completed if the fans have not been connected to an electrical supply and operated for two years or more.

A variable supply voltage will be required to reform the DC link capacitors. Full line voltage should not be applied until the reformation process has been completed.

Refer to the prolonged storage section of the specific suppliers’ O&M instructions regarding the necessary reformation procedure of the DC link capacitors.

## 4 ASSEMBLY

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### 4.1 INTRODUCTION

Here you will find information on how to assemble and install the unit.

Assembly and installation must be conducted exclusively by qualified staff. They must have adequate professional training and experience in the relevant accident prevention regulations and other generally recognised occupational health codes.

The unit must be installed so it is only accessible to trained and authorised service personnel.

The unit shall only be installed in accordance with the technical specifications provided in the supplied documentation.



Stacking manufactured equipment and other site-provided components/items is not permitted. However, exceptions apply for units delivered by Dalair where sufficient load-bearing capacity has been considered beforehand.

When connecting ductwork to the unit, ensure that no foreign objects/debris can enter the unit.

Suitable access hatches within the ductwork should be provided to allow access to the Air Handling Unit's inlet and outlet connections/components.

### 4.2 UNIT POSITIONING



Consideration should be given to the unit's final location so that it is not located near building flue stacks or exhaust ventilators to prevent the reintroduction of contaminated air through the outside air intake. Similarly, the unit should not be positioned too close to any obstruction that would restrict airflow into or out of the unit.

To alleviate the risk of damage, consideration should be given to using the services of Dalair or a plant movement specialist when moving unit sections into their final position.

Care should always be taken to avoid damage to the unit sections and finishes, considering method statements and lifting plans.



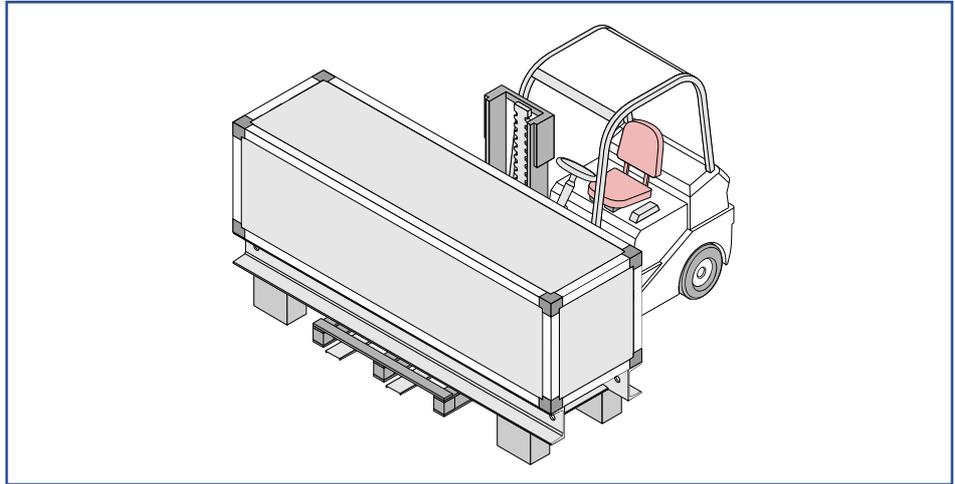
During positioning, it is paramount that the unit sections are always kept upright. Under no circumstances TILT or TURN the sections/unit.



#### 4.2.1 Units fitted with feet

Where unit sections are fitted with feet, it is recommended that these are tracked/positioned by a forklift truck, and adequate timber packing is provided to ensure that all forces are transferred through to the base support channels. Failure to observe this will damage or misalign the support feet and unit section base frame.

**Diagram 4: Recommended method of tracking/positioning unit sections fitted with feet**



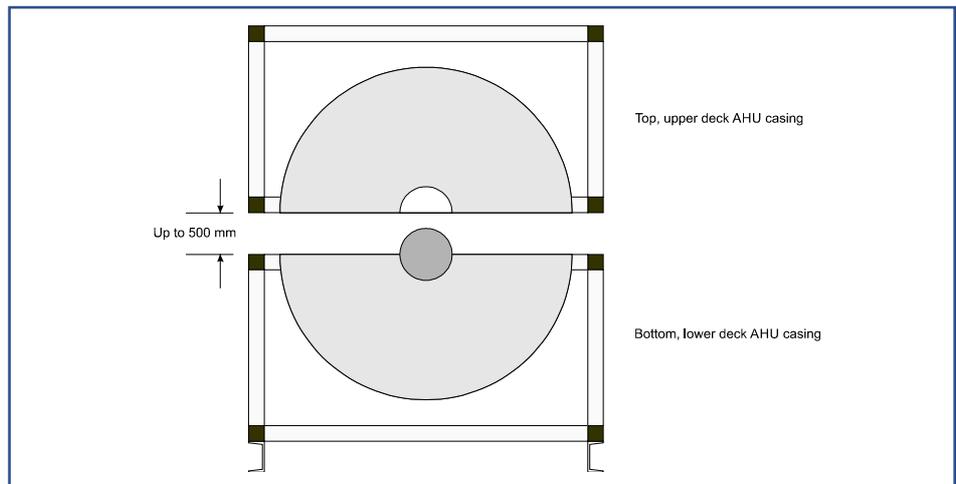
#### 4.2.2 Internal units with large thermal wheels

The air handling unit casework may be supplied as separate top and bottom casework sections for units with large thermal wheels (rotary heat exchangers).



When lifting the top unit casing onto the bottom casing, it is essential to make allowance for sufficient height to enable the top casing to clear the protrusion of the central wheel hub from the bottom casing. This hub can protrude by up to 500mm.

**Diagram 5: Additional clearance required for the wheel hub of large rotary heat exchangers**



**NOTE**

### 4.3 SITE INSTALLATION

Dalair is not responsible for the set-out datum point and coordination of units/sections.

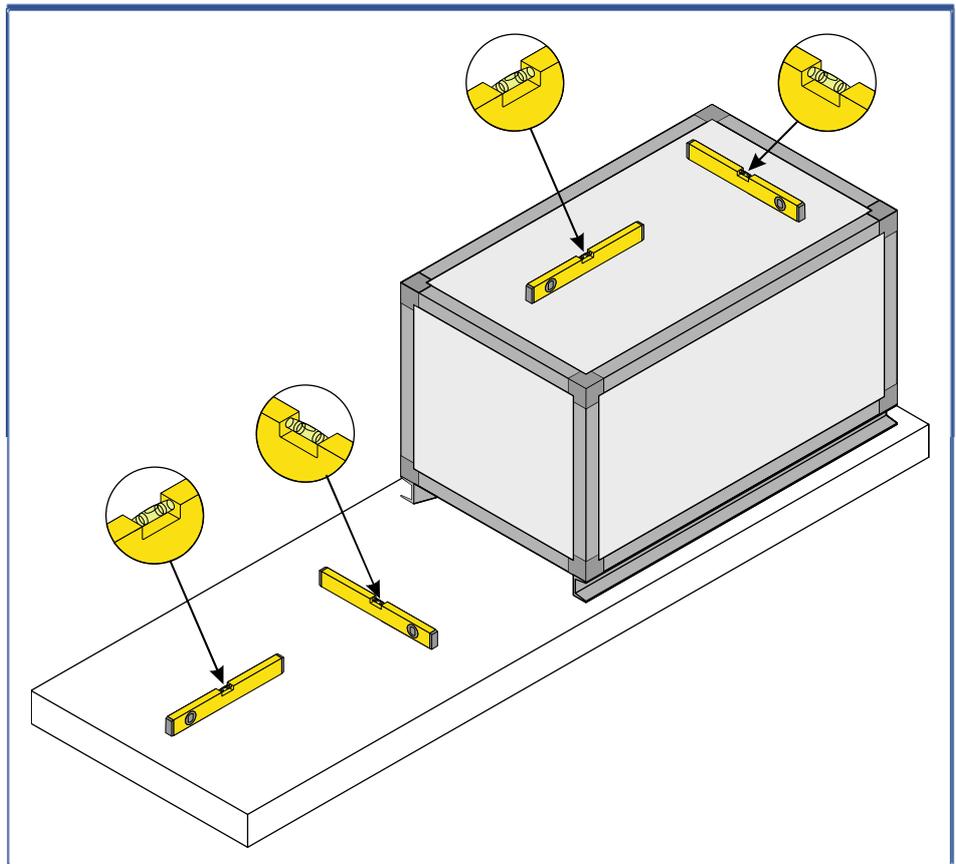
The responsibility of the AHU support system (including steelwork, big-foot systems and concrete plinths) is by others. Consideration needs to be given to the weight of the unit/sections, including the weight of water or refrigerant in the coils.

For the unit/section installation, the site shall meet the following requirements:

- It must be level and stable.
- The maximum deflection must not exceed 4 mm per meter.
- Where a base is fitted, support must be provided around the entire unit base frame periphery. There shall be no overhanging (cantilever).
- Support must be provided across the complete unit width at all site/section joints.

Ensure sufficient height for units/sections that are provided with drain trays. The height of the on-site AHU support system, including steelwork and concrete plinths, must also consider the required trap height. (Refer to Section 5.3.4. "Drain tray trapping").

**Diagram 6: AHU support and installation must be level in all planes.**



**NOTE**

4.3.1 Minimum Clearances

Ensure that provision has been made in the location of the unit/sections to allow for installation, the regular inspection and maintenance of internal components and future removal of components on the designated access side.

Typically, this should be for the following components:

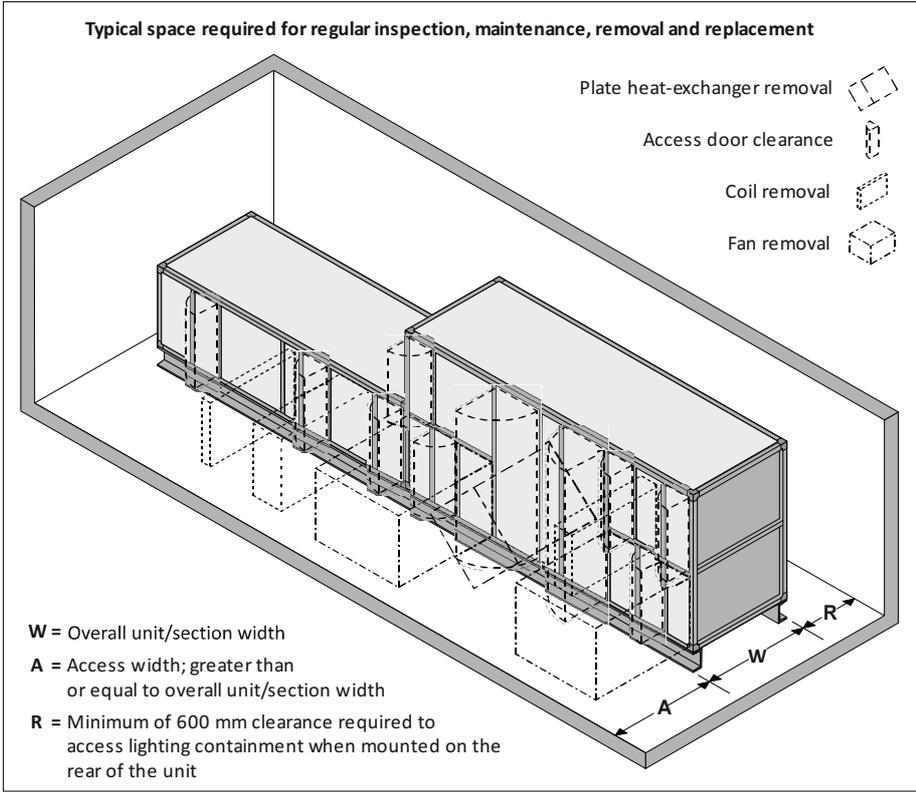
- Fans
- Electric heaters
- Filters
- Coils
- Removable drain trays
- Humidifiers.
- Thermal and desiccant wheels
- Plate heat exchangers
- Gas burners
- Access Sections

Access should be free from any obstructions over the entire unit/section height.

The required space for the future removal of components should be slightly greater than or equal to the overall unit/section width.

Where lighting containment is mounted on the rear of the unit, a minimum 600mm clearance is required along the back of the unit to facilitate the final connection of the lighting circuits.

**Diagram 7: Minimum unit clearances**



## 4.4 INSTALLATION OF INDIVIDUAL MODULES

### 4.4.1 Section-to-section joints

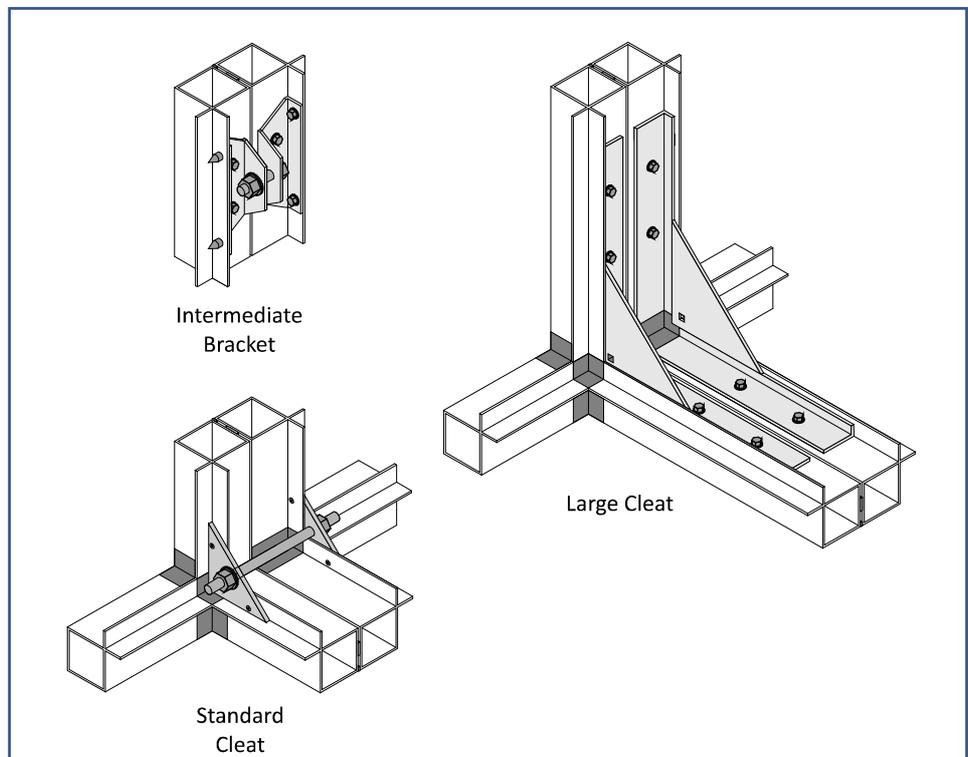
Ensure that the units/sections are positioned correctly as shown on the drawings and that the unit handing and references are correct.

- Sections should be accurately aligned and abutted before bolting together using the fixings and the closed cell neoprene gaskets provided.
- All units have a corner gusset for bolting the sections together.
- On larger units, an intermediate joining bracket is added.
- Incorrect installation will result in air leakage and unacceptable noise.

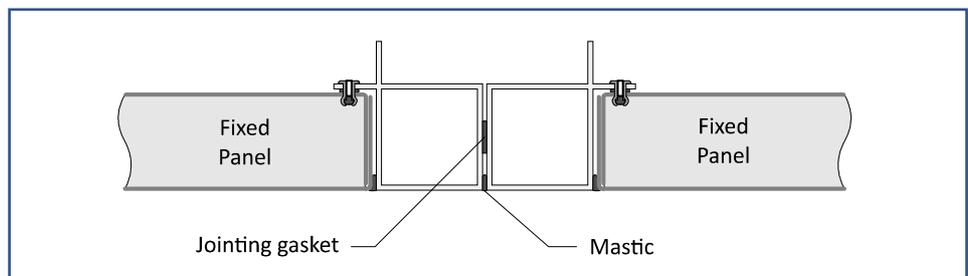
 **NOTE**

After assembly, a mastic seal must be applied to the section-to-section joints.

**Diagram 8: Section to section joints – Cleat and bracket detail**



**Diagram 9: Section to section joints – Jointing gasket and mastic seal detail**



## 4.5 OUTDOOR UNITS

Single-section externally mounted units are weatherproofed in the factory, whilst the section-to-section joints of externally mounted units supplied in multiple sections are weatherproofed on site.

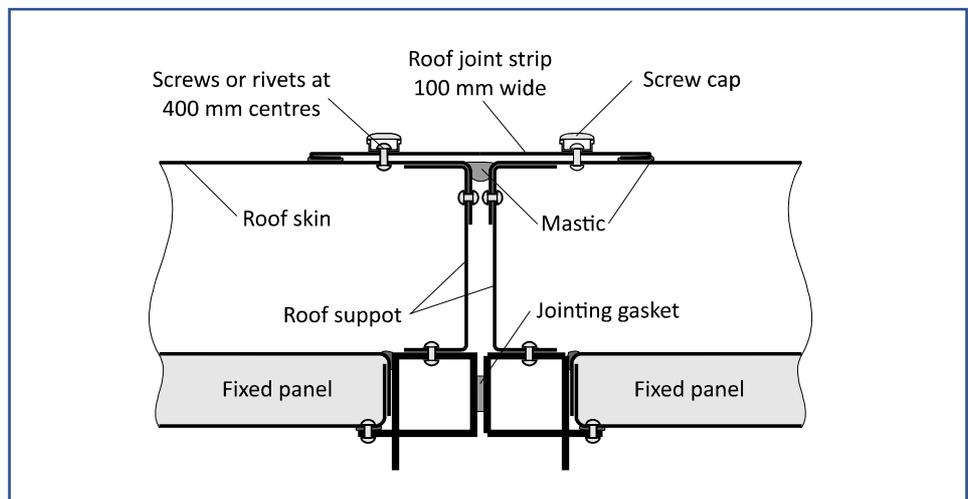
Before the final assembly of sectionalised units, the rubber jointing gasket supplied should be fitted between the section-to-section joints.

(See above Section 5.4.1 Section-to-section joints).

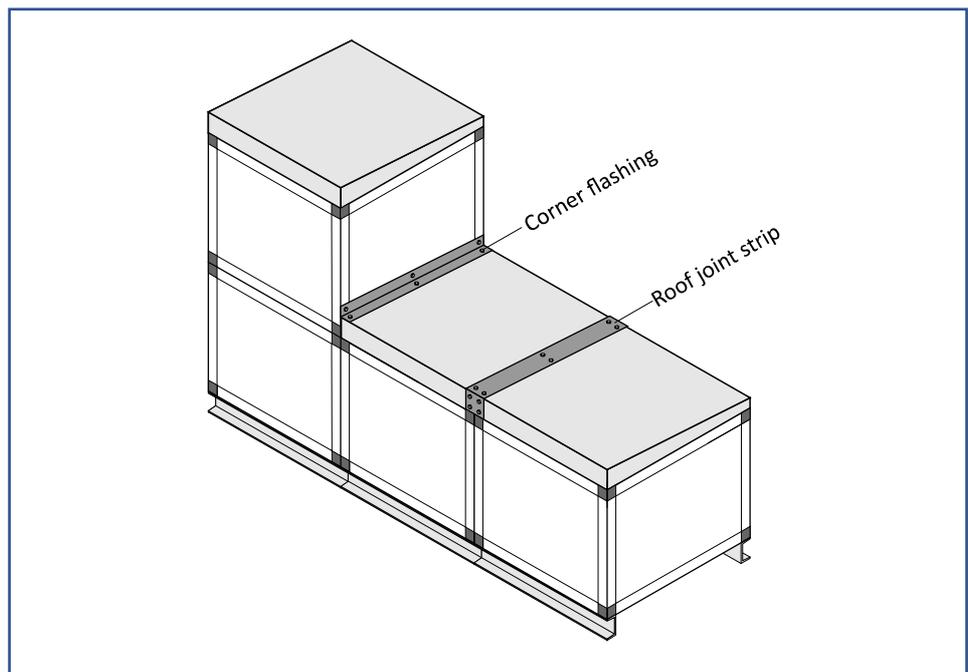
An outer sealant **MUST** be applied, followed by fixing the roof strips, (and corner flashings as necessary), to ensure a fully weatherproof seal.

(Dalair provides the sealant, roof strips and fixings.)

**Diagram 10: Roof jointing strip detail**



**Diagram 11: Roof jointing strip and corner flashing detail**



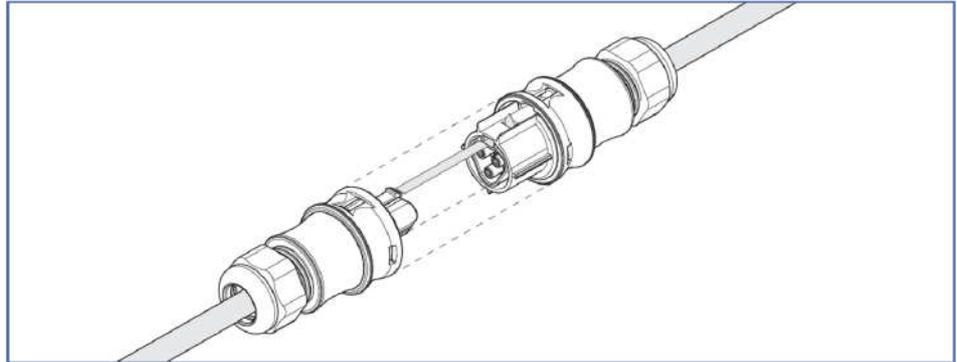
#### 4.6 INTERNAL LIGHTING CONNECTORS

When sections are fitted with internal lighting, the power wiring connection cable at each section **MUST** be connected using the provided in-line connectors. Care must be taken to mate the two fittings correctly. Incorrect connection or disconnection may result in damage to the release mechanism.



Refer to the relevant installation instructions specified in the supplied documentation.

**Diagram 12: Internal lighting connector detail**

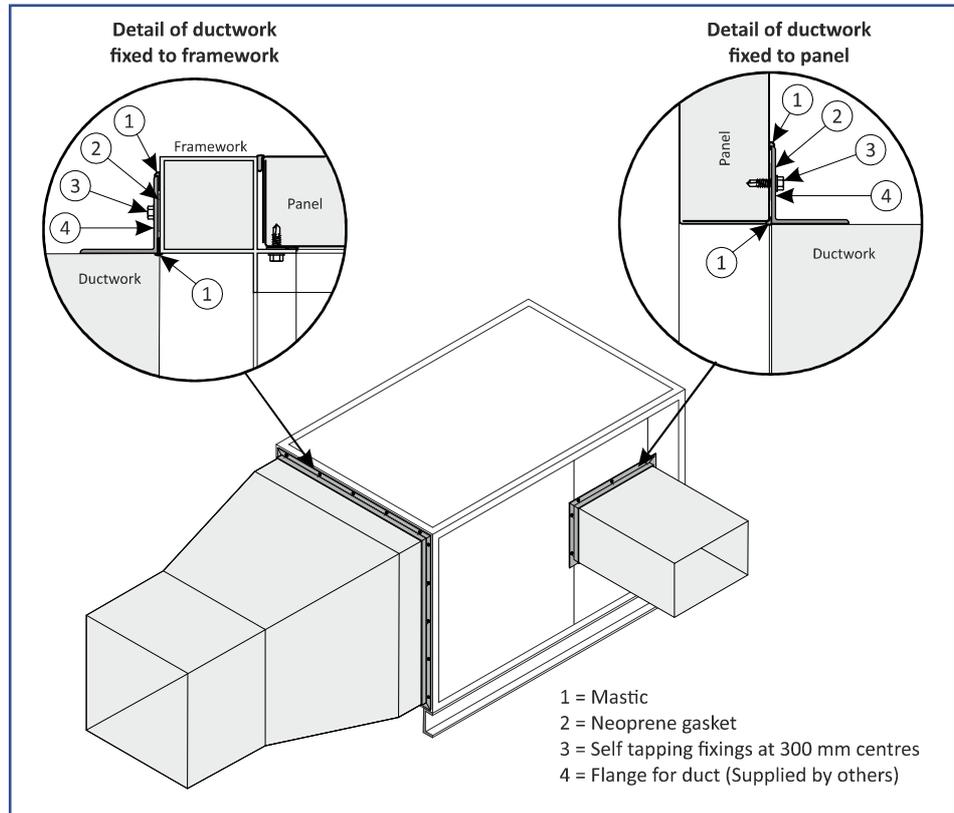


#### 4.7 CONNECTION OF DUCTWORK

Ductwork may be connected directly to the unit. However, ductwork, steelwork and other services **must NOT** be supported off the unit.

All support systems for ductwork, steelwork and services are to be provided by others.

**Diagram 13: Ductwork connection details**



#### 4.8 LEAKAGE-TESTED TESTED UNITS

Air handling units are manufactured and assembled to recognised industry standards and will achieve the air leakage test classification specified when conducted according to current HVAC standards.

**NOTE**

However, due to the stresses, strains and forces imposed during loading, transportation, offloading and site positioning, the air handling unit structures will move, and panel seals will not always remain fully intact.

Therefore, re-sealing of the panels and joints may have to be carried out on-site for the air-handling units to achieve the required leakage classification.

We can only accept responsibility for the failure of on-site leakage testing if Dalair's site installation team has assembled the units.

## 5 INSTALLATION

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All M&E connections, including water, condensate, refrigerant, electrical, controls and mains power, shall only be performed by qualified, licensed staff.

To perform the tasks, the qualified personnel or other individuals must have the appropriate professional training and experience in the relevant accident prevention regulations and all additional recognised safety and occupational health codes.

### 5.1 RISK OF DAMAGE TO THE UNIT



#### 5.1.1 Access sections

When entering Dalair units, ensure that no excessive load (i.e., no greater than 50 kg/m<sup>2</sup>) is applied to the floor panels.

Units defined as “walk-in” are supplied with appropriate walkway/gridding in all maintenance sections. These areas can support a maximum working load of up to 200 kg.



#### 5.1.2 Externally mounted AHU roofs

All externally mounted units are supplied with an appropriate roof. The roof is not suitable for walking on or for the installation/support of other services.

Please refer to section 4.1.1 for site installation specifics.

### 5.2 GENERAL CONSIDERATIONS

Consideration must be given to the primary support method (provided by others) to ensure adequate support of the AHU. Sufficient height (to accommodate condensate drain traps) and space for access/maintenance must also be considered.

#### 5.2.1 Vibration and noise dampening devices.

Check if vibration and noise dampening pads/devices are provided.

The following may apply:

- **Rubber pads** fitted between the foundation and AHU and used for level installations to insulate the foundation in a location where no specific requirements for neutralising structure-borne noise apply.
- Commercially available **spring-based elements** used for installations where the unit is suspended from the ceiling.
- Other **special acoustic requirements**:  
You may need to consult an acoustical engineer to select the most suitable method for neutralising structure-borne noise.

### 5.3 INSTALLING DUCTWORK COMPONENTS

To prevent the transmission of structure-borne noise, enable a tension-free connection between the ductwork and the AHU by using flexible connectors or sound attenuators to prevent structural noise transmission.

When using flexible connections between the unit and the ductwork, the installation length of the connectors must be smaller than their length in an expanded condition.



Consideration is to be given to the AHU inlet/out components for access and maintenance within the ductwork.

### 5.4 INSTALLING PIPEWORK TO COIL CONNECTIONS

Follow water quality regulations (WRAS) when operating pumped warm water and chilled water.

#### 5.4.1 General

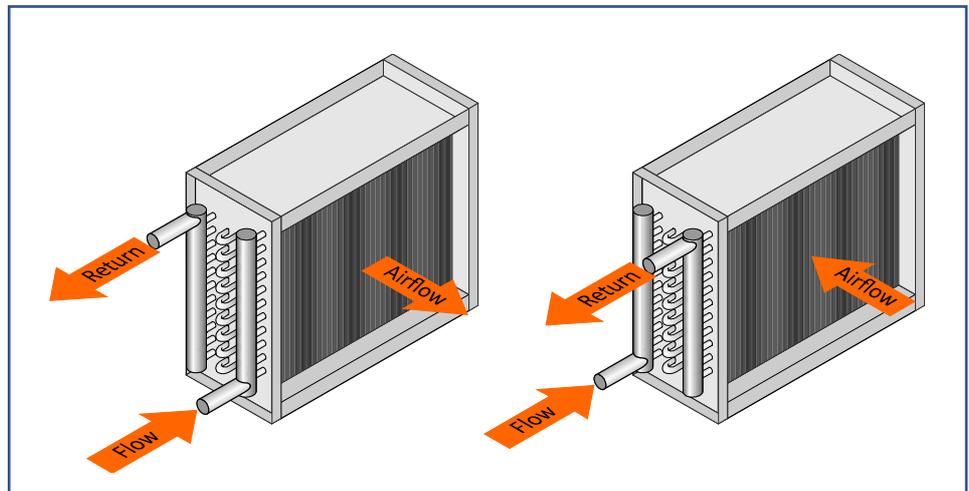
Pipework should be connected in accordance with good engineering practices



Care should be taken when connecting threaded fittings to the unit.

All pipework must be adequately supported to ensure the air handling unit bears no additional load.

**Diagram 14: Coil connection details**



#### 5.4.2 Coil connections

Check the following before performing water connections to the unit:

- Check that allowances for expansion and contraction have been made.
- To allow maintenance and service, install drainage valves at all low points of the water circuit to ensure that the water circuit can be fully drained.
- Provide drainage with a shut-off valve for emptying the unit's water circuit.
- Ensure that any vents are installed at high points and can be easily accessed.
- If a frost coil is not fitted, then the appropriate action must be taken to prevent the coils from freezing.



##### 5.4.2.1 PN coil flanges

Where supplied, 'PN' coil flanges will be loosely fitted in reverse. The correct fitting of all flanges is to be undertaken on-site by others.

##### 5.4.2.2 Extended pipework

Where connection extension pipes are supplied loose, the connections must be bolted, tensioned, insulated (as appropriate) and pressure tested before operation.

#### 5.4.3 Steam Humidifier connections

Steam coils should be supplied with a good quality dry steam via the appropriate control method, with a steam trap preferably of the mechanical float type.

Please refer to the specific manufacturer's installation instructions.



#### 5.4.4 Condensate drain trapping

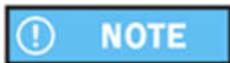
Each coil section should be individually trapped. Vertical rising condense lines should be avoided unless pumped.

All condensate drain connections must be correctly trapped. Incorrect trapping can result in flooding within the unit and consequent flooding of the immediate area.

Drain lines should be a minimum of the same size as the drain pan connection. They should pitch downwards continuously, with a minimum fall of 10 mm per meter, to a tundish or another form of air-break.

All drain lines should be insulated where they pass through any space where damage from condensation drip might occur.

Fittings with cleanout plugs should be used at each change of direction in the drain line.



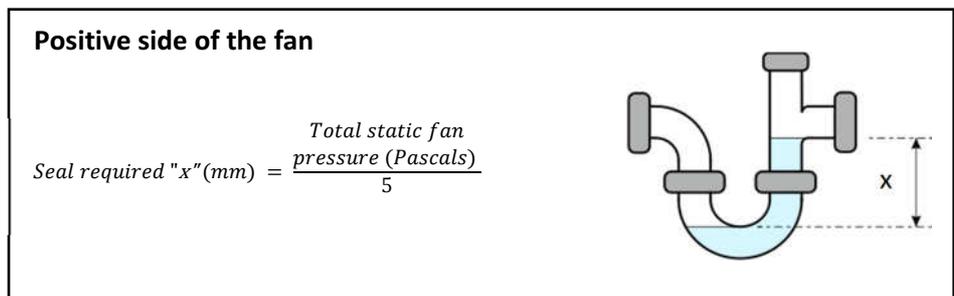
Consideration should be given to trace-heating methods for externally mounted AHUs.

Drain installations should comply with all local authority regulations.

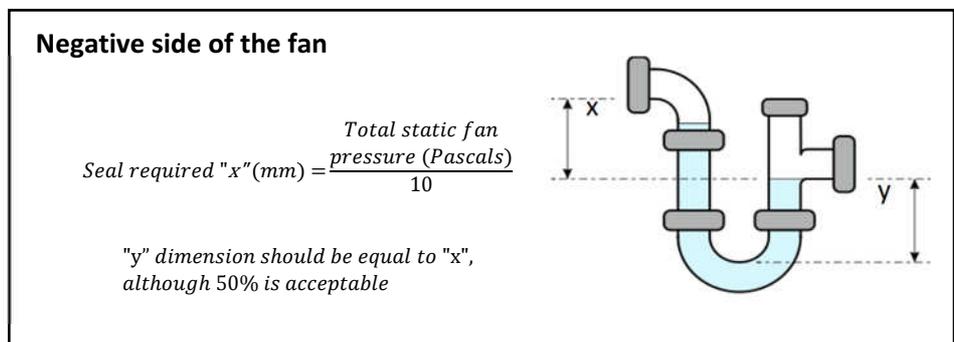
A suitable water treatment regime must be implemented, and regular cleaning/legionella checks should be conducted in accordance with local authority regulations.

Recommended condensate trap arrangements are shown in the diagrams below: -

**Diagram 15: Positive pressure condensate drain trap details.**



**Diagram 16: Negative pressure condensate drain trap details.**



## 5.5 INSTALLATION OF INTEGRATED REFRIGERATING SYSTEMS

The bulb of the thermostatic expansion valve for direct expansion coils should be securely fitted to the suction line before any equalising connection.

Please refer to the specific manufacturer's installation instructions.

## 5.6 ACCESSORIES/ANCILLARY EQUIPMENT

Please refer to Dalair for further information.

## 6 ELECTRICAL CONNECTION

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Electrical components should be connected to the supply in accordance with the Institution of Electrical Engineers (IEE) and Institution of Engineering and Technology (IET) Regulations and local by-laws where appropriate.



Ensure that the rotation of the motors corresponds with the direction shown by the arrow on the fan frame.

Ensure that the electrical connection to the fan motor is made using flexible cabling/containment materials to permit fan belt adjustment and to allow for movement of the anti-vibration mounts.

If safety-isolating switches are fitted to access doors, they must be wired through the appropriate motor control circuits.

Ensure and observe all protective measures.

Electrical connection must be assured and documented between all shipment units. (Potential equalisation is usually provided via screw connections).

Connect the entire unit to the same Earth.



Provision should be made for installing a run-on fan control to prevent residual heat emanating from the heating plant from damaging components such as the fan, motor, filters etc. when the unit is shut down.

This objective may be achieved by:



- A thermostat that controls the fan and ensures that the temperature within the unit does not rise above 40°C if air ceases to flow.
- Using a delay timer.
- Airflow switches.

### 6.1 REQUIREMENTS

Conduct a complete visual inspection of the entire unit and installed components.

Before setting up the unit electrical connections, check the following:

The properties of the mains power supply must comply with EN 60204-1 regulation and the unit's power requirements.

A qualified licensed electrician has determined the size of the cable, MCB and fuse based on the unit-rated current.

The motors must operate at their rated capacity, where the input voltage with rated frequency is between 95% and 105% of the nominal voltage.

### 6.1.1 On-site routing of cables and cable penetrations. (By others)

Avoid penetrations and routing wires near doors, dampers, panel connections and cover strips.

Ensure screw connections and cable openings are leak-free.

Connecting cables in the fan chamber should be long enough to allow for future maintenance movement of the motor (belt tensioning on belt-driven fans, for example).

Where provided, any fitted cable gland must be used.

## 6.2 CONNECTING THE UNIT

Separate earthing for each assembly group with an electrical connection is required.

Consider the relevant instructions specified in the enclosed manuals for the accessory items.

Please refer to the specific manufacturer's installation instructions.

### 6.2.1 Motor protection

Depending on the motor size and type, the AC motors are fitted with two to six PTC thermistors switched in series.

The PTC thermistors are embedded in the motor windings to enhance the reading of the winding temperature.

PTC thermistors are semiconductor resistors with variable temperature-dependent values.

The resistance reading will increase rapidly when the maximum allowed winding temperature of 135 °C is reached. This control method and the full motor-protection electronics deactivate motors.

Where motor thermistors are provided, and the motor is to be run from a VSD (inverter), the thermistors must be wired back to the VSD, and the appropriate inverter input and configuration settings programmed to act as thermal protection.



### 6.2.2 Motor connection (AC motors)

The terminals of AC motors are labelled in such a way that the alphabetical sequence of the terminal designation U1, V1, and W1 corresponds with the temporal sequence of the phases L1, L2, and L3 (with clockwise rotation).

The rotation direction can be reversed by exchanging two connecting wires:

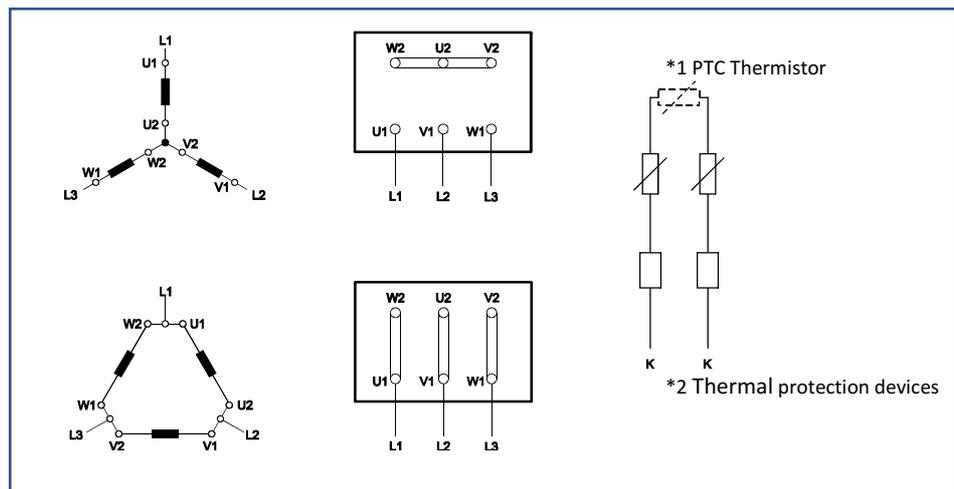
- Exchange the connecting cables, e.g., U1 and V1
- Y-switch: exchange the connecting wires, e.g., U1 and V1
- $\Delta$ -switch: exchange the connecting wires, e.g., U2 and V2



Ensure that the supply voltage at mains frequency falls within 95% to 105% of the rated voltage. If this condition is met, motors can deliver the rated capacity. Otherwise, non-compliance can result in equipment damage.

Connect the motor according to the wiring diagram and check each motor nameplate for the correct connection, either star or delta, for the connection voltage being used.

**Diagram 17: Wiring diagrams for 3-phase, single speed motors**



**Table 2: Typical motor starting methods.**

Motor Power Range	DOL	Star Delta	Inverter
0.18 to 3 kW	Star	N/A	Star
4 to 5.5 kW	Delta	N/A	Delta
7.5 to 90 kW	N/A	Star/Delta	Delta

### 6.2.3 VSD (Variable Speed Drive, Inverter)

Connect the inverter according to the wiring diagram and check each motor nameplate, then make the parameter settings during unit start-up.

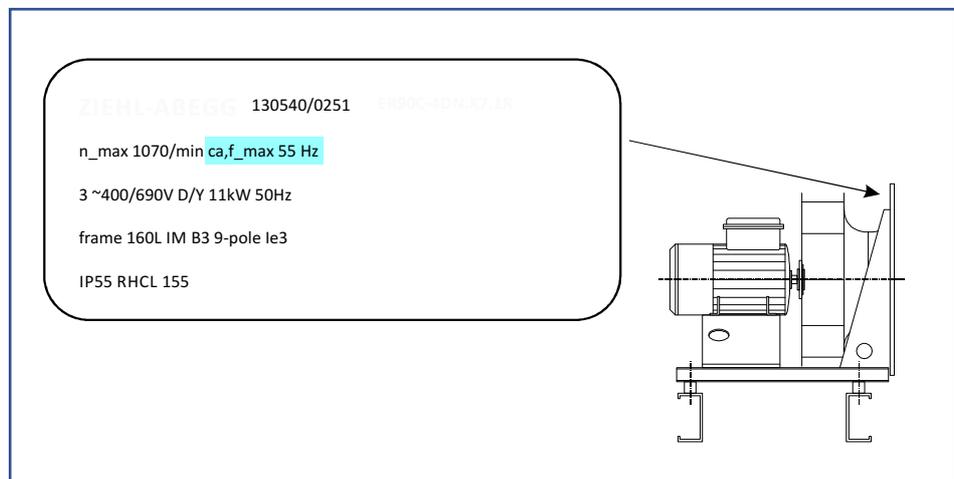
Please refer to the specific manufacturer's installation instructions.

Please be advised that if supplied with the AHU, any VSD will NOT be programmed or commissioned by Dalair.

The correct initial maximum operating frequency must be entered by a suitably qualified engineer before start-up, failure to do so will damage the AHU components for which Dalair will not be held responsible.

The maximum operating frequency for each fan can be found on the fan identification label.

**Diagram 18: Maximum operating frequency.**



### 6.2.4 EC motors

EC motors (fans) are electronically commuted motors with permanent magnets and a built-in integrated speed controller.

Connect the fan motor according to the documentation/wiring diagram and observe the manufacturer's instructions.

When using RCD circuit breakers, please ensure they are sensitive to universal current (type B).



Observe the pin or plug assignment detailed where the motor control and comms are prewired to a terminal box outside the AHU.

Please refer to the specific manufacturer's motor power wiring instructions.

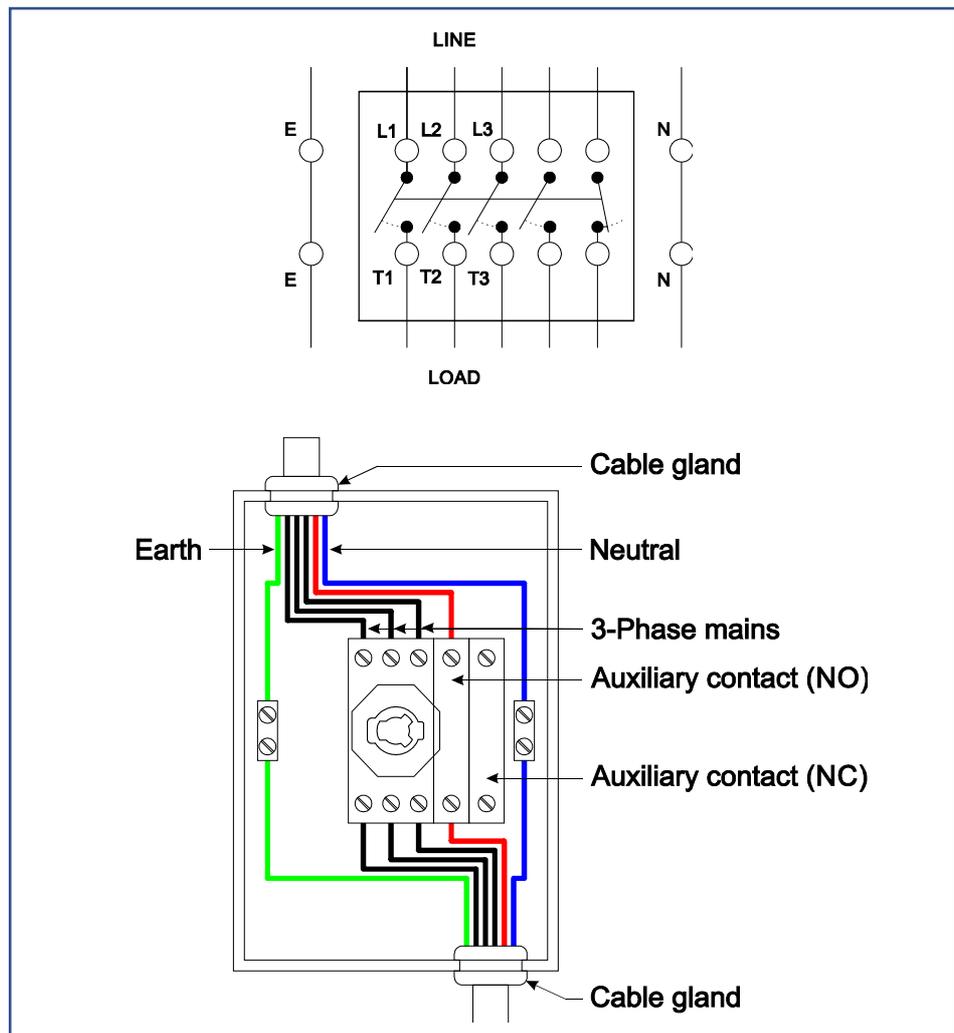
### 6.2.5 Local isolators

A suitable lockable local isolator must be installed to the access door of or panel adjacent to the following components if included in the AHU:

- Fan
- Electric heater
- Humidifier
- Thermal wheel.

Where fitted and wired by Dalair, any local isolator will be a 3-pole c/w two auxiliary contacts (early break type contacts).

**Diagram 19: Lockable isolator wiring diagram**



### 6.2.6 Additional electrical components

Connections should be made following the relevant supplier documentation and wiring diagrams provided.

## 7 COMMISSIONING

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A blue rectangular box with a white exclamation mark inside a circle on the left and the word "NOTE" in white capital letters on the right.

### 7.1 GENERAL CONSIDERATIONS

Before commissioning, ensure that the unit has been completely assembled, as described in the installation section. (See Section 5).

The unit is supplied with access doors, which should be closed whenever the unit is in operation.

#### **Complete the following commissioning steps:**

- Remove any documentation from within the AHU before commissioning.
- Ensure that the unit is positioned and assembled in accordance with these instructions.
- Check that the fan base shipping restraints have been removed and the anti-vibration mounts adjusted.
- Check the electrical supply voltage.
- Check the tightness of all electrical connections.
- Check alignment of fan and motor pulleys.
- Check that taper lock bushes are tight.
- Check fan belt tension.
- Check any other bearings and couplings where fitted.
- Manually rotate fan impellers and motors to ensure freedom of movement.
- Check and prime condensate drain traps.
- Check that all filters are fitted.
- Energize momentarily to check for the correct direction of fan rotation.
- Check that all control system components, such as fan run-on timers, airflow switches, etc., are wired correctly.
- Check control damper operation.
- Check that ductwork is complete and that any fire/balancing dampers installed downstream of the fan are open.
- Check that access panels and doors are fitted and secure.
- Check the fan motor current draw.

A blue rectangular box with a white exclamation mark inside a circle on the left and the word "NOTE" in white capital letters on the right.

Note that the motor and drive are designed to operate against a given system resistance. If the system is not complete or access doors and panels are open, the motor rating will be exceeded, and damage to the motor may occur.

A yellow rectangular box with a black exclamation mark inside a triangle on the left and the word "CAUTION" in black capital letters on the right.

Be advised that Dalair is not responsible for setting system pressures and airflows. These must be conducted by trained and qualified personnel.

## 7.2 FAN ASSEMBLY AND DRIVES

### 7.2.1 General fan commissioning (common to all fan types)

Before running up the fan, remove the transit protection fittings from the fan/motor base frame, which are to be found adjacent to the four anti-vibration mounts.

Then adjust each mount until the fan/motor base frame is level. Adjustment is achieved by releasing the locknut and screwing the central levelling screw into the mounting. When the equipment is level, tighten the locknut.

Do not operate fan motors in a continuous overload amperage condition.

Certain components may require specific individual commissioning. The relevant instructions can be found in Section 9. Commissioning and Maintenance of Individual Components.

## 7.3 COMMISSIONING CONTROL SYSTEMS



Our warranty only extends to control systems supplied and commissioned by Dalair.

If commissioning of the control system is undertaken by others, then the operational warranty for the control system would also be the responsibility of others.

#### 7.4 COMMISSIONING CHECKLIST

	Action	<input checked="" type="checkbox"/>	N/A
1.	Units received undamaged.	<input type="checkbox"/>	
2.	Equipment received as ordered.	<input type="checkbox"/>	
3.	Unit positioned and assembled in accordance with installation instructions.	<input type="checkbox"/>	
4.	Fan base shipping restraints removed.	<input type="checkbox"/>	
5.	Anti-vibration mounts adjusted.	<input type="checkbox"/>	
6.	Check the electrical supply voltage.	<input type="checkbox"/>	
7.	Check the tightness of electrical connections.	<input type="checkbox"/>	
8.	Check alignment of fan and motor pulleys.	<input type="checkbox"/>	<input type="checkbox"/>
9.	Check the tightness of taper lock bushes.	<input type="checkbox"/>	<input type="checkbox"/>
10.	Check fan belt tension.	<input type="checkbox"/>	<input type="checkbox"/>
11.	Check additional bearings and couplings. (Where fitted)	<input type="checkbox"/>	<input type="checkbox"/>
12.	Manually rotate fan impellers and motors to ensure freedom of movement.	<input type="checkbox"/>	
13.	Check and prime condensate drain traps.	<input type="checkbox"/>	<input type="checkbox"/>
14.	Check that filters are fitted.	<input type="checkbox"/>	
15.	Energise the fan momentarily to check for the correct direction of rotation.	<input type="checkbox"/>	
16.	Check control system components, (fan run-on timers, airflow switches, etc.,) are wired correctly.	<input type="checkbox"/>	<input type="checkbox"/>
17.	Check control damper operation.	<input type="checkbox"/>	<input type="checkbox"/>
18.	Check that ductwork is complete and that any fire dampers installed downstream of the fan are open.	<input type="checkbox"/>	
19.	Check that all access panels and doors are fitted, closed and secure.	<input type="checkbox"/>	
20.	Check the fan's current draw.	<input type="checkbox"/>	
21.	Check all shaft bearings and belt tension after 24 hours of operation.	<input type="checkbox"/>	
22.	Check that condensate traps are primed and working.	<input type="checkbox"/>	<input type="checkbox"/>

## 8 MAINTENANCE

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**NOTE**

### 8.1 MAINTENANCE SCHEDULE

The specified maintenance intervals apply to air conditions with normal levels of contamination. However, maintenance intervals must be reduced according to the level of air contamination. For example, particular attention must be given to units installed in coastal environments.

Refer to Section 9.3 Maintenance Interval Checklist.

### 8.2 ROUTINE MAINTENANCE AND CLEANING

#### 8.2.1 General cleaning of the AHU

- Remove remaining debris following a subsequent installation of add-on accessory items.
- Use a dry cloth or an industrial vacuum cleaner, if necessary, to remove dry, coarse dirt.
- For other contaminants, use a dry cloth to remove dirt.
- If necessary, wash off using a solution of water containing a mild alkaline cleaning agent.
- Note that the use of cleaning materials may require appropriate COSHH assessment.
- Alcohol-containing agents are not allowed due to the risk of explosion, fire and contamination.
- Do not use abrasive sponges or tools that may scratch or scrape the protective surface during cleaning, as the surface can be damaged.
- Treat galvanised parts with a preservative spray.
- Apply a lubricant spray to all moving parts, including door latches and hinges, except for dampers and louvres.
- Clean gaskets on the inspection doors and check for leaks, microbial growth and mould. It is recommended that gaskets are treated with a waterproof preservative.
- Replace any gasket materials if required, especially on filter modules.
- Check all electrical connections.
- Ensure that the unit is dry and residue-free!



#### 8.2.2 Cleaning of coils

The fins require cleaning to ensure that the coil continues to operate efficiently.

- Use a soft brush (not a wire brush) or an industrial vacuum cleaner.
- Do not use hard or sharp cleaning tools.
- Use compressed air against airflow direction or water spray at low pressure to clean copper or aluminium fins.
- Only use pressure or steam-jet appliances to clean steel galvanised heat exchangers or heat exchangers with reinforced fins.



### 8.3 MAINTENANCE INTERVAL CHECKLIST

Check the last maintenance report and intervening service reports.  
Pay attention to the items mentioned in the following checklist.

#### 8.3.1 Routine maintenance checklist (Part 1)

Unit part	Period	Action	✓
All Units	Every 3 months	• Check casing for damage and access panels for correct fit/operation.	<input type="checkbox"/>
		• Check/replace access door gaskets.	<input type="checkbox"/>
		• Check panels for damage and corrosion; renew corrosion protection.	<input type="checkbox"/>
Outdoor Units	Every month Every 12 months	In addition to completing the steps specified for "All units" above: -	
		• Check protection screen mesh on inlet louvres and hoods. Clean if necessary.	<input type="checkbox"/>
		• Verify that the unit roof is leak free.	<input type="checkbox"/>
Units located in/near a Coastal Environment	Every month	<b>The interval for ALL maintenance checks MUST be reduced to MONTHLY.</b> In addition to completing the steps specified for "All units" & "Outdoor units" above: -	
		• Wipe down and remove salt from panels/frames.	<input type="checkbox"/>
Belt-driven Fans	Every 3 months	• Check fans and motors are securely mounted	<input type="checkbox"/>
		• Check fans for debris, damage and corrosion.	<input type="checkbox"/>
		• Check anti-vibration mounts for correct alignment, adjust if necessary.	<input type="checkbox"/>
		• Check belt and inlet guards are securely fastened, and clean if necessary.	<input type="checkbox"/>
		• Check impeller for unbalanced condition.	<input type="checkbox"/>
		• Check tension of V-belt and inspect for wear; re-tension or replace, as necessary.	<input type="checkbox"/>
		• Check fan/motor for noise in bearing, replace bearing if necessary.	<input type="checkbox"/>
Belt-driven Fans (Extended shaft)	Every 3 months	• Check the shaft seal is intact and adequately packed with grease.	<input type="checkbox"/>
Direct-driven Fans	Every 3 months	• Check fan motors for debris, damage and corrosion.	<input type="checkbox"/>
		• Check motors for noise in the bearing. Replace the bearing if necessary.	<input type="checkbox"/>
		• Check the impeller (especially welded seams) for cracks; replace the bearing if necessary.	<input type="checkbox"/>
Filters (General for all panel and bag types)	Every 3 months	• Check filters for debris, damage and odour.	<input type="checkbox"/>
		• Clean filter chamber.	<input type="checkbox"/>
		• Check maximum specified filter pressure drop is not exceeded. Replace the filter if necessary.	<input type="checkbox"/>
Activated carbon filter	Refer to the relevant maintenance instructions specified in the supplier documentation.		
Grease filters	Refer to the relevant maintenance instructions specified in the supplier documentation.		
HEPA filters	Refer to the relevant maintenance instructions specified in the supplier documentation.		

### 8.3.2 Routine maintenance checklist (Part 2)

Unit part	Period	Action	✓
Heating Coils (LPHW) Bare tube coils	After 3 months from initial operation	• Inspect coil tube surfaces for patination, brush off any loose debris.	<input type="checkbox"/>
	Every 6 months	• Inspect coil tube surfaces for patination, brush off any loose debris.	<input type="checkbox"/>
Heating Coils (LPHW)	Every 12 months	• Check for leak-free condition.	<input type="checkbox"/>
		• To ensure frost protection, periodically check the safety devices and take proper precautions such as draining the equipment or adding antifreeze agents.	<input type="checkbox"/>
		• Ensure that pipework connections and mountings are securely fixed.	<input type="checkbox"/>
		• Clean on-air side, if necessary (blow through heat exchanger using compressed air or low-pressure water).	<input type="checkbox"/>
		• Vent.	<input type="checkbox"/>
Heating Coils (Steam)	Every 12 months	• Check for leak-free condition.	<input type="checkbox"/>
		• To ensure frost protection, periodically check the safety devices and take proper precautions such as draining the equipment or adding antifreeze agents.	<input type="checkbox"/>
		• Ensure that pipework connections and mountings are securely fixed.	<input type="checkbox"/>
		• Clean on-air side, if necessary (blow through heat exchanger using compressed air or low-pressure water).	<input type="checkbox"/>
		• Check steam inlet and condensate drain for proper operation.	<input type="checkbox"/>
Indirect-fired Gas Heaters	Refer to the relevant maintenance instructions specified in the supplier documentation		
Direct-fired Gas Heaters	Refer to the relevant maintenance instructions specified in the supplier documentation		
Electric Heaters	Refer to the relevant maintenance instructions specified in the supplier documentation		
Cooling Coils	Every 12 months	• Check for leak-free condition (With or without drop eliminator)	<input type="checkbox"/>
		• To ensure frost protection, periodically check the safety devices and take proper precautions such as draining the equipment or adding antifreeze agents.	<input type="checkbox"/>
		• Ensure that pipework connections and mountings are securely fixed.	<input type="checkbox"/>
		• Clean on-air side, if necessary (blow through heat exchanger using compressed air or low-pressure water).	<input type="checkbox"/>
		• Air vent.	<input type="checkbox"/>
		• Check condensate trays for cleanliness, clean with appropriate cleaner	<input type="checkbox"/>
		• Check condensate trap for correct operation, top up, as necessary.	<input type="checkbox"/>
		• Check eliminator blades for cleanliness, clean with appropriate cleaner	<input type="checkbox"/>
Heat Recovery Coils (Run-around Coils)	Every 12 months	• Complete the same steps specified for "Cooling Coil" on extract side and "Heating Coil" on supply side.	<input type="checkbox"/>
Plate Heat Exchangers	Refer to the relevant maintenance instructions specified in the supplier documentation		
Rotary Heat Exchangers	Refer to the relevant maintenance instructions specified in the supplier documentation		
Rotary Heat Exchangers (Desiccant Wheels)	Refer to the relevant maintenance instructions specified in the supplier documentation		
Steam Humidifiers	Refer to the relevant maintenance instructions specified in the supplier documentation		
Adiabatic Humidifiers	Refer to the relevant maintenance instructions specified in the supplier documentation		
Dampers (Inlets, outlets & mixing/recirculation)	Every 6 months	• Check damper blades and seals, lubricate blade bearings	<input type="checkbox"/>
		• Detach actuator from damper. Check if damper is moving freely and that the damper can fully open and close.	<input type="checkbox"/>
Silencers (Sound Attenuators)	Every 6 months	• Check the individual splitters for dirt, clean with appropriate cleaner	<input type="checkbox"/>

## 9 COMMISSIONING & MAINTENANCE OF INDIVIDUAL COMPONENTS

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### 9.1 FAN ASSEMBLY AND DRIVES

#### 9.1.1 General fan commissioning (common to all fan types)

Before running up the fan, remove the transit protection fittings from the fan/motor base frame. The transit “clamps” are located adjacent to the four anti-vibration mounts.

Adjust each anti-vibration mount until the fan/motor base frame is level. Adjustment is achieved by releasing the locknut and screwing the central levelling screw into the mounting. When the equipment is level, tighten the locknut.

#### 9.1.2 General fan maintenance (common to all fan types)

Consideration is to be given to the fan and motor assembly removal by using lifting equipment/beams and quick-release power connections.



Ensure the fan has been turned off (locally isolated) before entering the fan section.



The fan section contains unprotected rotating parts. Isolate unit and rundown for a minimum of two minutes before gaining access.

Access to the fan is usually gained by opening the fan access door and removing any guard.



Inspect the fan blades and remove any build-up of dust by lightly brushing, using compressed air or a vacuum cleaner. If the impellor is coated with a greasy film of dirt, it can be washed with a mild detergent or solvent. Gentle handling is essential.

Steam or other high-pressure cleaners must NOT be used.

Check the fan shaft and bearings for signs of overheating and wear and lubricate as necessary (See Section 10.1.3 Bearings below)

Fan bearings may be replaced easily, although removing small fans from the unit may be necessary.

Inspect the flexible connection between the fan and unit for damage or wear and replace it if necessary.

### 9.1.3 Bearings

“Sealed-for-life” fan and motor bearings are generally fitted as standard; consequently, maintenance is not required.

Other bearings should be regularly checked and re-packed with a lithium-based grease, typically Shell GADUS s2 V100,3, as necessary.

Fan bearings are “lifelong” lubricated for 20,000 or 40,000 hours of operation. However, in heavy-duty operational conditions, maintenance intervals are to be established by the operator.

If no greasing intervals are specified, they lie nominally above 8,000 operating hours. Hence re-greasing must take place at least once yearly.

Depending upon operating conditions, it may become necessary to re-grease several times, as determined by the operator. Please refer to the details for motor bearings as explained in the adjacent motor section.

(See Section 10.2 Motors)

### 9.1.4 Duplex fans

Small duplex fans, (i.e., two fans driven by one motor), may share a standard drive shaft. Larger duplex fans generally have a flexible connection fitted between individual fan shafts.

Where the connection between the fan shafts is a “universal joint” type coupling, it should be inspected for wear and greased as part of the regular maintenance program.

Where a “rubber tyre” type coupling connects the fan shafts, it should be inspected for signs of wear (e.g., porosity or severe cracking) and replaced, as necessary.

### 9.1.5 Extended shaft fans (motor out of airstream)

When motors are mounted out of the air stream, the fan shaft and fan base steelwork are extended to penetrate the unit casework.

Ensure that the fan shaft seal is intact and adequately packed with grease.

Also, check the condition of the rubber seals surrounding the fan base penetrations for signs of damage and replace them if necessary.

### 9.1.6 Direct-driven fans

Direct drive fans eliminate the need for belts or pulleys as the motor is directly connected to the impellor.

Where fitted to direct drive fans, the coupling connecting the motor and fan shaft should be visually inspected for signs of wear and replaced, as necessary.

### 9.1.7 Belt-driven fans

Ensure that the motor and fan pulleys are aligned and that the taper lock bushes are tight.

The Wedge or CRE belt drives should be checked for wear and tensioned to comply with the appropriate motor manufacturers' instructions.

Replacement belts should have the same specification and matching length as those originally supplied.

Where multiple belts are fitted, always replace all belts as a set. Used belts will always be longer due to stretching.

## 9.2 MOTORS

Check all motor wiring before starting up. The cables should be capable of carrying the full load current of the motor (see motor nameplate) without producing overheating or an undue voltage drop under starting conditions. Terminal screws and fixing bolts should be tight.

Ensure the starter is compatible with the motor. Ensure the motor can be isolated from the mains. Remove the fan cover and ensure that all air-inlet holes are unobstructed. Clean any build-up of dirt and fluff from behind the fan and along the ribs of the frame.

Motors fitted with ball and roller bearings are dispatched with the bearing housings correctly filled with grease, which under normal conditions is sufficient to last at least two years. The annular clearance between the shaft and bearing covers is very small, so the bearing housing can retain the grease and keep out dust and dirt. Should the grease melt for any reason, leakage will occur but provided that the correct quantity of the correct grease is used, no trouble should be experienced.

Bearing lubrication can be conveniently carried out when the motor is stripped for periodic cleaning and inspection on a routine basis. Over lubricating bearings, particularly on high-speed motors, causes the bearing to run extremely hot and the grease to become thin and leak out.

SHELL GADUS S2 V100 3 Grease is recommended for most applications as its lubricating properties are retained over a wide temperature range (-20°C to +120°C). Any other good grade of lithium base grease with an IP penetration of 185/250 may be used.

If there is any doubt as to whether the old and the new grease will mix, it is recommended that the old grease is cleaned out and the bearing recharged with new grease so that the complete assembly, including caps, is approximately 50% full of the grease in close contact with the race, and not merely smeared inside the bearing cover.

## 9.3 BELT-DRIVEN FANS

### 9.3.1 Commissioning of belt-driven fans

Complete the following commissioning steps:

- Check the general condition of the entire casing and all components for damage and correct fit.
- Remove transportation brackets.
- Check the belt(s) for correct tension and alignment.
- Check fan rotation direction.
- Measure the motor current consumption. The rated motor current should fall within the range given on the motor identification plate; this reading must not exceed the specified limit.
- Check motor protection device for correct operation.
- Check that all system components (air regulating and shut-off and fire protection dampers for correct operation) are open to ensure free movement.

Where an airflow measuring device has been supplied, please refer to the specific manufacturer's instructions and recommendations.

### 9.3.2 Maintenance of belt-driven fans

Incorrectly tensioned belts can substantially shorten belt life and overload fan and motor bearings, shortening their life expectancy.

Over-tightened belts can fail the fan and motor shafts and bearings and can cause nuisance tripping of the motor overload.

Carry out the following maintenance and inspection steps:

- Check the fan for secure mounting.
- Check fans for dirt, damage and corrosion.
- Check anti-vibration isolators for correction installation/operation
- Check belt guard for correction installation (belts not rubbing).
- Check the impeller for unbalanced conditions.

### 9.3.3 Re-tensioning or replacing V-belt

#### 9.3.3.1 Initial check:

- Perform the initial check following 50 hours of operation

#### 9.3.3.2 Regular checks:

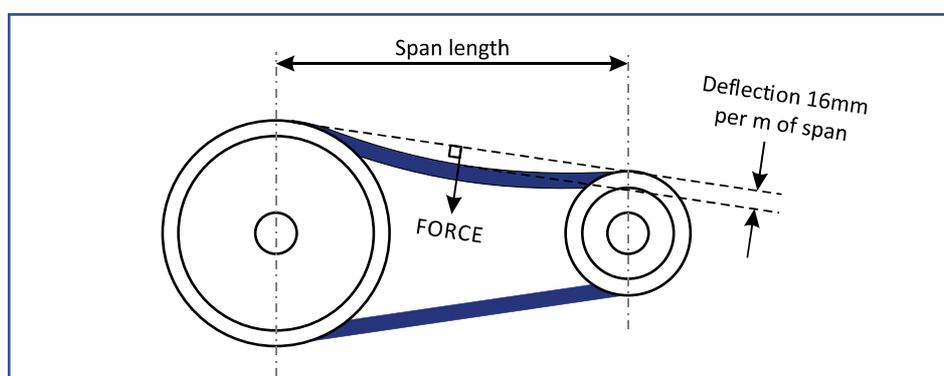
Subsequent checks depend on the operating load and experience.

- If the unit operates on a regular daily basis, (i.e., operational for approximately 8 hours a day), then check every three months,
- Perform more frequent inspections with higher operating hours.
- Inspect the belt(s) for wear and replace them if required.

9.3.3.3 To inspect or adjust the belt tension

- Measure the span length.
- At the centre of the span, apply a force at right angles to the belt to deflect one belt by 16mm per meter of span length. We recommend that a belt tension indicator be used to apply this force.
- Compare this force with the value in the Tensioning Forces table.
- Adjust the belt tension if required by moving the motor forward or backwards via the motor adjustment plate.
- A new belt drive should be tensioned to the higher value to allow for the normal drop in tension during the running-in period.
- After the drive runs for a few hours, the tension should be checked and re-adjusted.

**Diagram 20: Fan belt tensioning - deflection measurement details**



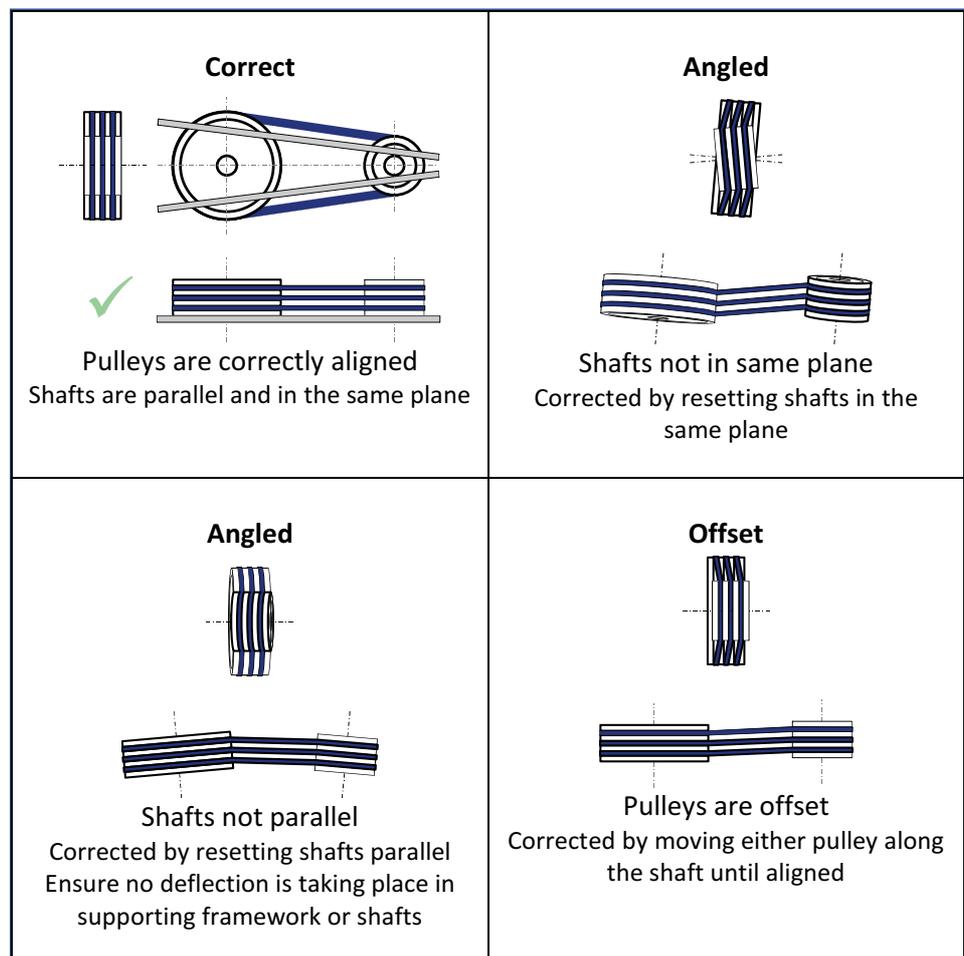
**Table 3: Fan belt tensioning forces**

Belt Type	Smallest pulley diameter mm	Force (N) required to deflect belt 16 mm per m of span
SPZ	70 - 85	13 - 19
	86 - 155	15 - 23
	116 - 150	19 - 27
	151 - 200	25 - 34
	201 - 250	29 - 38
SPA	112 - 150	25 - 34
	151 - 200	29 - 38
	201 - 250	35 - 44
	251 - 300	40 - 50
SPB	180 - 224	40 - 52
	225 - 300	46 - 60
	301 - 400	55 - 76
	401 - 500	67 - 90

### 9.3.3.4 To inspect and adjust the pulley alignment

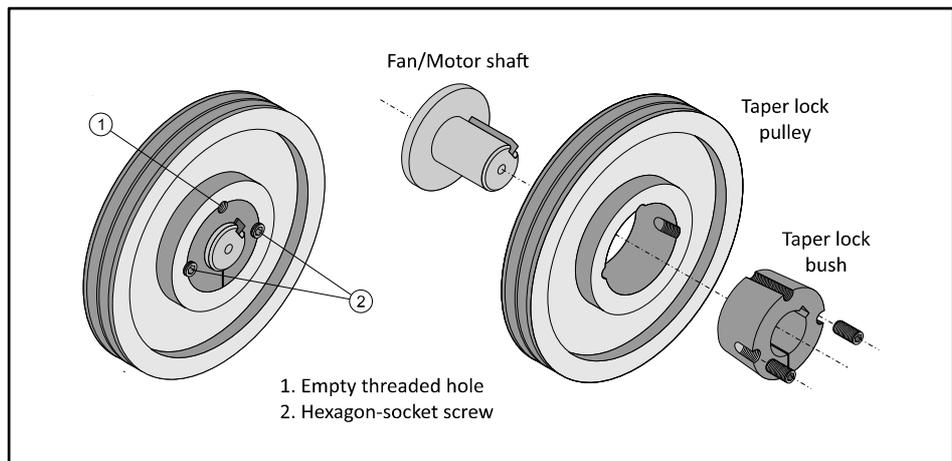
- Correct alignment of the pulleys is important.
- Proper alignment extends the service life of belts and bearings, reduces vibration and noise levels, and saves energy.
- Poor alignment also results in belt flank wear
- Traditional alignment methods, using mechanical tools such as straightedges or string, are quick but inaccurate.
- In comparison with traditional alignment tools, laser equipment enables measurements and adjustments to be made with a very high level of precision.

**Diagram 21: Fan belt/pulley alignment details**



### 9.3.3.5 Adjusting or removing fan belt pulley

**Diagram 22: Taper lock pulley details**



**To remove the fan belt pulley, proceed as follows:**

- Slacken and remove fan belt(s). Refer to Section 10.3.3 “Re-tensioning or replacing V-belt” on page
- Loosen and remove both hexagon-socket screws (2).
- Screw a hexagon-socket screw into the empty threaded hole (1) and turn it until both the pulley and bush are loose.
- Pull the pulley assembly off the motor shaft (fan shaft) and remove it.

**To mount the fan belt pulley, proceed as follows:**

- Position the pulley and bush so that these engage with one another. Align both holes and insert screws without tightening.
- Slide the pulley and bush on the shaft as close to the motor or fan as possible (to keep leverage small) and align
- Evenly tighten the hexagon-socket screws.

Refer to the following table for the maximum tightening torque of hexagon-socket screws during the installation.

**Table 4: Maximum tightening torque for taper lock pulley hex screws**

Bush No.	1008	1108	1210	1610	1615	2012	2517	3020	3030	3525	3535
Maximum tightening torque (Nm)	5.6	5.6	20	20	20	32	50	90	90	115	115

Check motors for damage and corrosion and secure mounting.

Inspect motor and fan for bearing noise and replace bearings if necessary.

**NOTE**

Lubricate non-sealed fan bearing according to the motor manufacturer’s recommendations. Please refer to the manufacturer’s documentation for correct lubrication details of non-sealed bearings.

Should the pulleys be changed in size for any reason, it should be noted that minimum recommended pulley sizes from the fan supplier must be adhered to.

#### 9.3.4 Commissioning of the direct-driven fan assembly

Remove remaining installation debris and any foreign matter from the impeller and inlet cone.

Check motor protection for correct setup.

Ensure the maximum inverter frequency does not exceed the allowable fan (impeller) maximum speed limit (refer to fan ID label).

Consider the relevant instructions specified in the enclosed manual for the frequency inverter.

#### 9.3.5 Maintenance of direct-driven fan assembly

Carry out the following maintenance steps:

- Check electric motors for dirt, damage, corrosion and secure mounting.
- Check electric motors for noise in bearings.  
If required, engage qualified licensed staff to replace bearings.
- Check the impeller, especially welded seams, for cracks.  
If required, engage qualified personnel to replace motor bearings.

### 9.4 FREQUENCY INVERTERS

#### 9.4.1 Commissioning of Frequency Inverters

Commissioning of inverters is not included by Dalair unless specifically ordered.

Where Dalair commissions inverters, this is limited to basic parameter setting only and does not include interfacing with controls/BMS, which is to be carried out by others.

Please refer to the inverter manual for specific commissioning instructions.

Commissioning must only be carried out by qualified personnel.

## 9.5 DIRECT DRIVEN (EC MOTOR) FAN ASSEMBLY

### 9.5.1 Commissioning of direct driven (EC motor) fan assembly

Remove remaining installation debris and any foreign matter from the impeller and inlet cone.

Check motor protection for correct setup.

Ensure the maximum inverter frequency does not exceed the allowable fan (impeller) maximum speed limit (refer to fan ID label).

Consider the relevant instructions specified in the enclosed manual for the frequency inverter.

### 9.5.2 Maintenance of direct driven (EC motor) fan assembly

Carry out the following maintenance steps:

- Check electric motors for dirt, damage, corrosion and secure mounting.
- Check electric motors for noise in bearings.  
If required, engage qualified licensed staff to replace bearings.
- Check the impeller, especially welded seams, for cracks.  
If required, engage qualified personnel to replace motor bearings.

## 9.6 FILTERS

The correct installation of filters is an essential requirement for the correct function and operation of any Air Handling Unit.

To establish a dirty filter condition and to check the entire installation, a filter measuring device must be fitted across every bank of filters to enable accurate measurement of the air pressure drop.

Therefore, it is necessary to ensure that each filter is intact before use and only installed in the manner recommended below.

If filters are replaced with an alternative manufacturer's product, consideration needs to be given to the filter pressure drops to ensure they match the original selections.

### 9.6.1 Commissioning of filters in General

Complete the following commissioning steps:

- Check filter assembly and the filters installed for damage.
- Check that the filter assembly is correctly fitting in the mounting frame.
- Check that the filter retaining clips and blanks are fitted, secured correctly, and not damaged.
- If required, clean installation dust before the filter assembly and unit parts in the direction of airflow.
- Put the AHU back into operation and take readings of the initial pressure difference (if available).

#### 9.6.2 Commissioning of HEPA, Carbon and Grease filters

These filters are supplied loose to be fitted on site when the installation is complete.

Due to the high efficiency of these filters and the often 'clean room' standards they must attain, the utmost care should be taken when replacing these filters to ensure there is no system contamination.

The filters must be stored in a clean, dry environment, and all packaging must remain in place until installation.

#### 9.6.3 Routine general maintenance for all filters

As a general requirement and depending on the operating conditions, all filters must be checked at regular intervals and replaced if necessary.

Carry out the following maintenance steps:

- Check filters for debris, damage and odour.
- Clean filter chamber.
- Check if the maximum allowed pressure difference specified by the manufacturer is exceeded and replace the filter if necessary.

#### 9.6.4 Hygiene inspection

Even if the filter shows no signs of dirt, microbial growth and mould may propagate through it because of its long-term use (in the air with low dust content).

Filters must be replaced regularly (at least every 6-9 months), even if dirt is barely visible.

## 9.7 PANEL AND BAG FILTERS

### 9.7.1 Maintenance of panel filters and bag filters

Carry out the following maintenance steps:

- Check filter and filter frame for dirt, corrosion and damage. Replace if necessary.
- Replace the filter if the maximum pressure difference is reached.
- Check seal/gaskets/clips and replace if necessary.

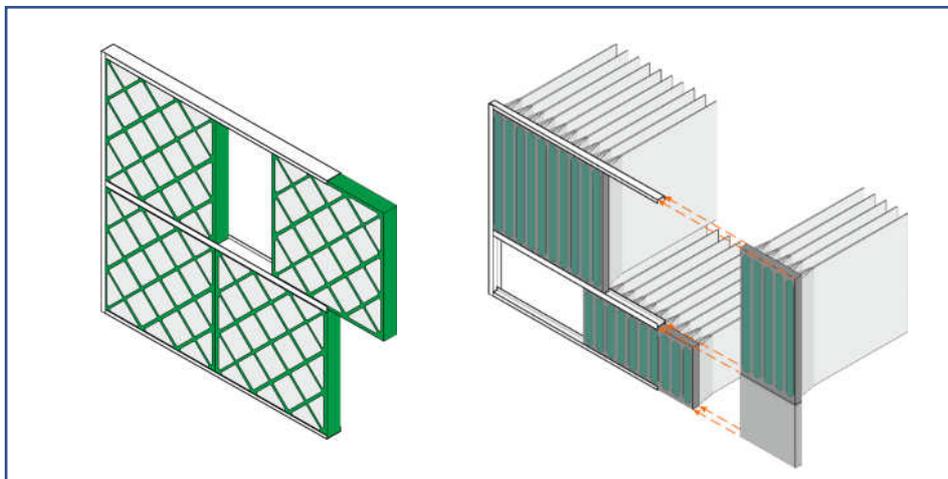
#### 9.7.1.1 Replacing the filters (side withdrawal)

Ensure that unit is turned off.

- Open the access door.
- Pull out each filter from the slide rails. Depending on design space constraints, a “grab arm” may be required to remove the filters. This item is to be supplied by others.
- Replace any damaged or dirty filters.
- Slide the filter back into the slide rails
- Ensure the correct fit and airtight seal
- Close the access door.

Filters must be disposed of correctly in accordance with local authority guidelines.

**Diagram 23: Side withdrawal filters**



**NOTE**

**Specific note for bag type filters:**

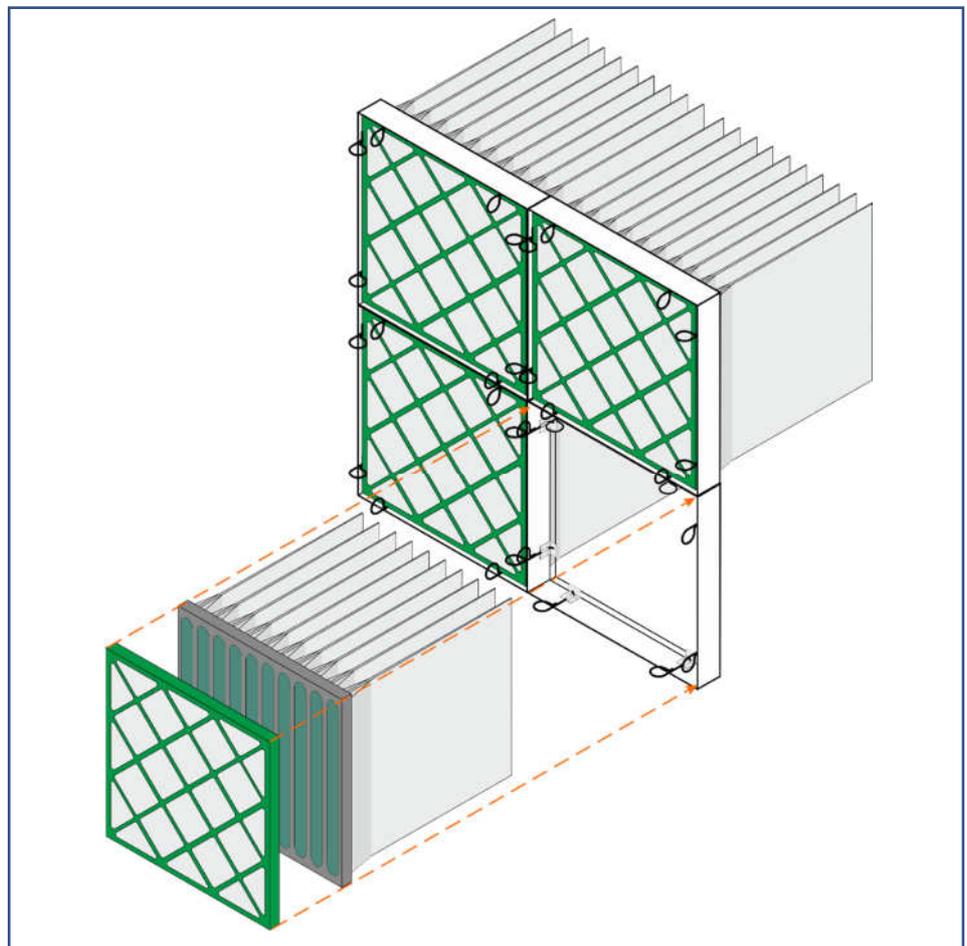
Install the filter so that the bag pockets are always in a vertical orientation.

### 9.7.1.2 Replacing the filters (front/rear withdrawal)

Ensure that unit is turned off.

- Open the access door.
- Release the top and bottom spring clips on each filter frame.
- Take out each filter from its individual frame
- Replace a damaged or dirty filter.
- Place each filter back in its individual frame
- Ensure the correct fit and airtight seal
- Secure the top and bottom spring clips on each filter frame.
- Close the access door.

**Diagram 24: Front withdrawal combined panel and bag filters**



**NOTE**

**Specific note for bag type filters:**

Install the filter so that the bag pockets are always in a vertical orientation.

## 9.8 HEPA FILTERS

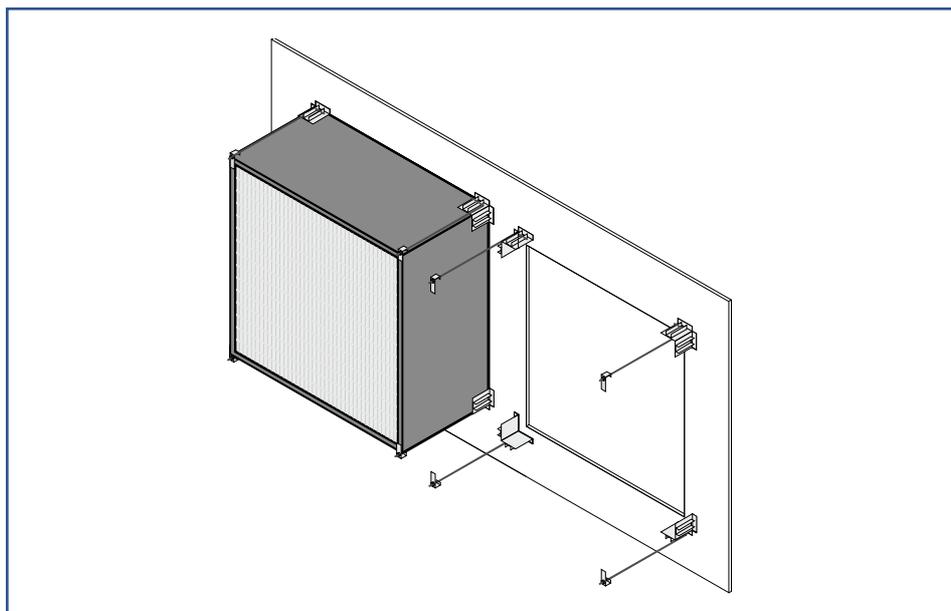
### 9.8.1 Maintenance of HEPA filters

Due to the high efficiency of these filters and the often 'clean room' standards they must attain, the utmost care should be taken when replacing these filters to ensure there is no system contamination.

Carry out the following maintenance steps:

- Ensure that unit is turned off.
- Open the access door.
- Release the four corner fixing clamps on each filter frame.
- Take out each filter from its individual frame
- Replace a damaged or dirty filter.
- Place each filter back in its individual frame
- Ensure the correct fit and airtight seal
- Secure the four corner fixing clamps on each filter frame.
- Close the access door.

**Diagram 25: HEPA filters**



## 9.9 SPARE FILTERS

If stated in our drawings, the AHU may have been supplied with a spare set of filters or a set of "disposable commissioning filters", which must be replaced once commissioning has been completed.

Any loose or spare filters should be stored in a dry and clean environment.

## 9.10 DAMPERS

### NOTE

#### 9.10.1 Commissioning of dampers and shut-off dampers

Dalair only accepts responsibility for damper actuators and linkages supplied as part of the equipment order.

Where damper actuators and linkages are supplied and fitted by others, these items should be set up in accordance with the control manufacturer's instructions and are the responsibility of others.

Dampers may be operated with pneumatic or electric actuators or manually operated with a quadrant handle.

If it is necessary to use a linkage between the damper actuator and the damper drive shaft, they should be positioned at least 350mm and a maximum of 1200mm apart. The link may be difficult to adjust on shafts less than 350mm apart and, if the shafts are more than 1200mm apart, the connecting linkage may lack stiffness to operate the dampers.

Ensure that all spring return actuators have stopped running and completed their stroke. If not, loosen the connection and let the actuator drive until the motor stops running. Adjust the damper blades to the desired position and re-tighten the actuator connection.

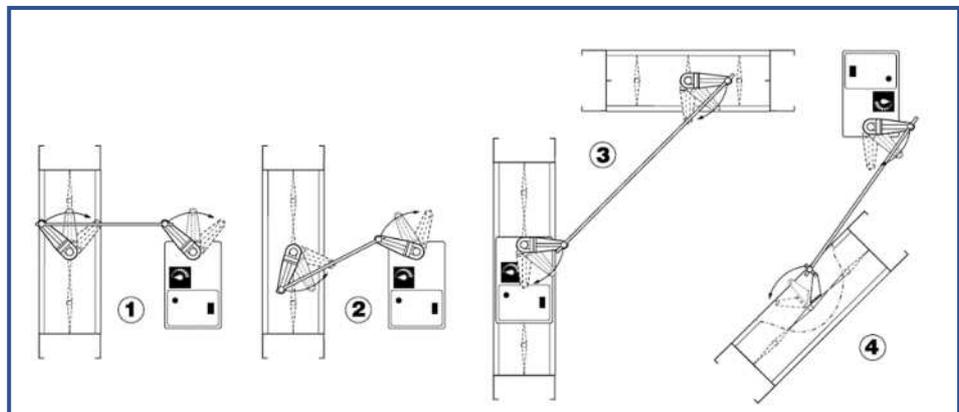
After power has been supplied to the unit, the dampers should be checked to ensure they operate freely and close tightly. Adjustment of the linkage may be required.

Complete the following commissioning steps:

- If several dampers are linked together, ensure that the connecting linkage is installed correctly and is moving freely.
- Check all screw connections for correct fit.
- Do not start up the fans with closed dampers.
- Do not overdrive damper actuators, as this may damage the damper.

### CAUTION

**Diagram 26: Typical remote damper linkage arrangements**



1. Remote actuator with the same direction of rotation
2. Remote actuator with different directions of rotation
3. Linked fresh air and return air dampers
4. Plate heat exchanger face & bypass damper with remote actuator showing knuckle joint

A linkage may be fitted between a control damper and actuator in situations where the actuator cannot be fitted directly to the damper drive shaft or between the fresh air and return air dampers of two-way mixing boxes. Initially, establish the direction of rotation of the damper drive shaft(s) and the actuator.

 **NOTE**

If a spring return actuator is fitted, ensure it has completed its stroke. Manually rotate the actuator to the position that is required for the closed position of the damper operated by the crank arm, then turn this damper to its mid-stroke

Where the direction of rotation is identical, install the crank arms, so they are parallel and at the same angle. When the direction of rotation is opposed, install the crank arms so that they are parallel but at 180° to each other.

At this stage, the crank arm on the damper shaft should be secured, but the crank arm on the actuator should be free to rotate.

Attach the push rod between the ball joint connectors on both crank arms and tighten the ball joint screws only thumb tight.

Manually rotate the crank arm on the actuator to drive the linkage and the damper shaft through its entire stroke to ensure proper damper action.

Return the damper with the crank arm to its closed position. Tighten and secure the crank arm of the actuator. In the case of 2-way mixing boxes, the damper driven directly by the actuator should be manually rotated to the fully open position before tightening the crank arm on the actuator.

While pushing the damper operated by the crank arm closed, tighten the ball joint screws to secure the drive rod.

Run the actuator back and forth through its entire stroke and check for proper damper and linkage operation. Adjust the linkage if required.

In some instances, e.g., the face and by-pass damper of a plate heat exchanger, the damper may be operated by a bracket attached directly to one of the blades rather than a crank arm fitted to a drive spindle. This type of linkage is often more challenging to set up and adjust.

In these circumstances, Dalair recommends using a bracket fitted with a knuckle joint, which makes provision for changes in the geometry of the drive rod as the damper is opened and closed.

Some non-return dampers may be gravity operated and do not require an actuator. Refer to project-specific general arrangement drawings for details.

### 9.10.2 Maintenance of dampers and shut-off dampers.

Carry out the following maintenance steps:

- Vacuum clean dampers (blow out).
- Detach the actuator from dampers and check if dampers are moving freely.
- Check that the damper actuator moves to its final position.
- Check the condition of any blade tip and side seals and replace them if necessary.
- Never apply grease to the bearings.



**NOTE**

## 9.11 INDIRECT FIRED GAS HEATERS

### 9.11.1 Commissioning/maintenance of indirect-fired gas heaters

Refer to the relevant commissioning/maintenance instructions specified in the supplied heater documentation.



**Important!** To avoid residual heat emanating from the direct-fired heater causing damage to itself or other components within the unit, a fan overrun (run-on) facility **MUST** be included in the control and operational strategy of the unit.

This objective may be achieved by:

- A thermostat controlling the fan and ensuring that the temperature within the unit does not rise above 40°C
- Utilising a delay timer to ensure the fan continues to run
- Airflow switches.

## 9.12 ELECTRIC HEATERS

### 9.12.1 Commissioning/maintenance of electric heaters

For commissioning, ensure that the thermal cut-out switch is operating correctly. For further details, refer to the specific instructions from the supplier.

If nuisance tripping of the electric heater occurs, the most probable cause is low air velocity over the individual heater elements. This may be due to dirty filters, too low fan speed setting or user adjustment to dampers remote from the unit.



**Important!** To avoid residual heat emanating from the electric heater causing damage to itself or other components, a fan overrun (run on) facility **MUST** be included in the control and operational strategy of the unit.

This objective may be achieved by:

- A thermostat controlling the fan and ensuring that the temperature within the unit does not rise above 40°C
- Utilising a delay timer to ensure the fan continues to run
- Airflow switches

If correctly filtered, no maintenance is required other than periodic checking of the fasteners and electrical connections for security/tightness.

## 9.13 SOUND ATTENUATORS

### 9.13.1 Commissioning/maintenance of sound attenuator

No commissioning is required.

Carry out the following maintenance steps:

- Check the sound attenuator section and sound insulating splitters for contamination, vacuum clean, if necessary

## 9.14 HUMIDIFIERS

### 9.14.1 Commissioning/maintenance of humidifiers

Refer to the relevant commissioning/maintenance instructions specified in the supplied humidifier documentation.

#### 9.14.1.1 *General maintenance*

Check any water treatment that may be appropriate.

Carry out the following maintenance steps:

- Clean coil drip tray and drain pipework and repair any areas of corrosion
- Check the trap for correct operation and top up, as necessary.

#### 9.14.1.2 *Spray Coil/Washer type*

Check all nozzles on the spray tree and clean as necessary to yield the full spray pattern.

Ensure that the pump inlet strainer is clean.

Check that the pump v smoothly and quietly.

Check that there are no leaks, particularly at the shaft seal. Ensure that the motor is not overheating. Remove and clean all filters.

Check the tripping time for the motor overload unit and ensure that all controls operate satisfactorily.

#### 9.14.1.3 *Wetted Cell (Evaporative) type*

Inspect pump operation as described in the previous section.

Ensure sump drainage is clear to allow water flow under flushing cycles.

Wetted cell humidification systems must not be supplied with softened water.

### 9.14.2 LEGIONELLA CHECK

At three monthly intervals, take dip slide samples of humidifier condensate drip tray water and send them for analysis under the requirements of the legislation concerning the Control of Bacteria in Water Systems.

If results are positive, disinfect all associated components of the air handling unit, including all drain trays, wash down sections and condensate trap arrangements.



## 9.15 PLATE HEAT EXCHANGERS

### 9.15.1 Commissioning of plate heat exchangers

Refer to the relevant commissioning instructions specified in the supplied plate heat exchanger documentation.



#### **Warning risk of damage to the unit!**

Avoid inadmissible high differential pressures between the supply air and the extract air as this will cause damage to the heat exchanger fins.

In this case, Dalair neither accepts warranty claims nor assumes liability.

Check the face/bypass and recirculation (if fitted) dampers for correct open and close operations.

### 9.15.2 Maintenance of plate heat exchangers

Refer to the maintenance instructions specified in the supplied plate heat exchanger documentation.

Carry out the following maintenance steps:

- Cleaning of exchanger fins as needed.
- Use a soft brush/vacuum to remove any dust build-up.
- Blow out the fins using compressed air against the airflow direction or spray with low-pressure water.
- Clean the drip tray and drain piping (if fitted), check the trap for correct operation and top up, as necessary.
- Check the face/bypass and recirculation (if fitted) dampers for correct open and close operations.



## 9.16 ROTARY HEAT EXCHANGERS (THERMAL WHEELS)

### 9.16.1 Commissioning of rotary heat exchangers

Refer to the relevant commissioning instructions specified in the supplied rotary heat exchanger documentation.

Document the commissioning of the rotation heat exchanger according to the commissioning report.

Complete the following commissioning steps:

- Check the tension of the drive belt and tighten it if necessary.
- Check the direction of rotation.
- Check brush sealing for correct fit operation.



Drive belts are not tensioned at the factory; therefore, correct tensioning must be carried out as part of the commissioning process. Commissioning is to be carried out by others unless ordered from Dalair.

### 9.16.2 Maintenance of rotary heat exchangers

Refer to the maintenance instructions specified in the supplied rotary heat exchanger documentation.

Carry out the following maintenance steps:

- Cleaning of the exchanger matrix (surfaces) as needed.
- Use a soft brush/vacuum to remove any dust build-up.
- Blow out the matrix using compressed air against the airflow direction or spray with low-pressure water. Never use high-pressure water or steam for cleaning the exchanger matrix.
- Clean drip tray and drain piping (if fitted), check the trap for correct operation and top up, as necessary.



## 9.17 HOT-WATER HEATING COILS

### 9.17.1 Commissioning of hot-water heating coils

Complete the following commissioning steps:



- Check supply and return pipework for correct connection.
- Check shut-off devices and other fixtures for correct installation.
- Open air vent. (If automatic air-venting is not installed.)
- Fill the coil at the lowest point to prevent air cushions and water hammering.
- Slowly open the air vent and wait until the coil is flushed with water.
- Open the air vent completely.
- Close the air vent. If the levels are different, then close the air vent gradually until water displaces the air and starts to run out.
- Activate the primary and secondary pump, check rotation direction and put the coil into service for ample time.
- Set the control valves in the reverse position (three-way valves).
- Perform a subsequent check by the repeated opening of the air vent.
- Check for a leak-free condition on all joints.

### 9.17.2 Maintenance of hot-water heating coils

Carry out the following maintenance steps:



- Check for leak-free condition of coil and pipework
- To ensure frost protection, periodically check the safety devices and take correct precautions, such as draining the coil or adding antifreeze agents.
- Ensure that pipework connections and mountings are securely fixed.
- Inspect visually and clean the coil fins (blow out with compressed air or low low-pressure water).
- Check and vent coil if automatic air-venting is not installed.

## 9.18 STEAM HEATING COILS

### 9.18.1 Commissioning of steam heating coils

Complete the following commissioning steps:



- Open drain and air vent.
- Slowly open steam valves and wait until steam starts to escape.
- Close drain and air vent.
- Check for a leak-free condition on all joints.
- Ensure correct condensate trapping/drainage to avoid damage to the coil.

### 9.18.2 Maintenance of steam heating coils

Carry out the following maintenance steps:



- Check for leak-free condition of coil and pipework.
- To ensure frost protection, periodically check the safety devices and take correct precautions, such as draining the coil.
- Ensure that pipework connections and mountings are securely fixed. Inspect visually and, if necessary clean the coil fins. (Blow out with compressed air or low-pressure hot water).
- Check steam inlet and condensate drain for correct operation.

## 9.19 COLD-WATER COOLING COILS

### 9.19.1 Commissioning of cold-water cooling coils

Complete the following commissioning steps:



- Check supply and return pipework for correct connection.
- Check shut-off devices and other fixtures for correct installation.
- Open air vent if automatic air-venting is not installed.
- Fill the coil at the lowest point to prevent air cushions and water hammering.
- Slowly open the air vent and wait until the coil is flushed with water.
- Open the air vent completely.
- Close air vent. If the levels are different, then close the air vent gradually until water displaces the air and starts to run out.
- Activate the primary and secondary pump, check rotation direction and put the coil into service for ample time.
- Set the control valves in the reverse position (three-way valves).
- Perform a subsequent check by the repeated opening of the air vent.
- Check for a leak-free condition on all joints.
- Clean the drip tray and condensate drain pipework and fill the condensate trap with water.

### 9.19.2 Maintenance of cold-water cooling coils

Carry out the following maintenance steps:

- Check for leak-free condition of coil and pipework
- To ensure frost protection, periodically check the safety devices and take correct precautions, such as draining the coil or adding antifreeze agents.
- Ensure that pipework connections and mountings are securely fixed. Inspect visually and, if necessary clean the coil fins (blow out with compressed air or low-pressure water).
- Check and vent coil if automatic air-venting is not installed.
- Clean the drip tray and drain piping.
- Check condensate trap for correct operation and top up, as necessary.
- Clean droplet eliminator (if fitted) with a descaling spray. Eliminator blades can be removed to facilitate inspection and cleaning of the coil “air off” face.

## 9.20 DX COOLING AND CONDENSER HEATING COILS

### 9.20.1 Commissioning of DX cooling and condenser heating coils

The sizing and selection of condensers are carried out by others. Consideration must be given to the coil selections to ensure that the condenser is compatible.

Complete the following commissioning steps:

- For connection, work ensure that nitrogen charge is present in coils. Check liquid and suction lines for correct connection.
- Check shut-off devices and other fixtures for correct installation,
- Ensure that pipework connections and mountings are securely fixed.
- Charge the refrigeration circuit with a medium specifically designed for the system.
- Check if the system is airtight.
- Check the correct operation of safety valves.
- Check the maximum temperature and pressure of the unit in operation
- Clean the drip tray and condensate drain pipework and fill the condensate trap with water.

### 9.20.2 Maintenance of DX cooling and condenser heating coils

Carry out the following maintenance steps:

Check for leak-free condition of coil and pipework

- Ensure that pipework connections and mountings are securely fixed. Inspect visually and, if necessary clean the coil fins (blow out with compressed air or low-pressure hot water).
- Clean the drip tray and drain piping.
- Check condensate trap for correct operation and top up, as necessary.
- Clean droplet eliminator (if fitted) with a descaling spray. Eliminator blades can be removed to facilitate inspection and cleaning of the coil "air off" face.
- Ensure that all refrigeration components are functioning correctly.

## 9.21 HEAT RECOVERY COILS (RUN-AROUND)

### 9.21.1 Commissioning & maintenance of heat recovery coils

Refer to commissioning/maintenance of hot water heating and cold-water cooling coils sections 7.14.1, 7.14.2, 7.16.1 and 7.16.2.

## 9.22 BULKHEAD LIGHTS

### 9.22.1 Commissioning of Bulkhead lights

No commissioning is required.

### 9.22.2 Maintenance of Bulkhead lights

Always switch off and isolate the electrical supply before checking or changing the bulb.

Periodically check the tightness of the screw-type bulb as they can work loose.

#### 9.22.2.1 *Standard bulkhead lights*

Check that the replacement bulb is the correct type, paying attention to the voltage and wattage.

LED bulbs: type E27, 9W, 240V 50Hz.

#### 9.22.2.2 *To replace a bulb: -*

Remove the diffuser by unscrewing the two fixing screws. Remove the old bulb and fit the replacement. Refit the diffuser, ensuring that the gasket seal remains intact. Do not over-tighten the fixing screws. An effective seal can be achieved with moderate tightening of the screws.

#### 9.22.2.3 *Externally maintainable bulkhead lights*

Older units are fitted with externally mounted standard bulkhead lights mounted within a purpose-made, coated sheet steel box, hinged on one side and secured with a retaining screw.

Remove the retaining screw and open the box to access the bulkhead light. Bulb replacement is as described above.

Newer units are fitted with dichroic lamps housed within polycarbonate terminal boxes. Dependent on customer requirements, these may be 240V or 12V. (12V lamps have a transformer fitted within the terminal box.) Lamp Replacement is as described below.

#### 9.22.2.4 *To replace the lamp: -*

Remove the terminal box cover by unscrewing the four fixing screws. Grip the sleeved lamp holder cover and put it out of the terminal box to reveal the lamp. Remove the old lamp and fit a new lamp of the same voltage. Push the sleeved lamp holder cover back into position and refit the terminal box cover, ensuring that the gasket seal remains intact.

## 10 DISMANTLING AND DISPOSAL

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### 10.1 RISK OF ENVIRONMENTAL DAMAGE!

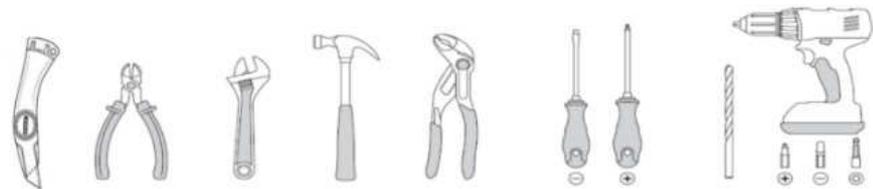
Dismantling and disposal must be carried out by qualified personnel in accordance with all local authority regulations and guidelines.

All units supplied by Dalair are manufactured with consideration to components for reuse before being sent for recycling or disposal.

Most of the unit is manufactured from recyclable metallic and plastic materials.

### 10.2 DISMANTLING

#### 10.2.1 Tools required



Basic hand tools, including a utility knife, pliers, hammer, electrical screwdrivers, adjustable spanners and wrenches, and power tools such as a cordless drill and reciprocating saw, are required.

#### 10.2.2 Hazardous voltage

When performing any decommissioning and dismantling work on the unit, you must disconnect all electrical power supply connections and ensure the power supply cannot be inadvertently switched back on.

#### 10.2.3 Refrigeration coils

Refrigeration circuits contain gas at high pressure. Therefore, a suitably trained and qualified person must be engaged to recover the refrigerant (F-Gas) in accordance with current F-Gas regulations when disposing of equipment.



## 10.3 RECYCLING



### 10.3.1 Electrical items

As part of Dalair’s environmental strategy, we are fully committed to complying with WEEE regulations that came into effect on 1st July 2007.

All waste electronic and electrical items including, but not limited to, motors, inverters, damper actuators, controllers and light fittings, should be disposed of in accordance with current WEEE regulations

### 10.3.2 Plastics

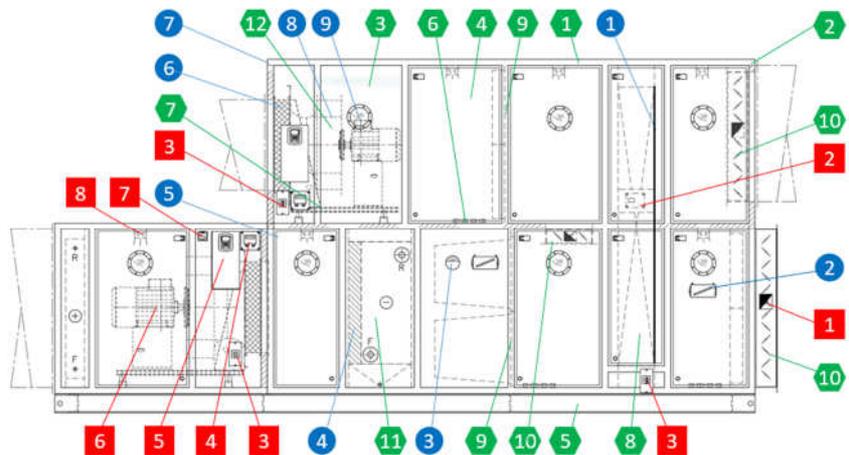
Plastic components, such as viewing panels, framework corners and hinges, can be recycled in accordance with current legislation.

### 10.3.3 Metals

Once electrical and plastic components have been removed, the remaining metallic materials can be recycled in accordance with current legislation.



Please note that the AHU drawing depicted below is of a typical air handling unit and is for illustrative purposes only. The illustration is by no means limited to the Dalair range of products or components that are available for selection and manufacture.



- | WEEE Recyclables   | Plastic Recyclables   | Metal Recyclables  |
|--|---|--|
| <ul style="list-style-type: none"> <li>1. Actuator</li> <li>2. Controller</li> <li>3. Isolator</li> <li>4. Volumeter</li> <li>5. Inverter</li> <li>6. Motor</li> <li>7. Light switch</li> <li>8. Bulkhead light</li> </ul> | <ul style="list-style-type: none"> <li>1. Drive belt</li> <li>2. Manometer/tubing</li> <li>3. Magnehelic gauge</li> <li>4. Polypropylene eliminator</li> <li>5. Rubber mount</li> <li>6. Flexible canvas</li> <li>7. Nylon corner</li> <li>8. Impellor</li> <li>9. Port window</li> </ul> | <ul style="list-style-type: none"> <li>1. Framework</li> <li>2. Diecast corner</li> <li>3. Panel</li> <li>4. Door</li> <li>5. Base frame</li> <li>6. Aluminium tread plate</li> <li>7. Fan base/frame</li> <li>8. Heat wheel frame</li> <li>9. Filter frame</li> <li>10. Damper</li> <li>11. Coil</li> <li>12. Impeller</li> </ul> |

# 11 TROUBLESHOOTING

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## 11.1 GENERAL FAULT-FINDING PROCEDURES

Have fully qualified, licensed staff perform troubleshooting and repair procedures.

A simple diagnostic fault-finding table specifying troubleshooting problems and actions is shown opposite.

Contact Dalair's Service and Maintenance department ([dsm@dalair.co.uk](mailto:dsm@dalair.co.uk)) for detailed maintenance and repair procedures.

## 11.2 FAULT-FINDING TABLE

Symptoms	Potential causes	Checks & corrections	Notes
Unit not operating No power	Main or local isolation off	Check all isolators from mains to unit	Check for loose wires
	Fuse or fuses failed.	Check all fuses in the mains Replace blown fuses after correcting the fault	
Unit not operating Power on	Unit not switched on	Switch on	Do not link out without the customers' written consent.
	External interlock fault	Investigate and correct	
	Control MCB tripped	Reset MCB after investigating and correcting the fault	
	A loose wire in the control circuit	Investigate and tighten wires	
Motor runs but no volume	The fan motor overload tripped.	Reset after investigating power wiring and MCB If it trips again, check the motor and contactor	Disconnect the motor from the wiring to enable the motor winding to be checked.
	Broken belts or drive pulleys lose.	Check drive belt and pulley security	Replace damaged belts
Water is evident in the AHU casing.	Insufficient depth of condensate trap	Check static differential pressure at component and rectify trap depth to suit	Ensure multiple drain traps are individually trapped. Drain traps must not be connected to each other. Check also for damper malfunction on the air inlet. Also, ensure that the BMS control system, where fitted, has been set up and is operating correctly.
	Blocked filters affecting the water seal in the trap	Change filters	
	AHU performance may be above design, creating high air velocity through the cooling coil and moisture carry-over	Recheck AHU performance and adjust as necessary	
Motors constantly trip out and run at excessive current	The humidification system may be over-humidifying, resulting in excessive moisture.	Investigate and, if necessary, recommission the humidification system	
	System design over volume or pulleys incorrectly selected	Isolate unit and refer to Dalair for advice	