

BPS V/T-ES

Vertical Boxer Packaged Solution with Ecosmart Classic Control (ES) Installation and Maintenance Manual



1.0 IMPORTANT SAFETY INFORMATION

- The provision of the electrical supply and the connection of the unit to the mains must be carried out by a qualified electrician.
- Isolate from power supply before removing any covers. During installation / maintenance ensure all covers are fitted before switching on the mains supply.
- All-pole disconnection from the mains as shown in the wiring diagram must be incorporated within the fixed wiring and shall have a minimum contact separation of 3mm in accordance with latest edition of the wiring regulations.
- This unit must be earthed.
- Ducting must be securely fixed with screws to the spigot to prevent access to live parts. Duct runs terminating close to the fan must be adequately protected by suitable guards.
- If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.
- Precautions must be taken to avoid the back-flow of gases into the room from the open flue of gas or other fuel-burning appliances.
- This appliance should not be used by children or persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning the safe use of the appliance by a person responsible for their safety. Children shall not play with the appliance. Cleaning and user maintenance shall not be carried out by children.

1.1 HAZARD SYMBOLS



GENERAL WARNING

Signifies a general warning regarding hazard specified by supplementary information.



ELECTRIC SHOCK

This unit must be completely electrically isolated before any panels are removed. Check mains supply and control connections.



ROTATING PARTS

This unit contains fast moving rotational parts which may start automatically. It is the sole responsibility of the installer to adequately guard these components.



REFER TO INSTRUCTION MANUAL

Read and understand the installation and maintenance manual before installing, operating or maintaining this product.

1.2 IMPORTANT INFORMATION

This manual contains important information on the safe and appropriate assembly, transport, commissioning, operation, maintenance, disassembly and simple troubleshooting of the product.

While the product has been manufactured according to the accepted rules of current technology, there is still a danger of personal injury or damage to equipment if the following general safety instructions and the warnings contained in these instructions are not complied with.

- **Read these instructions completely and thoroughly before working with the product.**
- **Keep these instructions in a location where they are accessible to all users at all times.**
- **Always include the operating instructions when you pass the product on to third parties.**

1.3 PERSONAL PROTECTIVE EQUIPMENT

The following minimum Personal Protective Equipment (PPE) is recommended when interacting with Nuaire products:

- **Protective Steel Toed Shoes:** When handling heavy objects.
- **Full Finger Gloves (Marigold PU800 or equivalent):** when handling sheet metal components.
- **Semi Fingerless Gloves (Marigold PU3000 3DO or equivalent):** when conducting light work on the unit requiring tactile dexterity.
- **Safety Glasses:** when conducting any cleaning/cutting operation or exchanging filters.
- **Reusable Half Mask Respirators:** when replacing filters which have been in contact with normal room or environmental air.

Nuaire would always recommend a site specific risk assessment by a competent person to determine if any additional PPE is required.

2.0 INTRODUCTION

The information contained in this document provides details of installation, operation and maintenance for installers and users of the BOXER PACKAGED SOLUTION (BPS) AHU units with heat recovery.

The BPS AHU range, is manufactured from Magnelis corrosion resistant steel, with 50mm double skinned panels and anodized aluminium frame of a totally thermally-broken design, complying with the following specification in accordance with BS EN 1886: Mechanical strength, D1; Leakage class, L1; Thermal transmittance, T2; Thermal bridging, TB1.

This range includes high efficiency centrifugal fans with EC motors, a high efficiency thermal wheel or plate heat exchanger, G4 pre-filtration and F7 main filtration of the supply air and M5 filtration of the extract air.

Optional heating (LPHW or Electric) model variants are available. Ancillaries including but not limited to attenuators, dampers, weather terminals and frost modules are available from Nuaire.

These units are supplemented with the Ecosmart Classic (ES) control platform. General information regarding performance and specification for the equipment is available via our technical literature, and/or project specific documentation.

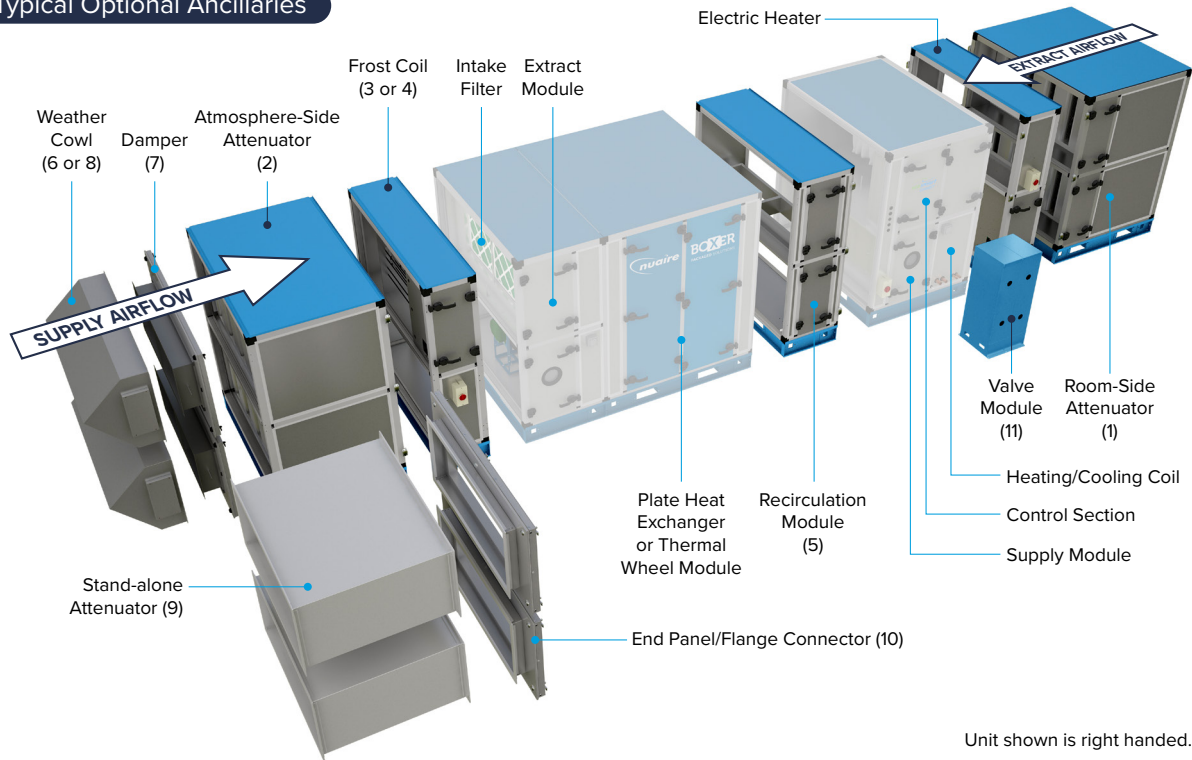
2.1 CODE DESCRIPTION:

1	2	3	/	4	5	/	6	-	7
B	17	V	/	L	N	/	ES	-	L

- | | |
|---|---|
| 1. Range: | B = Boxer Packaged Solution |
| 2. Unit Size: | 07, 12, 17, 22, 32 or 42
(size 07 is not Passivhaus certified) |
| 3. Heat Recovery Type: | T = Thermal Wheel
V = Vertical Plate Exchanger
(Passivhaus = Thermal Wheel only) |
| 4. Heating Type: | E = Electric
L = Low Pressure Hot Water (LPHW)
N = No Heating |
| 5. Cooling Type: | N = No Cooling |
| 6. Control Type: | ES = Ecosmart Classic |
| 7. Access Handing
(in direction of supply airflow) | L = Left Hand
R = right Hand |

3.0 OPTIONAL ANCILLARIES

Fig 1: Typical Optional Ancillaries



3.1.1 TABLE OF OPTIONAL RIGHT HANDED ANCILLARIES

The **-R** in the codes below signifies to a right handed ancillary. For left handed unit codes, simply change **-R** to **-L**. Where there is no **-R** in the code the ancillary is suitable for both handings.

Ancillary Type	Code	Description
1 Room-side Attenuator	B**AT/AR900-R	Attenuator for supply/extract, right handed, for thermal wheel units.
	B**AV/AR900-R	Attenuator for supply/extract, right handed, for vertical PHX units.
2 Atmosphere-side Attenuator	B**AT/AA900-R	Attenuator for intake/exhaust, right handed, for thermal wheel units.
	B**AV/AA900-R	Attenuator for intake/exhaust, right handed, for vertical PHX units.
3 Electric Frost Coil	B**AT/FE-R	Electric frost coil, right handed, for thermal wheel units.
	B**AV/FE-R	Electric frost coil, right handed, for vertical PHX units.
4 LPHW Frost Coil	B**AT/FL-R	LPHW frost coil, right handed, for thermal wheel units.
	B**AV/FL-R	LPHW frost coil, right handed, for vertical PHX units.
5 Recirculation Module	B**AT/RM-R	Recirculation module, right handed, for thermal wheel units.
	B**AV/RM-R	Recirculation module, right handed, for vertical PHX units.
6 Weather Terminal	B**AT/FRT	Weather terminal, for thermal wheel units.
	B**AV/FRT	Weather terminal, for vertical PHX units.
7 Inlet/Outlet Damper	B**AT/FD-R	Inlet/outlet dampers suitable for right handed thermal wheel units.
	B**AV/FD-R	Inlet/outlet dampers suitable for right handed vertical PHX units.
8 Weather Terminal & Inlet/Outlet Damper	B**AT/FRTD-R	Weather terminal & damper, right handed, for thermal wheel units.
	B**AV/FRTD-R	Weather terminal & damper, right handed, for vertical PHX units.
9 Stand-alone Attenuator	B**A/V-900	Single, 900mm long, in-line attenuator (Requires respective flange connector (10)).
	B**A/V-1200	Single, 1200mm long, in-line attenuator (Requires respective flange connector (10)).
10 End panel/Flange Connector	B**AT/F-R†	End panel & flange connector with Mez flange connection for thermal wheel units.
	B**AV/F-R†	End panel & flange connector with Mez flange connection for vertical PHX wheel units.
11 Valve Control Module	B**A/VM-C	PICV valve/actuator set module for chilled water cooling coils.
	B**A/VM-F	PICV valve/actuator set module for LPHW frost coils.
	B**A/VM-L	PICV valve/actuator set module for LPHW heating coils.
	B**A/VM-LC	PICV valve/actuator set module for both chilled water cooling & LPHW heating coils.

** Insert relevant BPS unit size for the matching ancillary.

† Size 07 & 12 end panel/flange connectors are not handed and therefore suitable for both handings.

4.0 DELIVERY & RECEIPT OF EQUIPMENT

All equipment is inspected prior to despatch and leaves the factory in good condition. Upon receipt of the equipment an inspection should be made and any damage indicated on the delivery note.

Particulars of damage and/or incomplete delivery should be endorsed by the driver delivering the goods before offloading by the purchaser.

No responsibility will be accepted for damage sustained during the offloading from the vehicle or on the site thereafter.

All claims for damage and/or incomplete delivery must be reported to Nuaire within two days of receipt of the equipment.

4.1 UNIT OFFLOADING AND HANDLING

The weight of unit modules and palletised items is displayed on the packaging. Some of the modules have an uneven weight distribution and this will be indicated by labelling where appropriate.

Offloading and positioning of the equipment is the responsibility of the purchaser, and should only be performed by competent personnel following an appropriate risk assessment.

To ensure that the delivery vehicle is loaded according to the planned method of offloading, Nuaire must be notified to ensure coordination. When offloading, care must be taken to ensure that the AHU is kept level at all times.

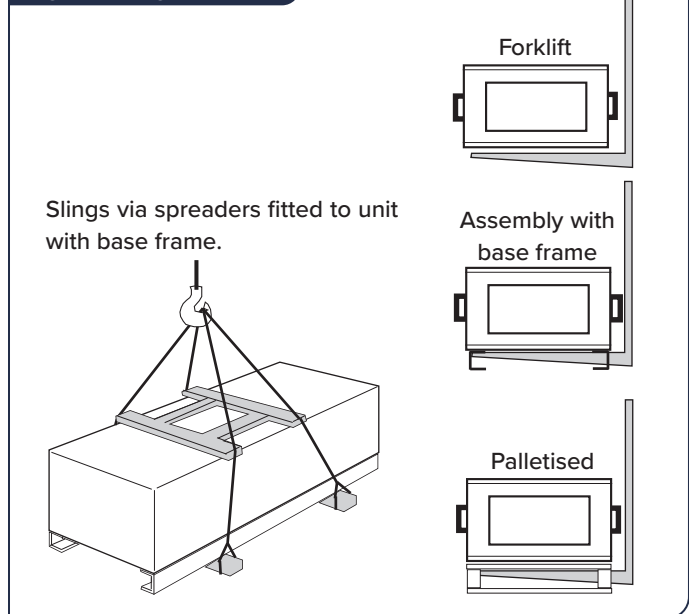
To ensure that no roof damage occurs additional timber packaging must be used.

4.2 BASE FRAME LIFTING POINTS

When units are constructed of multiple modules each module will have it's own individual base frame, which is then connected to the next to assemble the full system. **Only individual modules should be lifted or manoeuvred. The units must not be lifted or manoeuvred pre-assembled.**

All base frame sections will have 50mm square lifting holes at the end of each side to enable lifting. In addition to this, covered fork lifting channels are located across the width of the base frame, if the module length is sufficient to allow this. For shorter modules the fork lifting points will be along the length of the section, without a covered channel (Fig 3).

Fig 2: Lifting Methods



4.3 UNIT PACKAGING

Unless otherwise specified, unit sections will be delivered to site covered in "shrink wrap" polythene, which should provide a more than adequate level of protection against inclement weather.

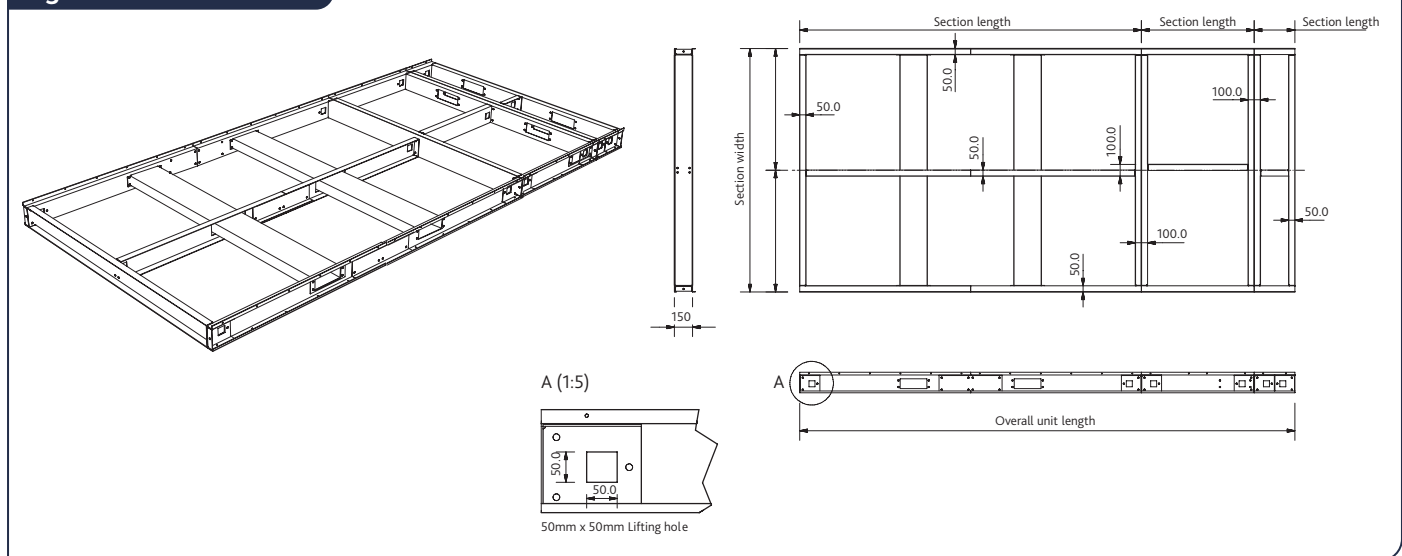
Should alternative methods of unit protection be required (i.e. timber, Corex, or flame retardant materials), Nuaire Limited should be notified of the specific requirements at the pre- contract stage. Waste must be disposed of by a registered waste carrier in accordance to national regulations.

4.4 UNIT STORAGE

The equipment must be stored in a dry, internal location. Ductwork connection apertures should be sealed against the ingress of dust, water and vermin. Note that units that are intended for external locations are generally not fully weatherproofed until their installation, including ductwork connections, is complete.

If the storage period is to exceed two months, contact Nuaire for guidance on the appropriate 'mothballing' procedures. Do not stack units, modules or components.

Fig 3: Base Frame Detail



5.0 UNIT ACCESS

Fig 4: Unit Access



In this product range, several unique concepts have been implemented with a view to simplifying the installation design.

- The unit must be installed with at least 600mm clearance from a wall/barrier. With this absolute minimum clearance, the unit may be connected to the power supply and control connection.
- With this clearance, unit filters may be changed, and the fans coils, heat exchanger and condensate tray may be inspected and cleaned if necessary.
- The LPHW and Electrical heater settings, coil bleed and drain, and all other control adjustments are similarly accessible.
- Side access, where possible, is preferred in all cases in terms of safe working access to the equipment under the CDM regulations.
- Note however, that access in the situation is difficult and additional time should be allocated. For convenience it is preferred that wherever possible, this minimum access provision is not adopted, and it is recommended that a minimum of around 600mm clearance (as stated in ADF 2010) is allowed.
- Where these arrangements are not suitable, the Consultant's and Contractor's project specific requirements will always be accommodated where possible.

5.1 HINGED / REMOVABLE PANEL ACCESS

All hinged access panels will be lockable and removable via locked hinges which can be opened for panel removal. All keys are identical and will open any handle or hinge.

The hinges do not need to be unlocked in normal operation of opening and closing.

Fig 5: Access Panel (Hinged)

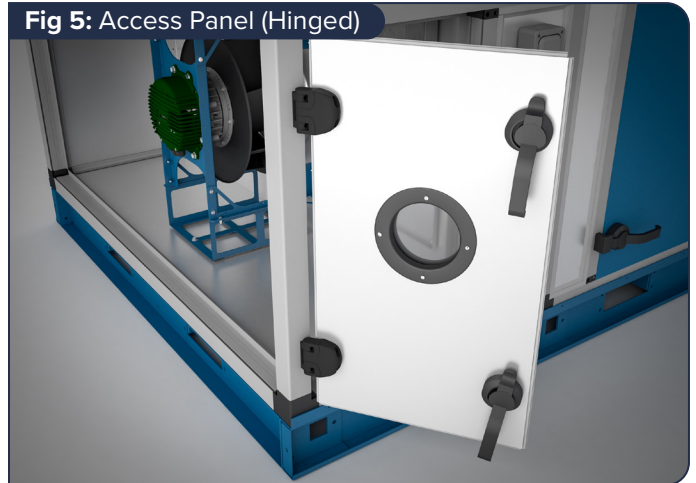
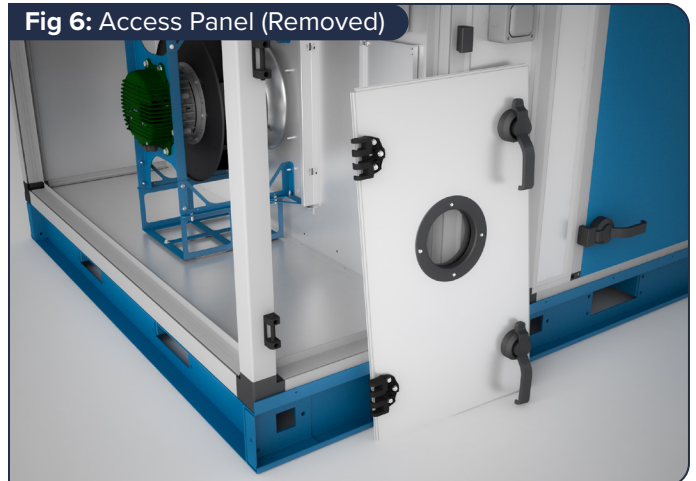


Fig 6: Access Panel (Removed)



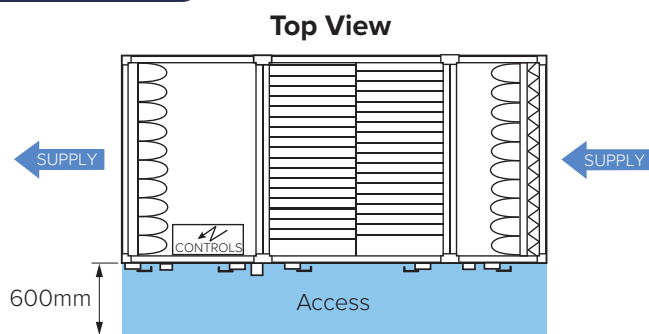
5.2 ACCESS AREAS

5.2.1 LEFT HANDED PLATE HEATER EXCHANGER UNITS

Fig 7: Access Panels and Airflow Direction



Fig 8: Top View

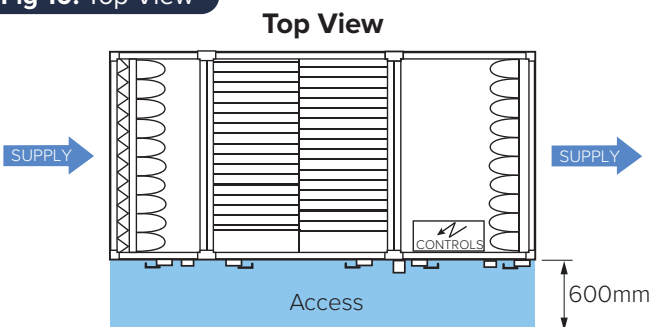


5.2.2 RIGHT HANDED PLATE HEATER EXCHANGER UNITS

Fig 9: Access Panels and Airflow Direction



Fig 10: Top View

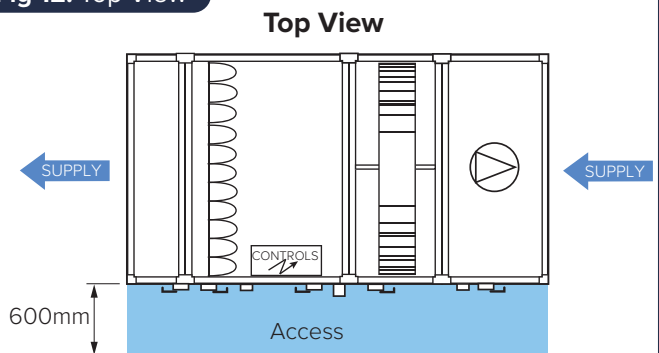


5.2.3 LEFT HANDED THERMAL WHEEL UNITS

Fig 11: Access Panels and Airflow Direction



Fig 12: Top View

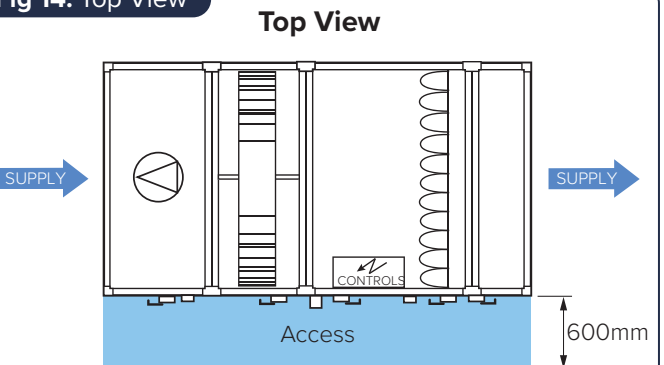


5.2.4 RIGHT HANDED THERMAL WHEEL UNITS

Fig 13: Access Panels and Airflow Direction



Fig 14: Top View



6.0 MECHANICAL INSTALLATION

Installation must be completed by competent persons, in accordance with good industry practice and should conform to all governing and statutory bodies i.e. IEE, CIBSE, etc.

The unit should stand upright and level on the floor, foundation or supporting steelwork which should be rigid, flat and level and should be capable of supporting the weight of the unit including water or refrigerant in the coils. Nuaire takes no responsibility for the coordination of support.

6.1 UNIT LOCATION

To prevent possible reintroduction of contaminated air through the outside air intake, the unit should be located away from building flue stacks or exhaust ventilators.

Once assembled and in position, sufficient free space must be available adjacent to the unit for future inspection, maintenance, component service, repair and replacement and connection of services. It is recommended that at least the unit width (vertically arranged units) + 100mm be allowed. A minimum of 600mm is required for regular maintenance.

Sufficient clearance for U-traps on condensate drain and overflow connections should also be considered by the purchaser.

6.2 AIR LEAKAGE

Loading, transportation, off loading and site positioning can cause the air handling unit structures to move, therefore panel seals will not always remain fully intact.

It is inevitable that in such cases, re-sealing of the units panels and joints may have to be carried out on site for the air-handling units to achieve the required leakage classification. Door locking mechanisms may also have to be adjusted.

Nuaire cannot be held responsible for the units failing a site leakage test if the above have not been carried out correctly.

6.3 MODULE JOINTS

After unwrapping, temporarily remove the rubber weatherproof cover strip and M10 base frame bolts from any modules and store in a safe location for later use.

Apply the sealing gasket as necessary to the mating faces of the unit frames. Typically the sealing gaskets are pre-fitted to the heat exchanger module; ancillary modules will be provided with a roll of sealing gasket for on-site fitting.

Make the unit joints in the following order:

- Left and right hand side M10 bolts between the modules' base frames (Fig 15).
- Left and right hand side M6 Lower 3-axis alignment clamps (Fig 16).
- Left and right hand side M6 Middle 3-axis alignment clamps.
- Left and right hand side M6 Upper 3-axis alignment clamps.

Air leakage, air blow marks to the unit casings and unacceptable noise levels could result if the correct installation procedures are not employed.

Prior to making the unit joints, you must ensure the base frames of adjoining modules are fully touching along the width of the unit. Failure to do so can result in deformation of the unit frame when using the three axis alignment clamps.

Fig 15: M10 Modular Base Frame Connection Bolt

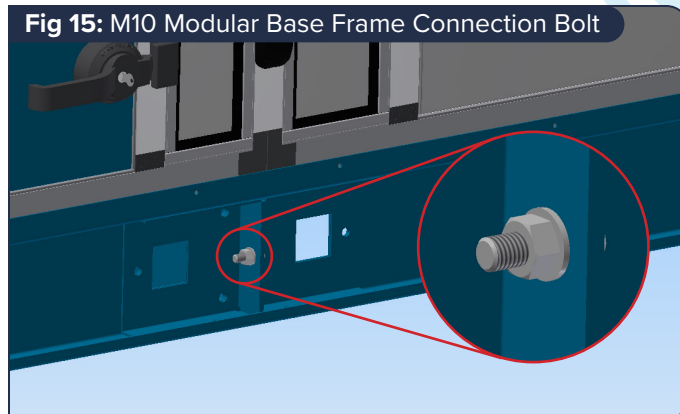


Fig 16: 3-Axis Clamp (Intelliclamp)



6.4 INTERNAL CONNECTIONS

There are a number of internal connections that need to be completed prior to starting/commissioning the unit. These consist of all the wiring connections and the condensate hose (plate heat exchanger option only).

Please ensure that the condensate hose is connected between modules. Care must be taken to ensure a constant fall in gradient is maintained and the hose is kept taut (Fig 17).

Access is available in the fan plate to allow electrical/wiring connections to be made between modules (Fig 18).

When making the wiring connections, the sensor loop (Fig 19) must be removed and relocated to the end of the unit.

Fig 17: Condensate Hose Connection

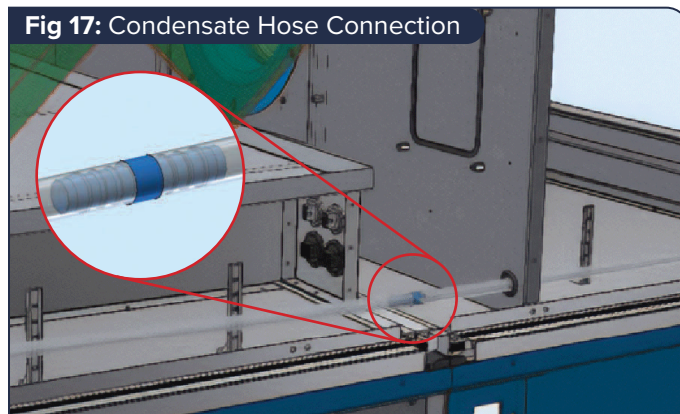
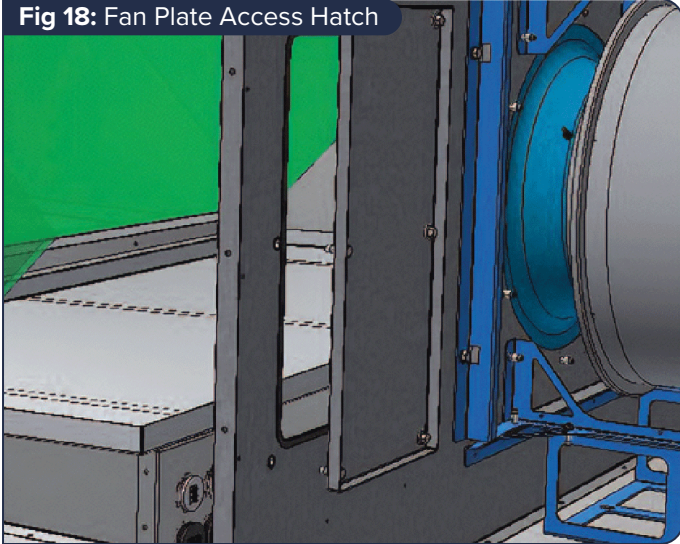
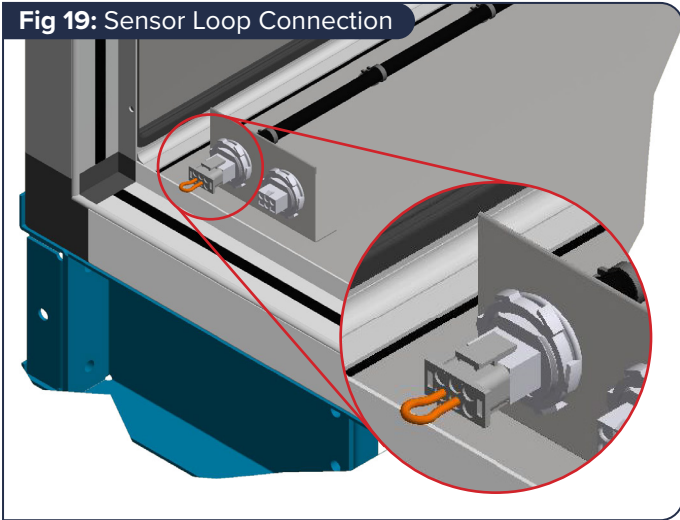


Fig 18: Fan Plate Access Hatch**Fig 19: Sensor Loop Connection**

6.5 CONDENSATE DRAIN

Plate heat exchanger components and modules that incorporate cooling coils may produce condensation during use. An insulated drip tray and condensate pump is provided where necessary. The drain connection must be connected to a suitable drainage point.

Condensate pump specification:

Maximum flow rate = 50 L/H

Maximum head = 20m Vertical, 100m Horizontal

Pipe Size (Low Pressure Condensate connection) = 8mm

6.6 THERMAL WHEEL DRIVE / BELT TENSION

Thermal wheel modules can be delivered with transport packing blocks, ensure any transport blocks are removed prior to operation of the thermal wheel.

The thermal wheel belt is unhooked to prevent the thermal wheel belt from stretching during transportation.

The thermal wheel motor is attached via a hanging motor bracket. To install the belt lift the spring motor upwards, hook the belt onto the pulley and slowly release the motor.

Ensure that the rotation sensor is aligned with the sensing studs, as this can become misaligned during transport/installation thus causing a fault signal.

6.7 WEATHER RESISTANT UNITS

The units are supplied in multiple sections and have weather resistant roof components that must be fitted and sealed after the unit sections are bolted together. All necessary fixings are supplied with each unit and are normally bagged and located within the fan section. Suitable mastic sealant is to be provided by others. Where the weatherproof roof assembly of two sections meet, the metal hinged weatherproof cover strip must be closed to seal the seam between unit sections and fixed with the bolts provided.

The equipment must not be exposed to the weather in an unassembled or partially assembled state. All weather terminal, ductwork, sealing and assembly work must be completed before the unit can be considered weather resistant.

6.8 UNIT CONNECTIONS

6.8.1 DUCTING

Nuaire do not provide ductwork connections with units, instead the open ended framework should be utilised. Flanged connections are available as an option, refer to technical documents for information relating specifically to the manufactured unit.

6.8.2 COIL

When connecting coils, special care is needed to allow for expansion and contractions. Prior to any equalising connection, ensure that the thermostatic expansion valve for the DX coil is securely fitted.

Additional care must be taken when using R32 or other flammable refrigerants: your commissioned system must comply with the requirements of BS EN 378. Units must be fitted with gas detection systems (or deploy other suitable control method) to ensure that, in the event of a refrigerant leak, the Lower Flammability Limit is not exceeded.

Each coil section should be trapped and special care should be taken to ensure that there are no vertical rising condense lines, unless pumped.

Wet pipe connections sizes are listed in the table below.

Care should be taken to ensure that all pipework is adequately supported, therefore ensuring that no additional weight is added to the unit. Extra precaution should be taken to prevent pipe damage on site, as the fragile pipework will protrude from the side of the unit.

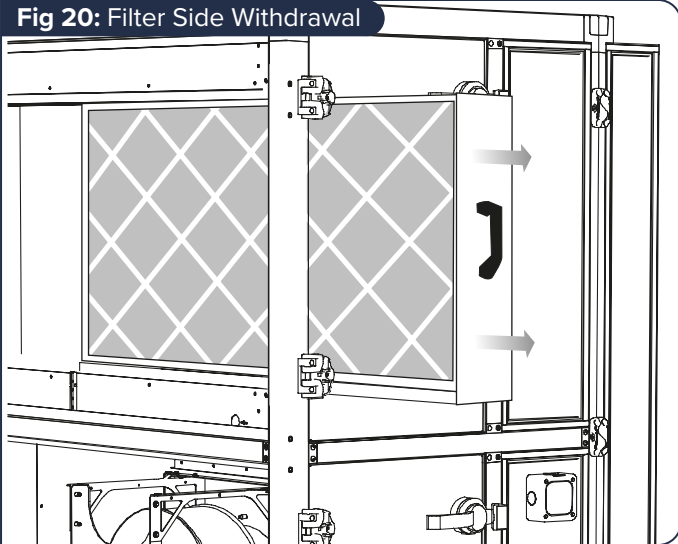
If a frost coil is not fitted then appropriate control methods must be taken to prevent the coils, filters and other equipment from freezing (by others).

6.8.3 COIL CONNECTION SIZES

Unit Size	Frost coil (LPHW)		Heating coil (LPHW)		Cooling coil (CW)	
	Flow	Return	Flow	Return	Flow	Return
07	22mm	22mm	35mm	35mm	28mm	28mm
12	22mm	22mm	35mm	35mm	28mm	28mm
17	22mm	22mm	35mm	35mm	35mm	35mm
22	22mm	22mm	35mm	35mm	35mm	35mm
32	28mm	28mm	54mm	54mm	42mm	42mm
42	35mm	35mm	42mm	42mm	42mm	42mm

6.9 FILTERS

Fig 20: Filter Side Withdrawal



6.9.1 FILTER REMOVAL

Filters will be provided in banks on suitable slide rails, so that they can be withdrawn from the access side of the unit. Differential “Dirty Filter” pressure switches are fitted as standard.

6.9.2 SPARE FILTERS

If specified with order, spare sets of filters will be provided and should be stored in a clean, dry environment. Should you require spare filter media, please contact Nuaire.

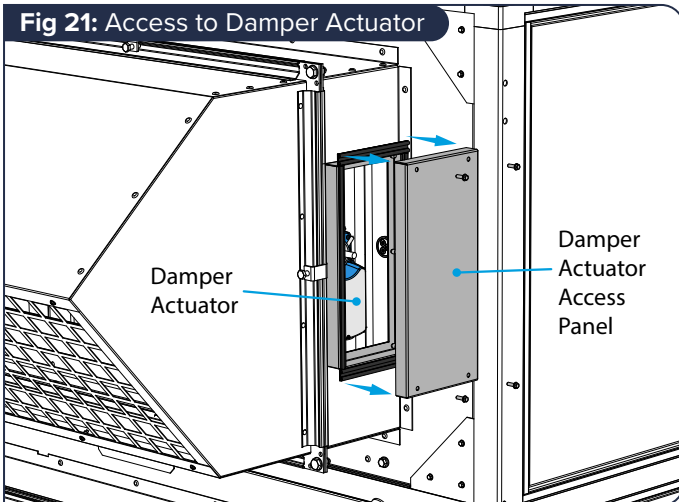
6.10 CONTROL DAMPERS

Care should be taken to ensure that all spring return actuators have stopped running and completed their stroke. If not, the connection needs to be loosened and the actuator should be left to drive until the motor stops running.

When the unit is powered, dampers should be checked to ensure that they operate freely and close tightly.

Where dampers are protected with a weather terminal, the weather terminal can be removed for access to the main damper. Access to the actuator can be from the side of the weather terminal without the requirement of removing the weather terminal (Fig 21).

Fig 21: Access to Damper Actuator



6.11 END PANEL ANCILLARIES

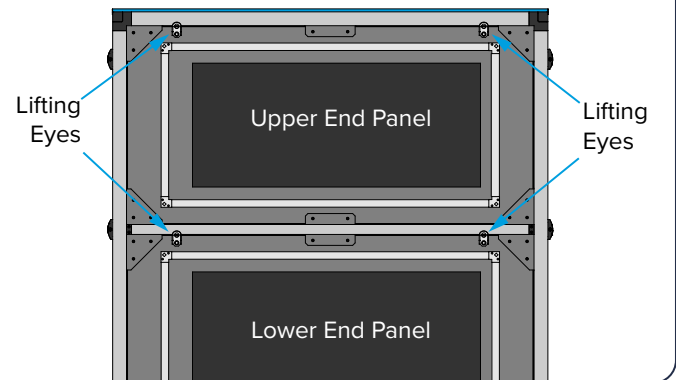
The inlet/outlet dampers, weather terminals and end panel/flange connectors are factory fitted for convenience.

For the larger sizes of BPS (Sizes 17, 22, 32 & 42) the end panels are provided with lifting eyes for on-site hoisting (if required).

6.11.1 END PANEL/FLANGE CONNECTOR REMOVAL

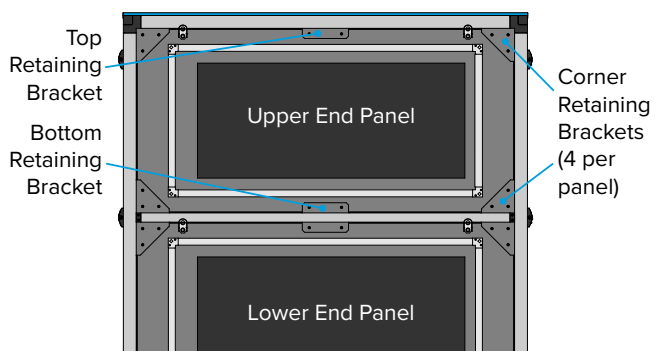
1. If lifting eyes provided (unit sizes 17-42), connect prior to any disassembly, to ensure weight is taken by lifting equipment.

Fig 22: Lifting Eye Position



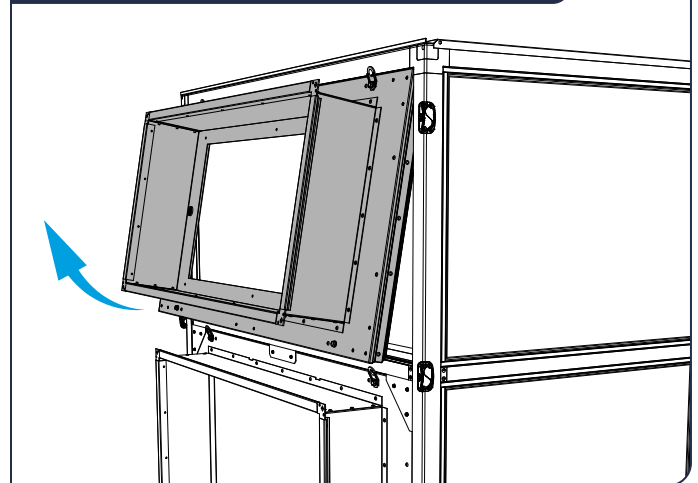
2. Remove the corner retaining brackets and top retaining bracket (see Fig 23).

Fig 23: End Panel Retaining Brackets



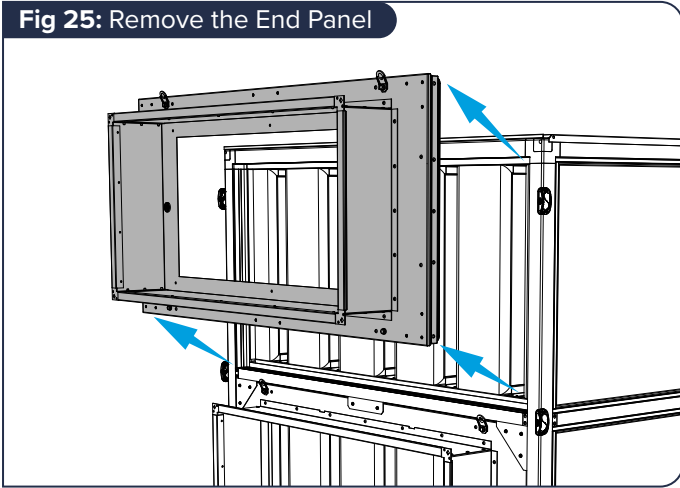
3. Remove the bottom retaining bracket (Fig 23) and pivot end panel from the top and drop to release retaining edge from the top frame (Fig 24).

Fig 24: Pivot the End Panel Out from the Top



4. Remove the end panel from the unit (Fig 25).

Fig 25: Remove the End Panel



6.11.2 WEATHER TERMINAL REMOVAL

1. Ensure appropriate lifting equipment in place to ensure weight is taken prior to disassembly.
2. Remove the Mez flange connections (clamps and corner bolts) to release the weather terminal (Fig 26 & Fig 27).

Fig 26: Weather Terminal Mez Flange Connections

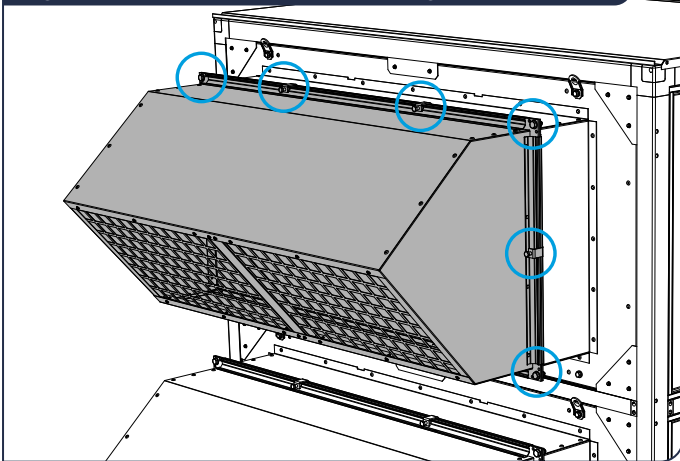
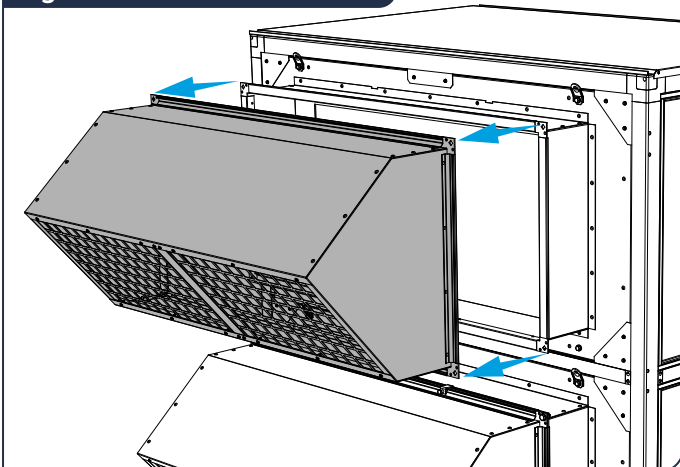


Fig 27: Remove Weather Cowl



6.11.3 INLET/OUTLET DAMPER REMOVAL

To remove the damper assembly, follow the steps provided in Section 6.11.1.

1. Once the damper assembly has been lowered, lay it with the flange connections facing down against the floor (Fig 28), using wooden blocks to support the smaller damper flange within (Fig 29).

Fig 28: Lay Damper Face-Down

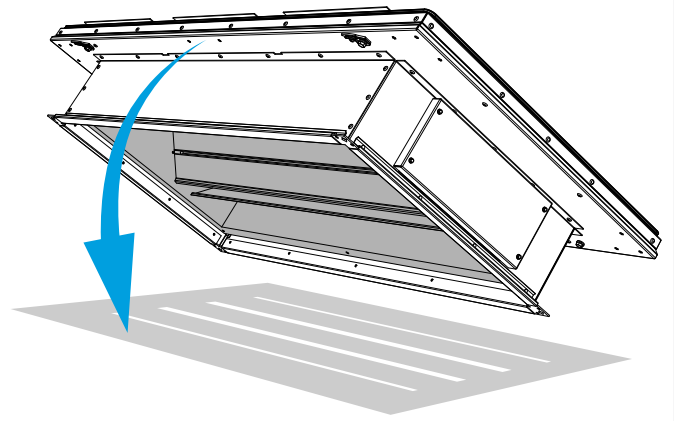
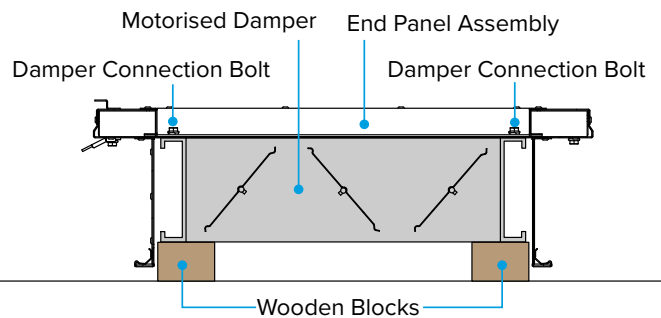
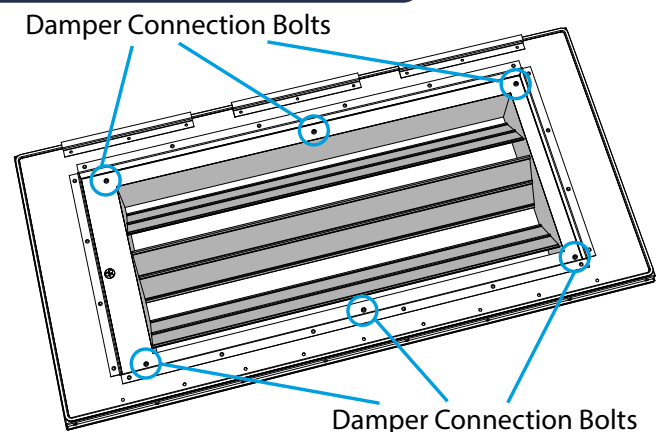


Fig 29: Use Blocks to Support Damper (Section View)



2. The connection bolts to the damper can be accessed from the rear and removed (Fig 30).

Fig 30: Damper Connection Bolts



3. To access/remove the damper actuator, remove the access panel on the side of the flange connector (Fig 21).

6.12 SUPPORTING ANCILLARY ITEMS

All ancillary items that are supplied without individual base frames require safe suitable support (supplied by others). This includes but is not limited to single attenuators, terminals and dampers etc.

6.13 INSTALLATION INSPECTION

- Thoroughly inspect the unit after installation is complete.
- The inside of the unit should be checked; any objects which may have been left should be cleared.
- Check fan impellers, scrolls and outlets.
- Remove any transit protection fittings that may be attached to the fan or motor base frame, and that all traps are primed.
- Check all access door seals for damage, and replace any panels that have been removed.

7.0 ELECTRICAL INSTALLATION

The electrical wiring must be carried out by competent persons, in accordance with good industry practice and should conform to all governing and statutory bodies i.e. IEE, CIBSE etc.

7.1 MAIN UNIT POWER SUPPLY

The control is powered by a 400Vac 50Hz 3 phase & Neutral supply. This must be isolated local to the unit and fitted with appropriate over-current and fault protection.

7.2 ELECTRIC HEATER POWER SUPPLY

For models with electric heating, the heating circuit is powered by 1 or 2 separate, higher current, 400Vac 50Hz 3 phase & Neutral supplies. This must be isolated to the unit and fitted with appropriate over-current protection. The main supply is still required. Electric heater elements are protected by a fail-safe over-temperature switch which will disconnect the heater supply if a temperature of 80°C is reached. Once the elements cool, the switch will reset but a power cycle is required to reset the heater supply contactor.

7.3 UNIT POWER SUPPLY DETAILS - FLC

Unit Size	Unit (FLC)	Unit with Electric Heater (Electric Heater Models Only)
B*07V/**ES	4.3 A	4.3 A + 17.5 A †
B*07T/**ES	8.3 A	8.3 A + 17.5 A †
B*12V/**ES	6.8 A	6.8 A + 35 A †
B*12T/**ES	12.52 A	12.52 A + 35 A †
B*17V/**ES	14.6 A	14.6 A + 52.2 A †
B*17T/**ES	18.6 A	18.6 A + 52.2 A †
B*22V/**ES	12.8 A	12.8 A + 52.2 A †
B*22T/**ES	16.8 A	16.8 A + 52.2 A †
B*32V/**ES	14 A	14 A + 35 A + 52.5 A ‡
B*32T/**ES	18 A	18 A + 35 A + 52.5 A ‡
B*42V/**ES	24.6 A	24.6 A + 52.5 A + 52.5 A ‡
B*42T/**ES	28.6 A	28.6 A + 52.5 A + 52.5 A ‡

* Denotes any Character.

† These heater models require a separate power supply for the electric heater section, with an appropriate over-current protection device.

‡ These heater models require two separate power supplies for the two (2) electric heater sections, each with an appropriate over-current protection device.

7.4 WIRING

All inter-connections between circuit boards, blowers and sensors are made at the factory. This diagram only shows the essential field wiring points for clarity.

Remove link wire if switched live signal, an enabler or BMS signal is connected.

If inlet and outlet dampers are fitted, remove the damper link wires. This will allow a 1 minute delay before starting the fans.

7.4.1 SWITCH LIVE

Switch Live (SL) terminal - A signal of 100-230V a.c. will activate the switch live signal.

Switch Live 2 (SL2) terminal - A signal of 100-230V a.c. will activate the switch live 2 (Fan Boost) signal.

A signal from an isolating transformer will produce an unpredictable result and is not recommended.

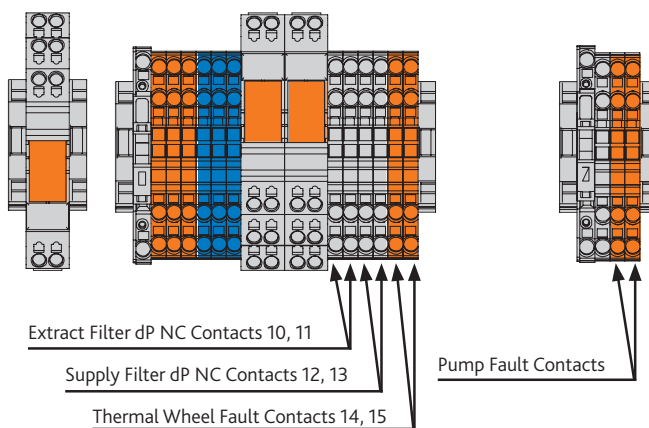
Extra low voltage versions of the switched live signals are also available. Link two contacts to activate the signal.

7.4.2 VOLT FREE CONTACTS

The volt free contacts are not fused. If these are used to power any external equipment, the installer must provide adequate fusing or other protections. These contacts are rated at 5A resistive, 0.5A inductive.

Run connections:	Contacts closed when fan is running.
Fault connections:	No Fault = contacts are closed. Fault = contacts are opened.
Heat demand:	Contacts closed when heating is selected.

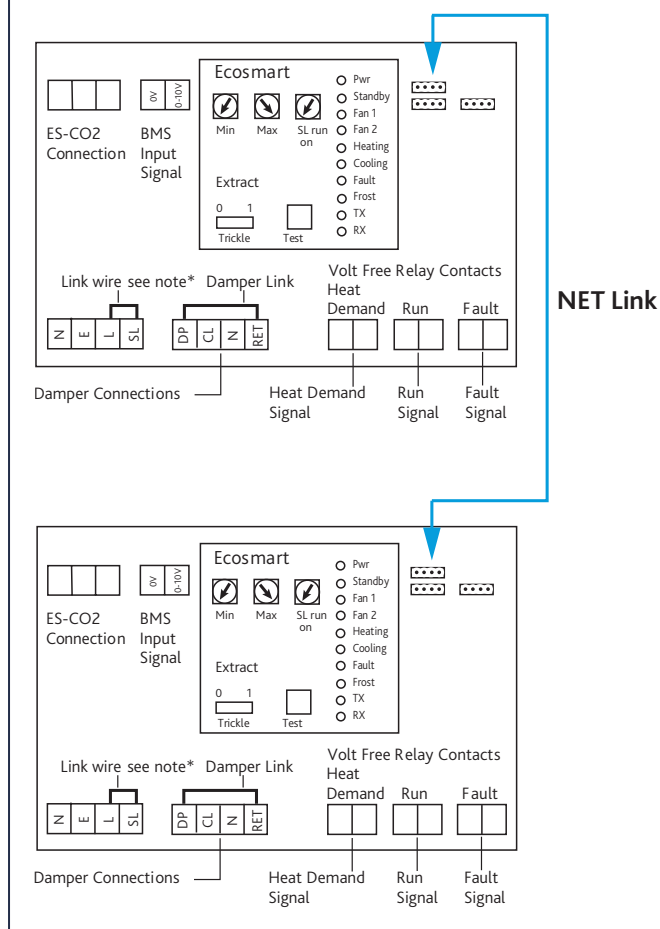
Fig 31: Volt Free Contact Wiring



7.4.3 INDEPENDENT SUPPLY & EXTRACT SPEED CONTROL

Remove NET link connection for independent speed control.

Fig 32: Speed Control NET Link



7.6 WIRING DIAGRAMS

All inter-connections between circuit boards, blowers and sensors are made at the factory. Remove link wire if switched live signal, an enabler or BMS signal is connected.

If inlet and outlet dampers are fitted, remove the damper link wires. This will allow a 1 minute delay before starting the fans.

A series of basic connection wiring diagrams have been provided to assist on-site wiring. In order to reference the relevant diagrams please use the code breakdown in section 2.1 to determine:

- Unit size
- If an electric heater is present
- If a LPHW heater is present

The below tables can then be used to reference the required connection and wiring diagrams.

Example:

Unit on site has code **B22V/EN/ES-L**. This indicates a size 22 unit with electric heating (see diagram in Fig 39).

7.6.1 WIRING DIAGRAM REFERENCE TABLE

Unit Size	Unit With No Heater	Unit with LPHW Heater	Unit with Electric Heater
07	Fig 34	Fig 36	Fig 38
12			
17	Fig 35	Fig 37	Fig 39
22			
32			Fig 40
42			

7.5 ISOLATOR WIRING POINTS

Main wiring points for the customer is to the isolators situated on the sides of the units as shown in Fig 33.

Cable glands are for additional ancillary cabling and are located on the sides of the units (Fig 33).

Fig 33: Isolator and Cable Gland Locations

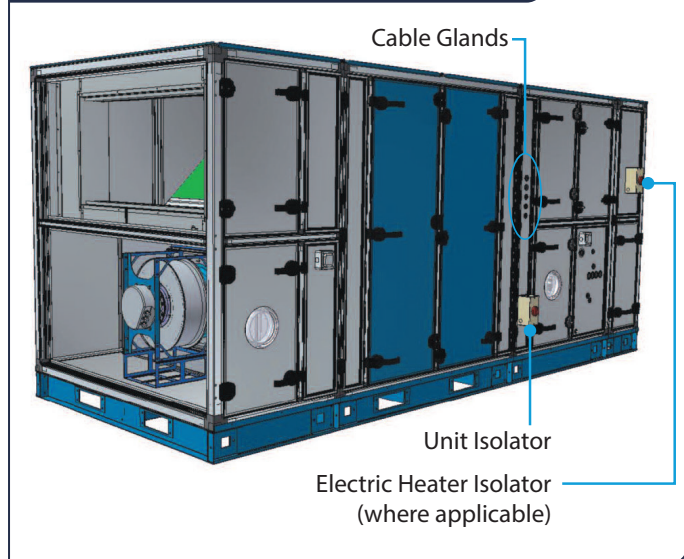


Fig 34: Unit Sizes 07 - 12 with No Heating Wiring Diagram**Key:**

Factory Connection

Customer Connection (Mandatory)

Customer Connection (Optional)

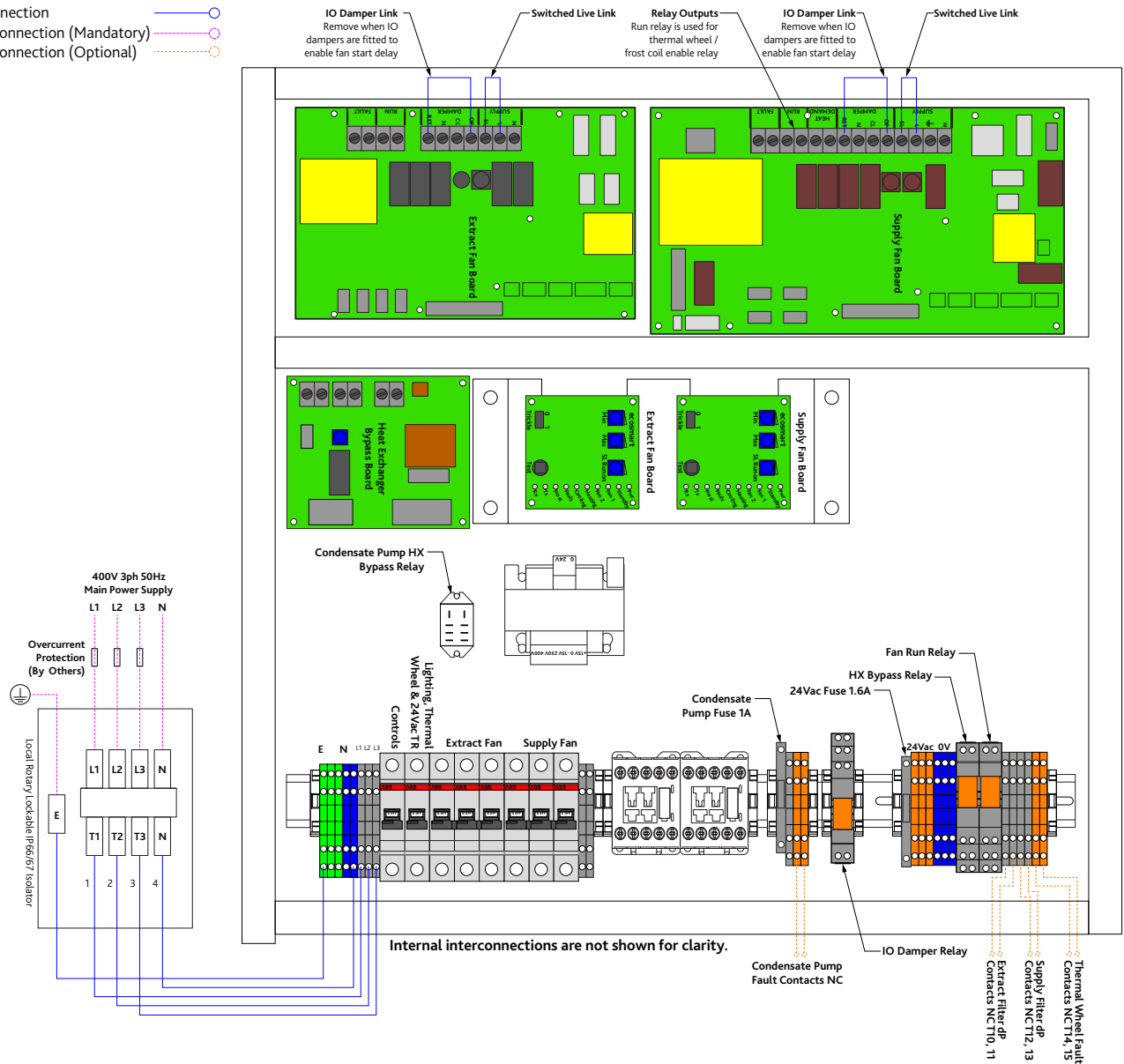


Fig 35: Unit Sizes 17 - 42 with No Heating Wiring Diagram**Key:**

Factory Connection

Customer Connection (Mandatory)

Customer Connection (Optional)

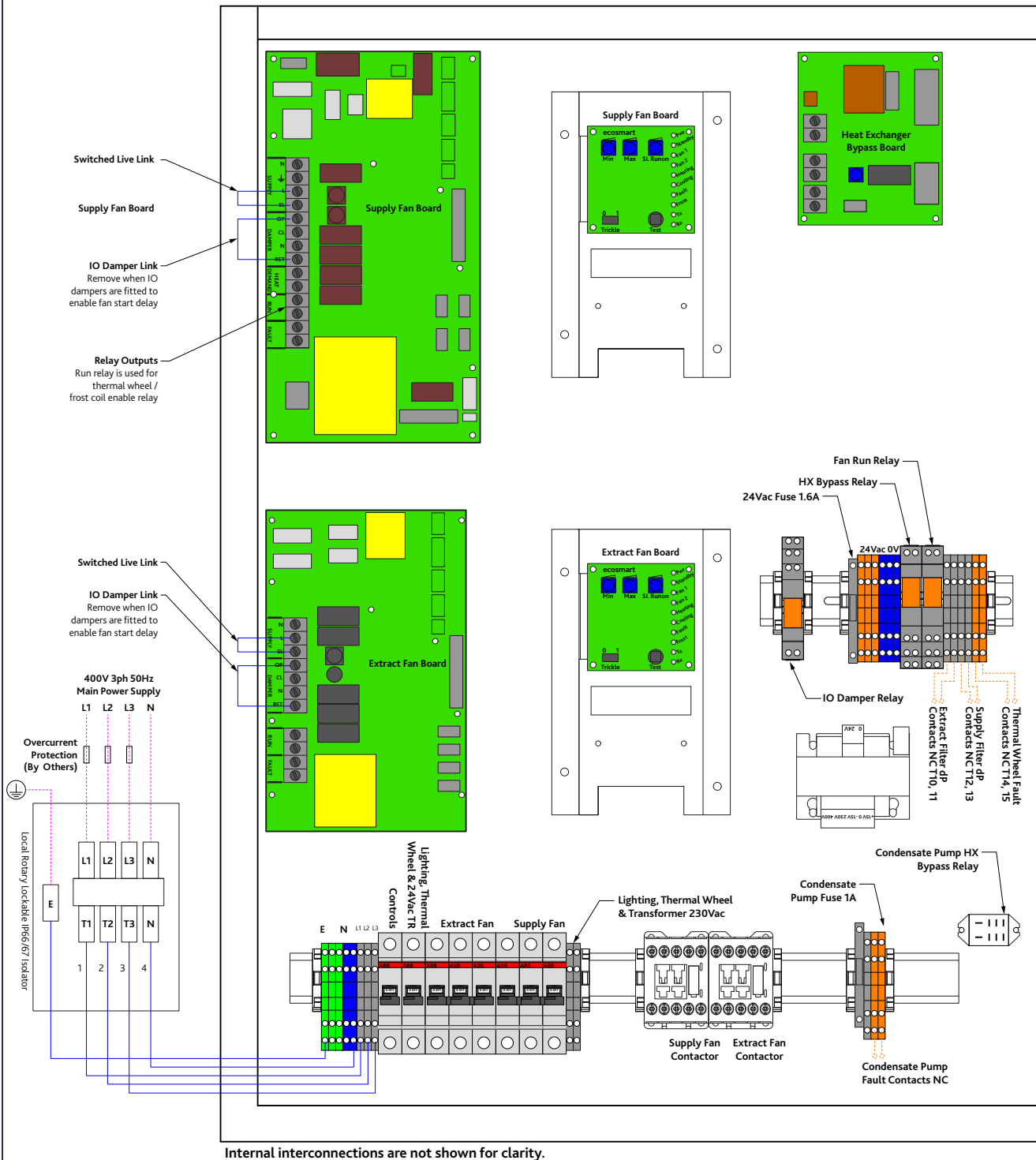


Fig 36: Unit Sizes 07 - 12 with LPHW Heating Wiring Diagram**Key:**

Factory Connection

Customer Connection (Mandatory)

Customer Connection (Optional)

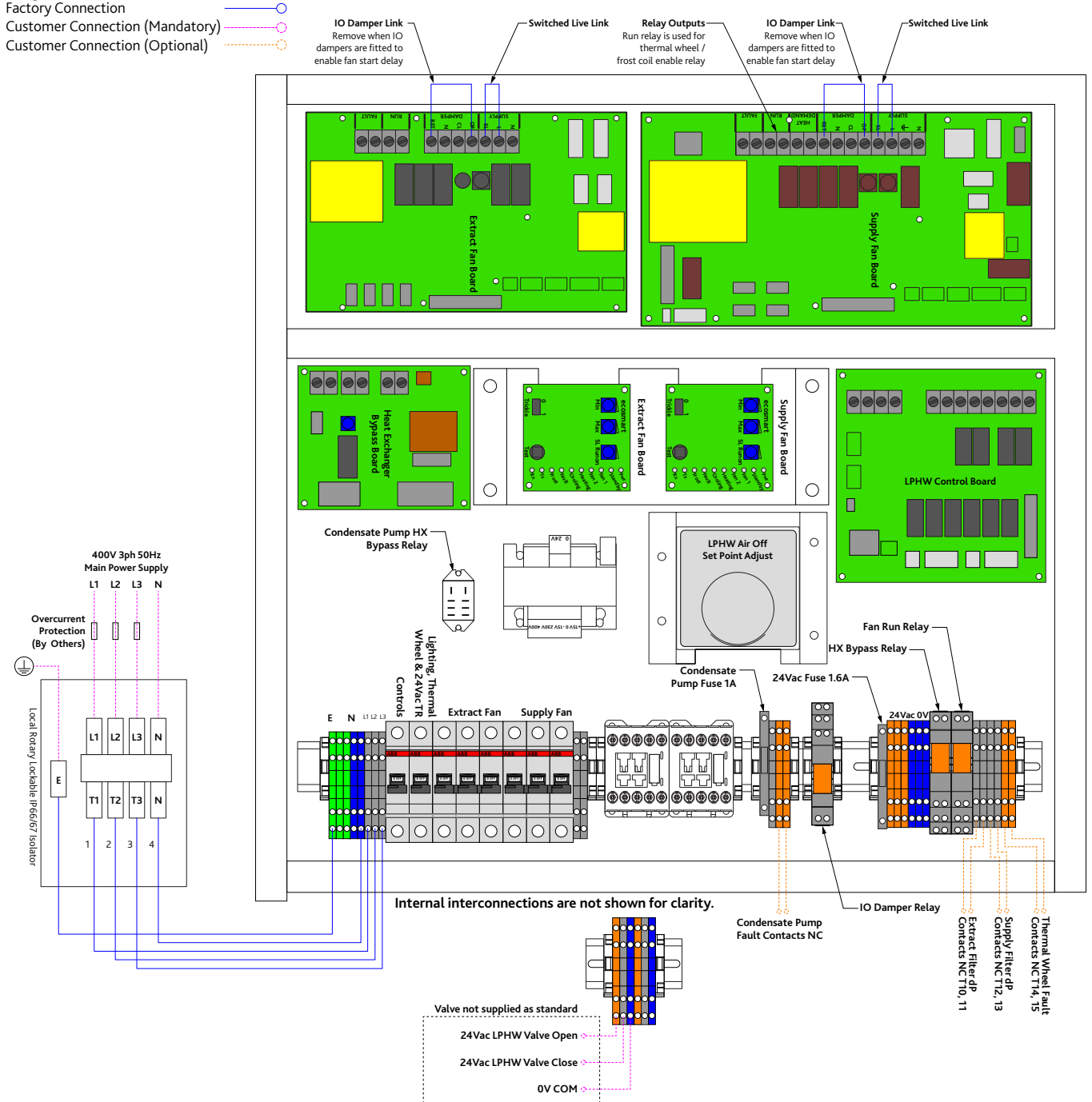
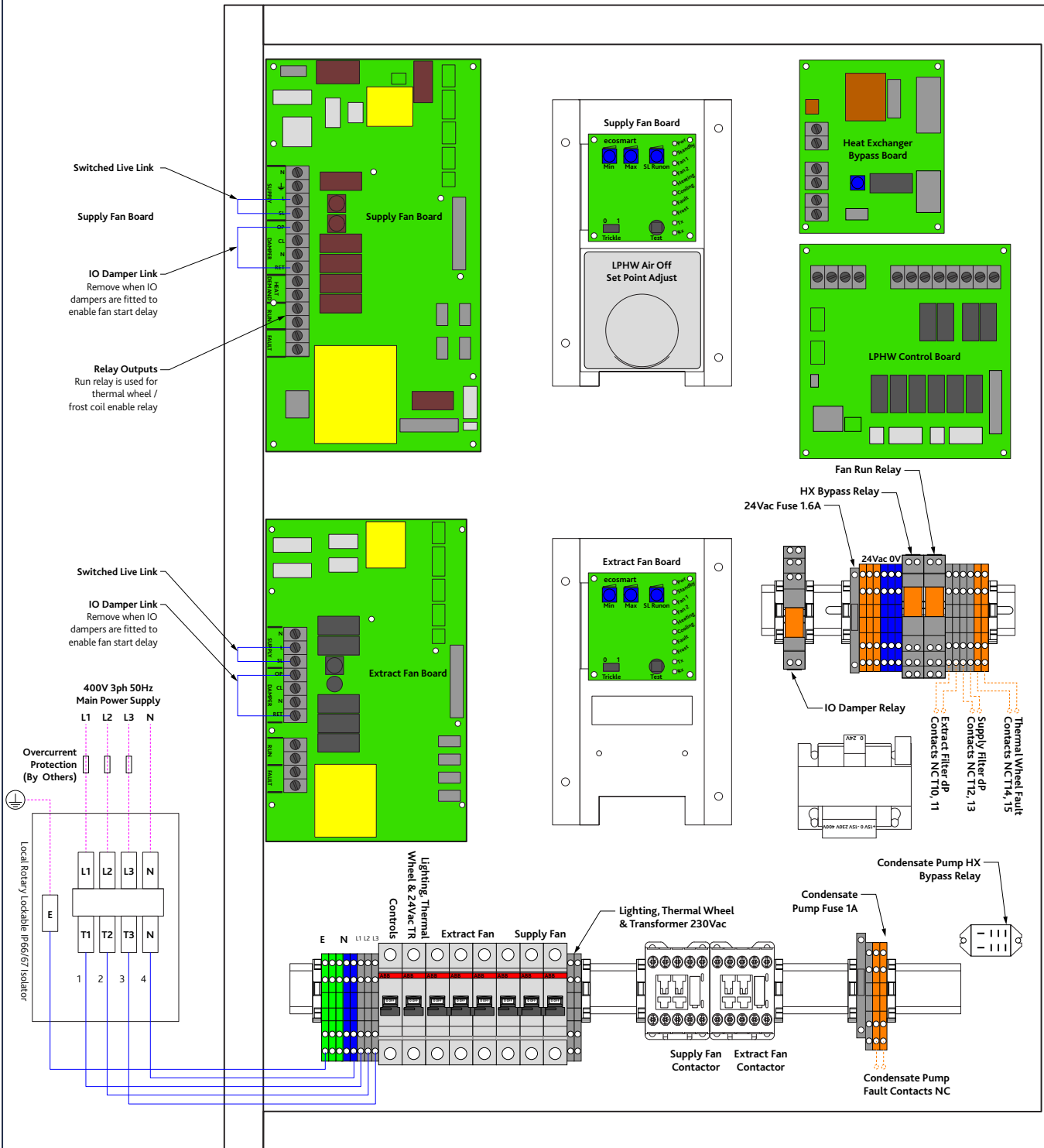


Fig 37: Unit Sizes 17 - 42 with LPHW Heating Wiring Diagram**Key:**

- Factory Connection ————○———
- Customer Connection (Mandatory) ————○———
- Customer Connection (Optional) ————○———



Internal interconnections are not shown for clarity.

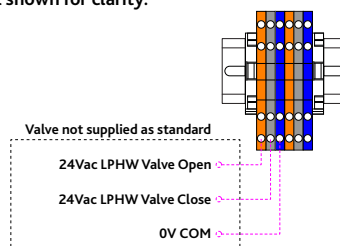


Fig 38: Unit Sizes 07 - 12 with Electric Heating Wiring Diagram**Key:**

Factory Connection

Customer Connection (Mandatory)

Customer Connection (Optional)

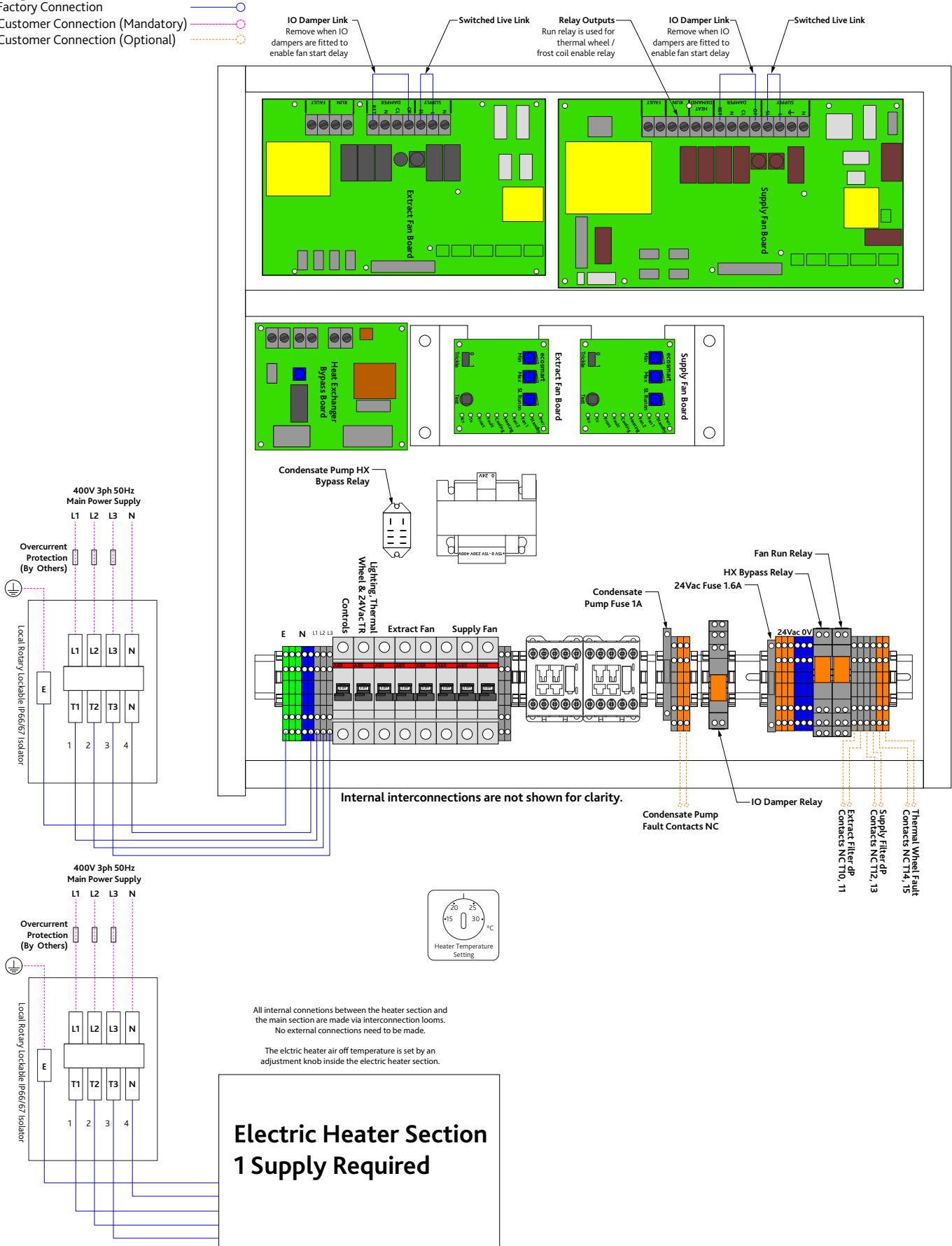





Fig 39: Unit Sizes 17 - 22 with Electric Heating Wiring Diagram**Key:**

- Factory Connection 
- Customer Connection (Mandatory) 
- Customer Connection (Optional) 

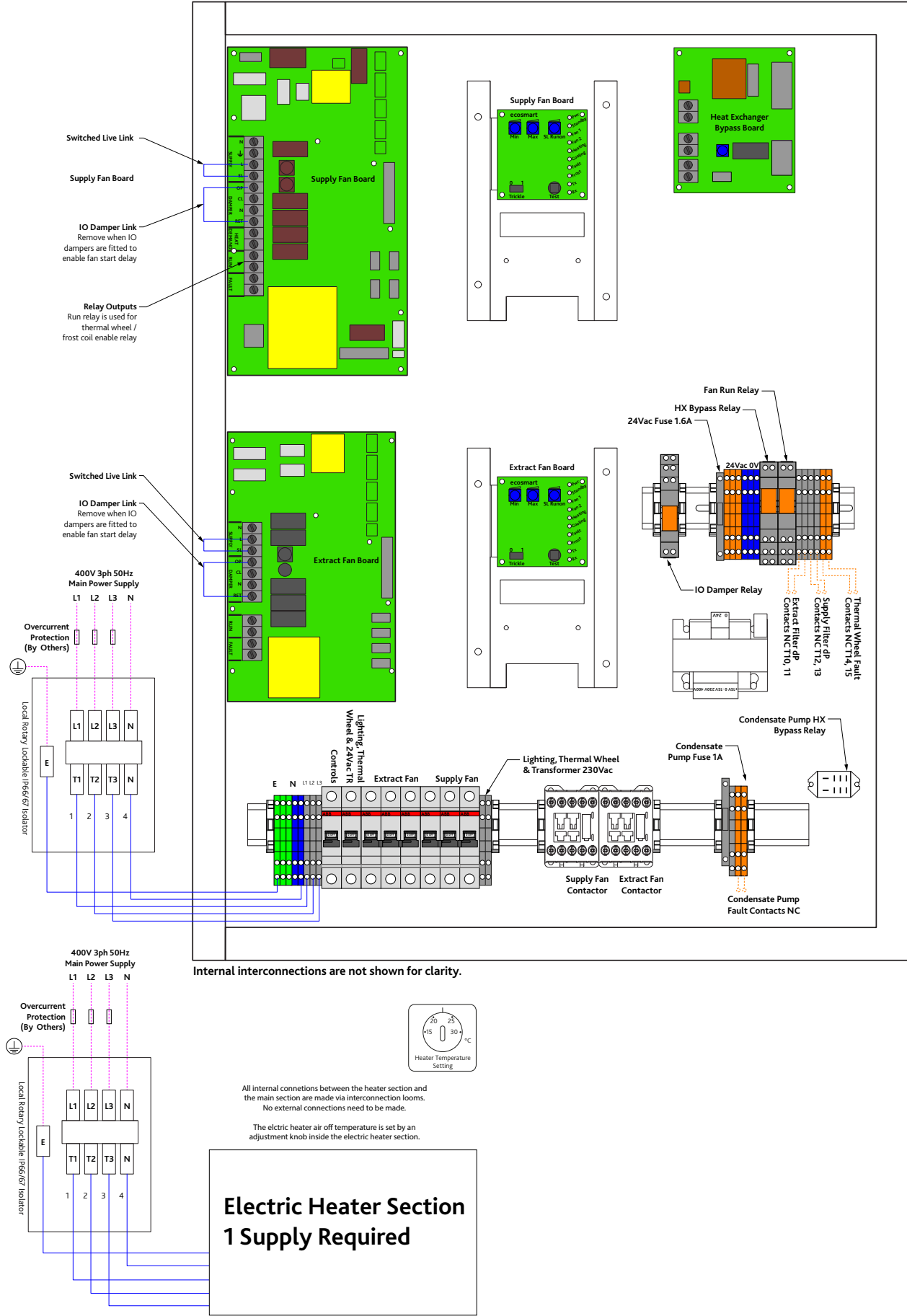
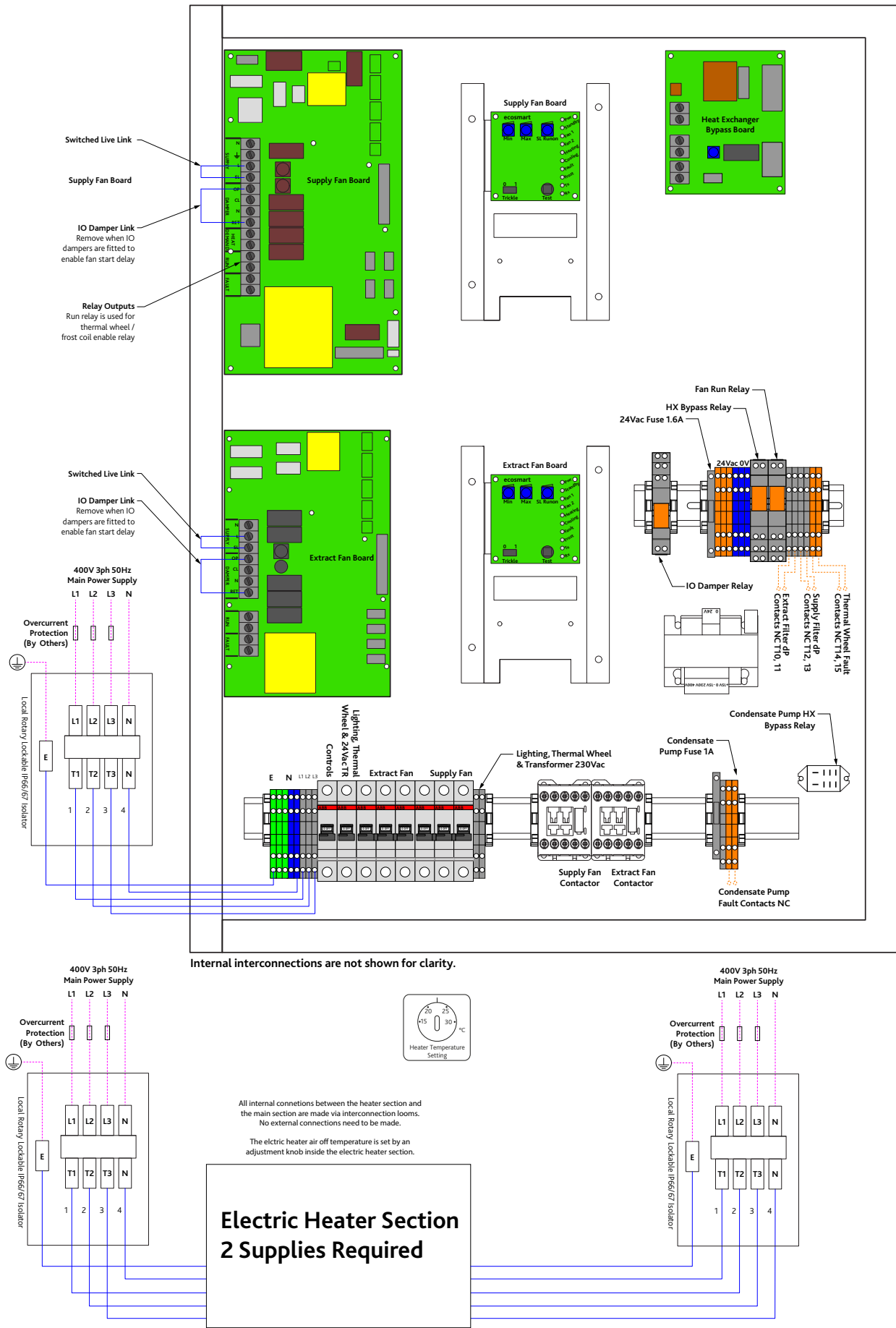


Fig 40: Unit Sizes 32 - 42 with Electric Heating Wiring Diagram**Key:**

Factory Connection

Customer Connection (Mandatory)

Customer Connection (Optional)



8.0 CONTROLS

8.1 TEST BUTTON

The test button allows the individual blowers within the unit to be checked for its operation. If the fan is running already, press the button once to stop the fan, press again to switch on the fan. **The fan will return to normal operation after 30 seconds.**

8.2 LED INDICATION

PWR GREEN: Power on & OK. RED: Too much power is taken by peripherals or there is a short circuit in the net cable. Check the cable and use a junction box (ES-JB) to connect some of the peripherals.

Standby LED on when fan is not running.

Fan 1 GREEN: Fan 1 is running, RED: Fan 1 faulty.

Fan 2 GREEN: Fan 2 is running, RED: Fan 2 faulty.

Heating* GREEN: Heating selected RED: Heating faulty.

Cooling* Not applicable. See note.

Fault LED on when a fault is present on unit.

Frost* Not applicable. See note.

TX LED on when the controller is transmitting data.

RX LED on when the controller is receiving data.

***Control panel is common to all Ecosmart products and will have indicators for functions that are not available in this particular unit. However these indicators will not be illuminated.**

8.3 BMS INPUT SIGNALS

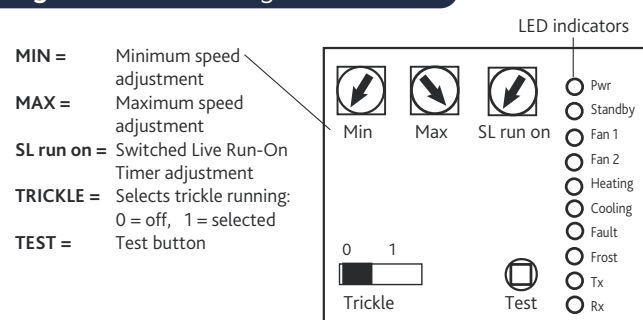
The system's response to a 0-10V dc BMS signal is given in the following table.

The BMS signal will override any sensors and user control connected in the system. The voltage tolerance is +/- 125mV and is measured at the fans terminal.

	Ventilation Mode	Cooling Mode*	Heating Mode*
Local Control	0.00	-	-
OFF/ Trickle	0.25	-	-
Speed 1	0.50	0.75	1.00
Speed 2	1.50	1.75	2.00
Speed 3	2.50	2.75	3.00
Speed 4	3.50	3.75	4.00
Speed 5	4.50	4.75	5.00
Speed 6	5.50	5.75	6.00
Speed 7	6.50	6.75	7.00
Speed 8	7.50	7.75	8.00
Speed 9	8.50	8.75	9.00
Speed 10	9.50	9.75	10.00

* Only available on relevant unit.

Fig 41: Commissioning Panel Details



8.4 SETTINGS

8.4.1 MAXIMUM AIRFLOW

- Ensure the power supply is switched off and that a link wire is connected from the supply L to the SL terminal. Unplug all items connected to the 'Net' connectors.
- Switch on the power supply.
- Wait for the fan to complete its self-test operation.

Measure the airflow using standard commissioning instruments at a suitable point in the ductwork. If adjustment is required, rotate the pot marked 'Max' to obtain the desired airflow.

8.4.2 MAXIMUM TRICKLE AIRFLOW

- Repeat the same procedure as for maximum airflow above but without the link wire between supply L and SL terminal. Ensure the trickle switch is in the 'ON' position. Adjustment must be made on the pot marked 'Min'.
- The minimum setting (nominally 40%) must be below the maximum setting, otherwise minimum setting will be automatically set to be the same as the maximum.

8.4.3 RUN ON TIME

A switched live of 100-230V at terminal SL will activate the fan. When the switched live signal is removed the fan will overrun for period set by the dial 'SL run on' - adjust the desired overrun time by rotating clockwise.

8.4.4 TRICKLE VENTILATION FACILITY

Slide the 'trickle' switch 0 = Off, 1 = On. With 'trickle' on and power to unit the fan will run at minimum speed until the switch live signal activates it to boost.

8.4.5 AIR OFF TEMPERATURE

The adjustment knob is located in the control pack and must be set to the desired 'air off' temperature.

8.5 FROST PROTECTION

Ecosmart frost protection is activated on any AHU fitted with LPHW heating, when the outlet air temperature is 4°C or below.

The unit reacts by shutting down the fan to prevent a 'wind chill' effect reducing the temperature to a point whereby the coil could freeze and burst. The unit will also drive open the LPHW valve to a fully open position to allow full water flow through the coil and the main PCB will close the 'Heat demand' contacts. These contacts could be used to send a signal to activate the boiler and/or valve to open to provide heat if not already doing so.

9.0 MAINTENANCE

It is important that maintenance checks are recorded and that the schedule is always adhered to, in all cases, the previous report should be referred to.

9.1 FANS

Please refer to general arrangement drawings for details of the type of fan and drive that is fitted. Maintenance guidelines for all fans are beyond this manual, please contact Nuaire for specific documents.

- Before any work is carried out, please ensure that:
- The power supply to the motor is switched off.
- The fan impeller is at rest.

Measures are taken to ensure that the accidental, uncontrolled running of the fan is prevented during maintenance work.

In general, fans should be inspected twice a year, and care should be taken to ensure that any unusual vibration or sound is investigated as an urgent matter.

Access to the fan section is via hinged or lift-off panels. Cable entry must be made through the apertures provided. Screwed glands with cable restraint devices should be used.

9.2 GENERAL FAN MAINTENANCE

Access to the fan is normally gained by opening the hinged access doors.

Care should be taken to remove any build up of dust (a light vacuum or light brushing will normally take care of this) Do not use a steam or any other high pressure cleaners.

Inspect the connection between the fan and unit for any damage or wear and tear.

9.3 BEARINGS

The bearings that are fitted will be (unless otherwise specified) "sealed for life", therefore consequence maintenance is not required.

Fan bearings are lifelong; up to 40,000 hours of operation. In cases of heavy duty operation, maintenance intervals are to be established by the operator.

9.4 FILTERS

When removing the filter access panels, pay attention to the airflow direction marked on the panel, this must be replaced to the exact position prior to being removed. Disposable filters should be checked, and changed when they become fully laden with dust. Washable filters should be removed and washed in a mild detergent, flushed with clean water and allowed to dry before refitting.

9.5 COILS

coils should be connected to ensure that full counter flow exists i.e. the entering airflow meets the return connection.

All coils should be connected with the flow at the bottom and the return at the top unless otherwise advised. Drain and bleed valves are located on the coil, others may be required in the system pipe-work depending on the installation.

Frost protection must be incorporated on shut down and fresh air conditions to avoid coil freezing. Ideally, where the system is at risk of frost damage, the addition of a proprietary antifreeze solution to the water is recommended.

Pipe-work connections should be made to the unit using appropriate techniques, and must be independently supported. The connections should be pressure tested.

All coils sit in a common drip tray connected to the pre-fitted condensate pump.

The coil panel has been pre-drilled and fitted with appropriate grommets for pipe connections. Do not drill or cut the unit casing for this purpose.

coils should have their finned surface examined for accumulation of dirt, lint and biological contaminants or similar. If necessary, wash down affected areas with a mild detergent solution and a soft brush. Care should be taken not to damage the finned surface, and any cleaning fluids should be rinsed away with water.

A compressed air line may be used to blow out any solids between fins. Do not probe the coil fin block with metal objects as damage may cause leaks. Drain lines should be checked to ensure that they are unobstructed and free draining. Drain pans should be flushed out periodically to remove contamination.

The unit application may require particular attention to this item – Check with Building Management personnel for details.

9.6 PLATE HEAT EXCHANGER

The recuperator block is normally protected from dust and contamination by upstream pre-filters. It is possible to clean the unit with compressed air in the case of dust deposits or by spraying with a mild detergent solution for grease deposits.

Solvents, strong alkaline, acidic or any products that may be aggressive to aluminium or plastics should not be used. Do not use cleaning water over 50°C.

Drain lines should be checked to ensure that they are unobstructed and free draining. Traps should be checked that they are fully primed and functioning.

Drain pans should be flushed out periodically to remove contamination, and chemical treatments may be used to provide protection between service visits.

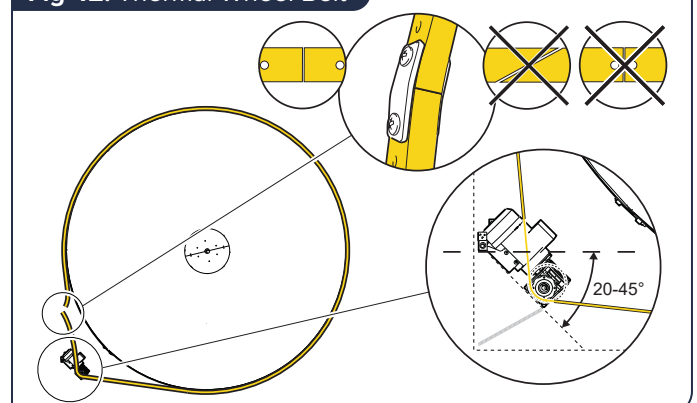
The unit application may require particular attention to this item – Check with Building Management personnel for details.

9.7 THERMAL WHEEL

After the 2-3 weeks of operation, and at least once per year, ensure the following maintenance is performed.

- Check that rotor is vertical and centred in casing. Adjust vertical and horizontal position if needed.
- Check the thermal wheel spins freely.
- Adjust sealing to ensure contact with the rotor and side plates. Replace brush sealing if it is worn.
- Check that motor bracket is in 20-45° angle from horizontal line.
- Adjust length of drive belt if needed.
- Check condition of belt and belt lock (joint).

Fig 42: Thermal Wheel Belt



Experience shows that clogging of heat exchangers is not expected in normal cooling and air-conditioning systems. However, if deposits accumulate on the exchanger when used for special applications, it can be cleaned as follows:

Remove dust and fibres with a soft brush or vacuum cleaner. Use caution when blowing dirt out with compressed air to avoid damage to the wheel. Keep at a distance!

Oils, solvents etc. can be removed with hot water (max. 70 °C) or grease-removing solvents or immersion.

9.8 LEGIONELLA CHECK

Legionella risk management should be undertaken by a competent person appointed by the duty holder in accordance with the latest edition of the HSE approved code of practice L8 Legionnaires' disease, the control of legionella bacteria in water systems. Particular attention should be given to:

- Cooling coil.
- Thermal Wheel.
- Drain trays.
- Water reservoirs.

9.9 ELECTRIC HEATERS

An air handling unit would normally require no heater maintenance. However a periodic check is advised to ensure that the fasteners and electrical connections are operating correctly.

The electric heater unit is fitted with fail-safe thermal switches (self-resetting) which will isolate the electric heater supply if a temperature of 80°C is detected. This action is performed independently of any controls fitted. Nuaire fitted controls will also stop heating if a fan or heater failure is detected.

9.10 BULKHEAD LIGHTS

Ensure that lights are switched off and isolated before checking or changing the lamp.

9.11 GENERAL

Inspect all internal and external surfaces to check for corrosion or peeling of painted surfaces.

Thoroughly clean affected areas with a wire brush, apply a coat of zinc rich primer or similar, and re-touch with suitable finishing paint. Ensure tightness of all nuts, bolts, and fixings.

Check all components for general condition.

9.12 SPECIALIST EQUIPMENT

Contact Nuaire for maintenance of specialised equipment that would have been specified during design stage. A breakdown of the component parts can be found on the design specification documents, additional maintenance literature is available, please contact Nuaire.

This applies to any components not specifically mentioned in this document.

9.13 MAINTENANCE SCHEDULE

9.13.1 ROUTINE MAINTENANCE

- Clean all areas of unit and treat any areas of corrosion.
- Check all access doors for leakage and if necessary locks should be adjusted and any replacement gasket materials should be replaced as required.
- Any drain trays should be cleaned and repaired if necessary.

9.13.2 EVERY 3 MONTHS

- Check filters and change/clean if required, failure to do so may impair the performance and energy efficiency of this unit.
- Ensure condensate drains are cleaned clear and that water can flow freely from unit.
- Check fin coil banks and heat exchangers. If necessary clean with a soft brush or vacuum. Check for signs of contamination.

9.13.3 ANNUALLY

- Thoroughly inspect the unit and its components for corrosion, acting immediately to treat/restore any damaged areas.
- All electrical terminals within the unit should be tightened.
- Check all earth connections.
- Check control dampers blades.
- Check operation of damper actuators and linkages and adjust as necessary.
- coil faces should be inspected and any dust removed.
- Check any thermal wheel belt, motor, bearings, seals and if necessary clean with a soft brush or vacuum cleaner.

10.0 COMMISSIONING

Before commissioning the unit, ensure that all equipment has been assembled in accordance with the installation procedure all instances where the unit is in operation the access doors should remain closed; at no time, during maintenance or otherwise, should anyone be inside a unit whilst it is in operation.

10.1 FAN & MOTOR

Care should be taken to ensure that the fan and motor run freely and that the fan is rotating in the correct direction.

The electrical current being drawn by motors should not exceed the manufacturers recommendations (specified on the motor plate). If the current exceeds this, check the fan volume flow rate and the static resistance.

10.2 COMMISSIONING CHECKLIST

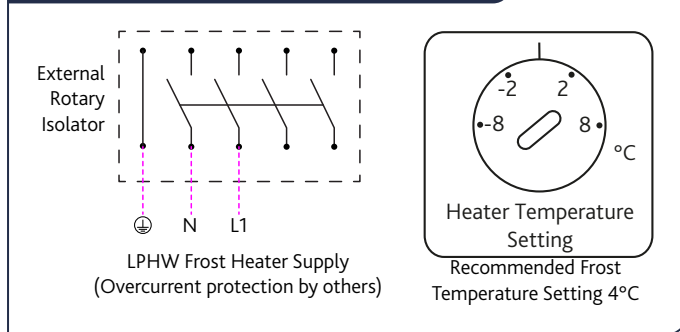
- All equipment received is according to specification/order.
- Any damage to unit identified.
- Fan base shipping restraints / Fixing Brace removed (if applicable).
- The correct installation procedure has been carried out in accordance to Nuaire's recommendations.
- Any fan and thermal wheel motor pulleys are properly aligned.
- Anti-vibration mounts are adjusted accordingly.
- Check / adjust fan and thermal wheel belt tension.
- Rotate fan impellers and motors to ensure they run freely.
- Check any additional bearings and couplings (where fitted manually).
- Condensate drain traps are checked. Check all filters are correctly fitted.
- Ensure ductwork is complete.
- Check electrical supply voltage and tightness of all electrical connections.
- Ensure control damper operation.
- Ensure access panels and doors are fitted properly and secure.
- Check fan motor current draw.

11.0 FROST COIL INSTALLATION (OPTIONAL ANCILLARY)

11.1 LPHW FROST COIL

LPHW frost coils are fitted with a frost stat on the air in side. Units are NOT provided with valve and actuator. If the frosts stat switches to a frost condition, to signal will be sent to open the valve actuator (by others). The valve will open whether the fans are running or not. This is for pipe freeze protection. The LPHW section requires its own supply in order to power the valve actuator.

Fig 43: Wiring - LPHW Frost Coil 07 - 42



11.2 ELECTRIC HEATER FROST COIL

Electric heater frost coils are fitted with its own internal control panel. The control is powered by a 400Vac 50Hz 3 phase & Neutral supply. This must be isolated local to the unit and fitted with appropriate overcurrent and fault protection. It connects to the main unit via “plug and play” interconnecting looms (see Section 6.4). No external connections are required. Electric heater elements are protected by a fail-safe over-temperature switch which will disconnect the heater supply if a temperature of 80°C is reached. Once the elements cool, the switch will reset but a power cycle is required to reset the heater supply contactor.

The frost coil is fitted with a burst fired controller with integral set point, air off thermistor, air in frost stat, thermal cut-out and contactor. The burst fired controller is only enabled if the frost stat reads a frost condition, the over-temperature cut-out is healthy AND a 24vac fan run signal is received from the main control panel. Once enabled the burst fired controller will increase heating output to achieve the set point set by the physical dial on the unit.

Fig 44: Wiring - Electric Frost Coil 07 - 22

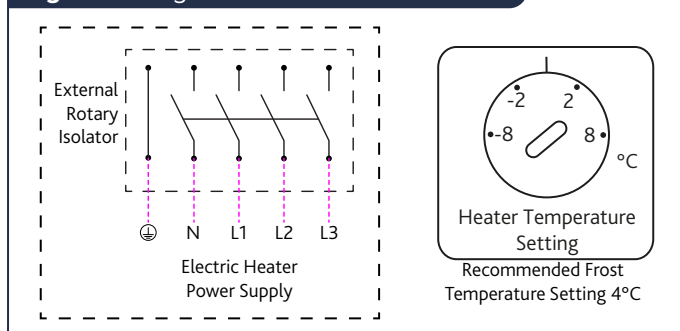
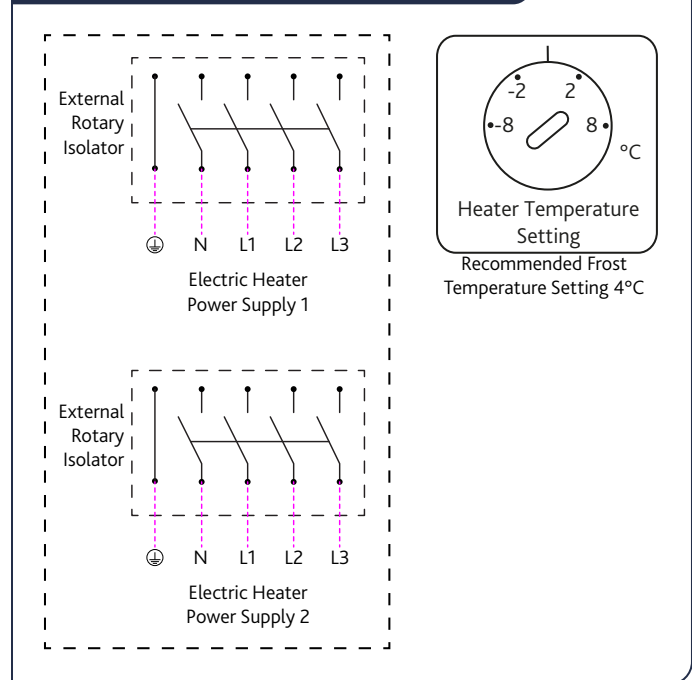


Fig 45: Wiring - Electric Frost Coil 32 - 42



11.3 ELECTRICAL SUPPLY FLCs

Unit Size	Electric Frost Heater FLC (Ancillary)	LPHW Frost Coil FLC (Ancillary)
B*07V/**ES	17.5 A	0.1 A
B*07T/**ES	17.5 A	0.1 A
B*12V/**ES	35 A	0.1 A
B*12T/**ES	35 A	0.1 A
B*17V/**ES	52.5 A	0.1 A
B*17T/**ES	52.5 A	0.1 A
B*22V/**ES	52.5 A	0.1 A
B*22T/**ES	52.5 A	0.1 A
B*32V/**ES	52.5 A + 35 A ‡	0.1 A
B*32T/**ES	52.5 A + 35 A ‡	0.1 A
B*42V/**ES	52.5 A + 52.5 A ‡	0.1 A
B*42T/**ES	52.5 A + 52.5 A ‡	0.1 A

‡ Double electric heater models require separate supplies for two heater sections, each with an appropriate overcurrent current protection device.

12.0 WARRANTY

The 5 year warranty starts from the day of delivery and includes parts and labour for the first year. The remaining period covers replacement parts only.

This warranty is void if the equipment is modified without authorisation, is incorrectly applied, misused, disassembled, or not installed, commissioned and maintained in accordance with the details contained in this manual and general good practice.

The product warranty applies to the UK mainland and in accordance with Clause 14 of our Conditions of Sale. Customers purchasing from outside of the UK should contact Nuair International Sales office for further details.

Failure to maintain the unit as recommended will invalidate the warranty.

DECLARATION OF INCORPORATION AND INFORMATION FOR SAFE INSTALLATION, OPERATION AND MAINTENANCE

We declare that the machinery named below is intended to be assembled with other components to constitute a system of machinery. All parts except for moving parts requiring the correct installation of safety guards comply with the essential requirements of the Machinery Directive. The machinery shall not be put into service until the system has been declared to be in conformity with the provisions of the EC Machinery Directive.

Designation of machinery: Boxer BPS Models
Machinery Types: Supply and Extract Fans with Heat Recovery
Relevant EC Council Directives: 2006/42/EC
Applied Harmonised Standards: BS EN ISO 12100-1
BS EN ISO 12100-2
EN60204-1
BS EN ISO 9001
BS EN ISO 13857
Applied National Standards: BS848 Parts 1, 2.2 and 5

Signature of manufacture representatives:

Engineering Director



A. Thomas
18-06-2016

Manufacturing Director



C. Sargent
18-06-2016

Basis of Self Attestation: BS EN ISO 9001
BSI Cert No. FM 665203

Nuaire: A Trading Division of Polypipe,
Western Industrial Estate,
Caerphilly, CF83 1NA.

All standards used were current and valid at the date of signature.

INFORMATION FOR SAFE INSTALLATION, OPERATION AND MAINTENANCE OF NUAIRE VENTILATION EQUIPMENT

To comply with EC Council Directives 2006/42/EC Machinery Directive and 2014/30/EU (EMC). To be read in conjunction with the relevant product documentation (see 2.1)

1.0 GENERAL

- 1.1 The equipment referred to in this Declaration of Incorporation is supplied by Nuaire to be assembled into a ventilation system which may or may not include additional components. The entire system must be considered for safety purposes and it is the responsibility of the installer to ensure that all of the equipment is installed in compliance with the manufacturers recommendations and with due regard to current legislation and codes of practice.

2.0 INFORMATION SUPPLIED WITH THE EQUIPMENT

- 2.1 Each item of equipment is supplied with a set of documentation which provides the information required for the safe installation and maintenance of the equipment. This may be in the form of a Datasheet and/or Installation and Maintenance instruction.
- 2.2 Each unit has a rating plate attached to its outer casing. The rating plate provides essential data relating to the equipment such as serial number, unit code and electrical data. Any further data that may be required will be found in the documentation. If any item is unclear or more information is required, contact Nuaire.
- 2.3 Where warning labels or notices are attached to the unit the instructions given must be adhered to.

3.0 TRANSPORTATION, HANDLING AND STORAGE

- 3.1 Care must be taken at all times to prevent damage to the equipment. Note that shock to the unit may result in the balance of the impeller being affected.
- 3.2 When handling the equipment, care should be taken with corners and edges and that the weight distribution within the unit is considered. Lifting gear such as slings or ropes must be arranged so as not to bear on the casing.
- 3.3 Equipment stored on site prior to installation should be protected from the weather and steps taken to prevent ingress of contaminants.

4.0 OPERATIONAL LIMITS

- 4.1 It is important that the specified operational limits for the equipment are adhered to e.g. operational air temperature, air borne contaminants and unit orientation.
- 4.2 Where installation accessories are supplied with the specified equipment e.g. wall mounting brackets. They are to be used to support the equipment only. Other system components must have separate provision for support.
- 4.3 Flanges and connection spigots are provided for the purpose of joining to duct work systems. They must not be used to support the ductwork.
- 4.4 Local Environment - Humidity. Ambient humidity (the humidity at the unit's installed location) shall be within the range: 10 to 95% (for controls, non-condensing). Air humidity (the humidity of the air passing through the unit) shall be within the range: 10 to 95% (for controls, non-condensing).

5.0 INSTALLATION REQUIREMENTS

In addition to the particular requirements given for the individual product, the following general requirements should be noted.

- 5.1 Where access to any part of equipment which moves, or can become electrically live are not prevented by the equipment panels or by fixed installation detail (e.g. ducting), then guarding to the appropriate standard must be fitted.
- 5.2 The electrical installation of the equipment must comply with the requirements of the relevant local electrical safety regulations.
- 5.3 For EMC all control and sensor cables should not be placed within 50mm or on the same metal cable tray as 230V switched live, lighting or power cables and any cables not intended for use with this product.

6.0 COMMISSIONING REQUIREMENTS

- 6.1 General pre-commissioning checks relevant to safe operation consist of the following:
 - Ensure that no foreign bodies are present within the fan or casing.
 - Check electrical safety e.g. Insulation and earthing.
 - Check guarding of system.
 - Check operation of Isolators/Controls.
 - Check fastenings for security.
- 6.2 Other commissioning requirements are given in the relevant product documentation.

7.0 OPERATIONAL REQUIREMENTS

- 7.1 Equipment access panels must be in place at all times during operation of the unit, and must be secured with the original fastenings.
- 7.2 If failure of the equipment occurs or is suspected then it should be taken out of service until a competent person can effect repair or examination

(Note that certain ranges of equipment are designed to detect and compensate for fan failure).

8.0 MAINTENANCE REQUIREMENTS

- 8.1 Specific maintenance requirements are given in the relevant product documentation.
- 8.2 It is important that the correct tools are used for the various tasks required.
- 8.3 If the access panels are to be removed for any reason the electrical supply to the unit must be isolated.
- 8.4 A minimum period of two minutes should be allowed after electrical disconnection before access panels are removed. This will allow the impeller to come to rest.

NB: Care should still be taken however since airflow generated at some other point in the system can cause the impeller to "windmill" even when power is not present.

- 8.5 Care should be taken when removing and storing access panels in windy conditions.