



# CLADE

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## Rowan 3 Plus Standard & Low Noise Heating ASHP Planner Manual



**PD-Rowan 32-03**

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Version: 1.3

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# 1 General Specifications

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## 1.1 Features and benefits

### 1.1.1 Energy Efficiency

The Rowan 3 Plus has been designed, tested and independently assessed to ensure consistent, verified performance in real-world UK operating conditions. Performance data is derived from testing conducted in accordance with EN 14511.

**R290 Natural Refrigerant:** The Rowan 3 Plus uses Propane (R290) as its refrigerant – a naturally occurring hydrocarbon with a Global Warming Potential (GWP) of 3 and an Ozone Depletion Potential (ODP) of zero. R290 exhibits excellent thermodynamic properties across a wide pressure and temperature range, enabling high efficiency at both low ambient temperatures and elevated flow temperatures. It is non-toxic and poses no long-term atmospheric accumulation risk, making it a future-proof choice as F-gas regulations continue to tighten. Utilises Propane (R290), a future-proof refrigerant with a Global Warming Potential (GWP) of just 3. This offers excellent thermodynamic properties whilst remaining non-toxic and environmentally sustainable.

**SCOP:** Achieves a high Seasonal Coefficient of Performance of 3.5\*

### 1.1.2 Functionality

**Wide Operating Envelope:** The Rowan 3 Plus maintains full heating output across an ambient air temperature range of  $-15^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ . This ensures year-round reliability without de-rating or lockout under extreme ambient conditions.

**Flexible Heating Temperature Output:** Available with up to  $80^{\circ}\text{C}$  heating flow option to suit varied building loads.

**No ATEX Zone:** The Rowan 3 Plus has been independently assessed against EN 378 and BS EN 60079-10-1 and declared to have no zone 2 ATEX zone. This significantly broadens permissible installation locations, eliminates the requirement for ATEX-rated electrical equipment in adjacent plant, and reduces both installation cost and regulatory burden on the designer. An internal refrigerant leak detection sensor and ventilation fan are fitted as standard and are integral to achieving this classification.

### 1.1.3 Modular design

**Cascade Operation:** The Rowan 3 Plus is designed for operation as part of a multi-unit array of up to 6, controlled via the Clade Multi Unit Controller. Multiple modules can be linked to increase total installed capacity or to provide system redundancy. This allows large heating loads to be met by standardised modular equipment rather than bespoke single units, simplifying procurement, maintenance, and future expansion.

**N+1 Redundancy:** The Clade Buffer Controller continuously monitors the operational status of each module in the array. In the event of a fault, the affected unit is isolated, and the remaining units continue to operate, redistributing the load automatically. This eliminates single points of failure and is particularly important in applications where loss of heating would have significant operational or safety consequences.

**Load-Sharing Logic:** When multiple heat pumps operate in multiplex mode with a Clade Buffer controller, run-hours and capacity demands are automatically balanced. This 'duty cycling' optimises efficiency and extends equipment life by preventing uneven wear.

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#### 1.1.4 Technology

**Inverter Technology:** The Rowan 3 Plus uses variable-speed DC inverter drives on both the compressor and evaporator fans. This allows continuous modulation of output to match actual building demand, rather than cycling between fixed-speed on/off states. The practical benefits are improved part-load efficiency, reduced acoustic output at lower loads, and more stable water outlet temperatures with reduced thermal shock to the system.

**Pressure Independent Control Valve (PICV):** Each Rowan 3 Plus module is factory-fitted with a Danfoss AB-QM Pressure Independent Control Valve on the water circuit. The PICV regulates flow through the plate heat exchanger by maintaining a constant differential pressure across itself, regardless of fluctuations in system pressure caused by other loads or pump modulation. This removes the need for separate commissioning set valves and ensures each module receives its design flow rate under all operating conditions. The unit does not include an internal circulating pump; flow is provided by the site hydraulic system.

**Electronic Expansion Valve (EEV):** Refrigerant flow is controlled by an Electronic Expansion Valve, which responds dynamically to suction superheat and system conditions. This provides more precise control than thermostatic expansion valves, maximises heat transfer efficiency across the full operating envelope, and contributes to compressor protection by preventing liquid return.

\* Declared in accordance with EN 14825. Average climate profile, variable flow temperature, W40/30. Figures do not include auxiliary energy or pump consumption unless stated.

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## 2 Technical Specification

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### 2.1 Standard & Low Noise Unit Technical Specifications

#### 2.1.1 Minimum and Maximum kW output:

| Mode             | Min Compressor kW | Max Compressor kW |
|------------------|-------------------|-------------------|
| Heating (-10/+7) | 82kW              | 121kW             |

*Output figures are at the water temperatures 65/50 for heating. Actual output will vary with ambient air temperature, water flow/return temperatures, and capacity control mode selected. Refer to Clade performance program for full performance data.*

**Structure:** Built on a heavy-duty FeZn 15/10 galvanized steel frame, the unit offers rigidity and longevity. The core chassis is designed for quick installation and stable placement, featuring integrated lifting eyes and forklift slots that streamline transport while ensuring reliable, vibration-resistant operation once sited.

**Paneling:** All external panels are fabricated from aluminium-zinc (AluZn)-coated steel, offering excellent corrosion resistance and a clean, uniform finish. Panels are secured to the chassis with stainless-steel fasteners and include integrated drip-edges and seal profiles to prevent water ingress. Access panels are hinged and lockable, providing full tool-free entry for service and maintenance. All panel joints are gasket-sealed to maintain IP24 protection

**Air-Side Heat Exchanger:** The air-side coil is a round-tube plate-fin (RTPF) arrangement, constructed with copper tubing and aluminium fins, engineered specifically for Propane (R290) operation. The coil geometry is optimised for low airside pressure drop and efficient defrost drainage. Hydrophilic fin coating is applied as standard to reduce ice adhesion and improve condensate shedding during defrost cycles.

**Water-Side Heat Exchanger:** The Rowan 3 Plus is fitted with a stainless-steel brazed plate heat exchanger on the water side, serving the heating water circuit. The PHE is constructed from stainless steel plates for improved corrosion resistance and long service life.

**Fans:** Two EC (electronically commutated) axial fans provide air flow across the air-side coil. EC motor technology delivers stepless speed control, with the fan speed modulated continuously in response to real-time operating conditions including ambient temperature, refrigerant pressures, and compressor load. This results in reduced power consumption at part-load, lower operating noise compared to fixed-speed alternatives, and extended bearing life through avoidance of unnecessary high-speed operation..

**Refrigeration circuit:** The state-of-the-art refrigeration system is engineered for Propane (R290) operation, ensuring superior thermal performance and ultra-low GWP (Global Warming Potential).

## 2.2 Refrigerant Information

### 2.2.1 Characteristics of R290 refrigerant

The Rowan 3 Plus range of heat pumps manufactured by Clade Engineering Systems are equipped with propane (R290). Propane is classified as an A3 refrigerant (low toxicity but highly flammable) and must be handled in accordance with flammable gas safety guidelines.

Propane is odorless in its pure form and is heavier than air. If released in an enclosed or low-lying area, it can accumulate and form a flammable mixture with air. All personnel involved with specification, installation, operation, and maintenance of these units must be fully qualified, competent, and hold any certifications required for work on flammable refrigerants.

Propane is listed with two GWP values to the difference between its theoretical warming impact and its practical behaviour in the atmosphere. Its theoretical GWP, as defined by the IPCC, is approximately 3 and represents propane's inherent ability to absorb infrared radiation, assuming it behaves like long-lived greenhouse gases such as CO<sub>2</sub>. However, in real-world applications, propane breaks down rapidly in the atmosphere, typically within two weeks, due to reactions with hydroxyl radicals. This short atmospheric lifetime means it does not accumulate and has a negligible long-term climate impact. As a result, its adjusted GWP over a 100-year timeframe is approximately 0.02, reflecting its true environmental impact in practical use.

Each unit is evacuated and pre-charged at the factory with the correct amount of R290, so no additional charge is required. The refrigerant charge can be found on the PED label.

In the event of component failure or a leak, the system should be stopped immediately. The remaining charge must be reclaimed or vented in a safe, controlled manner, observing all local regulations for flammable refrigerants. See the system maintenance manual for service valve access points and isolation procedures. Once repairs have been made, the system must be thoroughly evacuated and re-charged with the specified quantity of refrigerant as recorded on the PED label.

| Model (SN & LN) | Refrigerant (Kg) | Equivalent CO <sub>2</sub> tons (tCO <sub>2</sub> e) |
|-----------------|------------------|------------------------------------------------------|
| Rowan 3 Plus    | 7.3              | 21.9                                                 |

| Physical characteristics of the R290 refrigerant           |                                     |
|------------------------------------------------------------|-------------------------------------|
| Safety class (ISO)                                         | A3 (Low toxicity, Highly flammable) |
| GWP (kg.CO <sub>2</sub> e)                                 | 3                                   |
| Low flammability limit (LFL)<br>(Kg/m <sup>3</sup> @ 60°C) | ~0.038 (varies with temperature)    |
| Burning velocity (BV) (cm/s)                               | ~46                                 |
| Boiling point (°C)                                         | -42                                 |
| GWP (100 yr ITH)                                           | 0.02                                |
| ODP (Ozone Layer Depletion)                                | 0                                   |
| Self-ignition temperature (°C)                             | 470                                 |

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### 2.2.2 Gas Leak Detection

The Rowan 3 Plus heat pump is supplied with full leak detection safety systems. The design of the heat pump includes enhanced tightness joints and the refrigerant circuit is a sealed system. The design also separates electrical equipment to protect the system from any sources of ignition.

In the unlikely event of component failure or a leak the heat pump will detect a gas escape and shut down operation. Electrical systems will power down at 20% of the LFL (Lower Flammable Limit) except for the ventilation fan within the heat pump housing. The fan will continue to operate to remove any gas from the housing, ensuring any remaining charge is vented to atmosphere in a controlled manner.

The system will require a manual reset in the event of a gas leak shut down event. This prevents the system from automatically restarting until the cause of the leak or leak alarm is fully investigated and resolved.

See system maintenance manual for access points and isolation procedures. Once the issue has been rectified the system would need to be evacuated and re-charged with the correct amount of refrigerant as recorded on the PED label.

#### **WARNING**

|                                                                          |
|--------------------------------------------------------------------------|
| The designer/installer must consider adequate protection for gas escapes |
|--------------------------------------------------------------------------|

### 2.2.3 Hazardous Area Classification (ATEX)

The Rowan 3 Plus has been independently assessed against **BS EN 60079-10-1** and **EN 378**. Due to the integral safety mitigation systems, including active leak detection, the area immediately surrounding the unit is classified as Non-Hazardous during normal operation and foreseeable fault conditions.

Consequently, there is **no zone 2 requirement around the unit**. This allows for greater flexibility in siting the equipment compared to standard hydrocarbon chillers.

While the unit itself does not generate a hazardous zone, the installation site must be evaluated under the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).

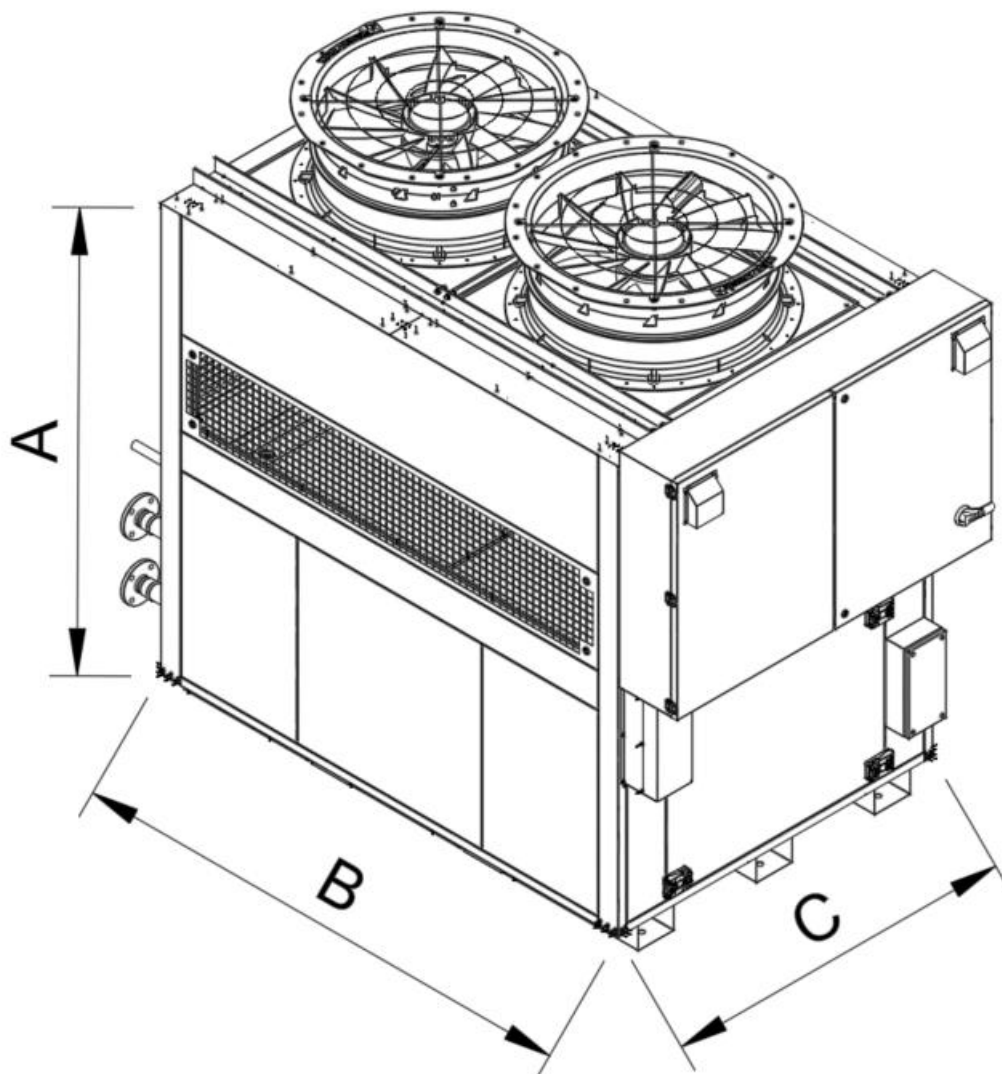
It is the statutory responsibility of the System Designer or Site Operator to conduct a site-specific DSEAR assessment. This assessment must look beyond normal operation and consider catastrophic failure scenarios, such as but not limited to:

- Total loss of refrigerant containment (e.g., pipe rupture).
- External fire affecting the unit.
- Physical impact damage.

The assessment should specifically evaluate the accumulation of heavier-than-air propane vapour in low-level areas, such as but not limited to:

- Nearby drains, manholes, and culverts.
- Basement wells or light wells.
- Trenches and service ducts.

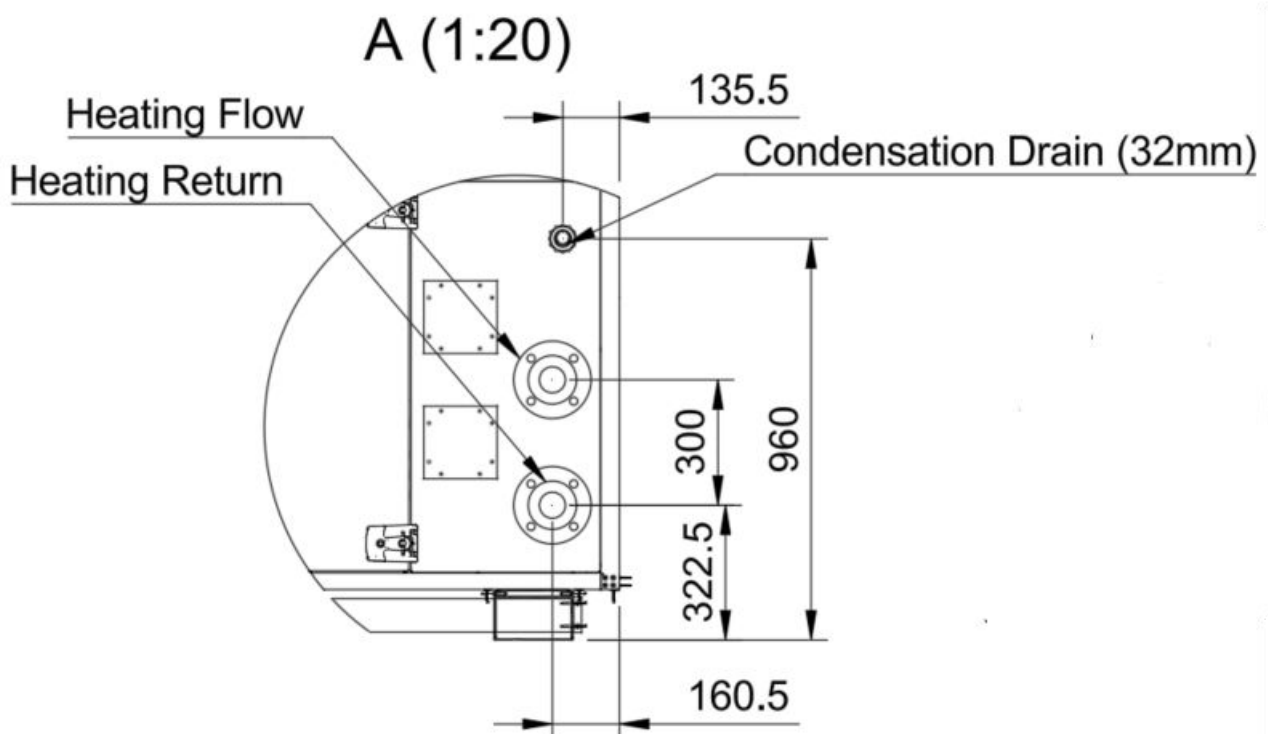
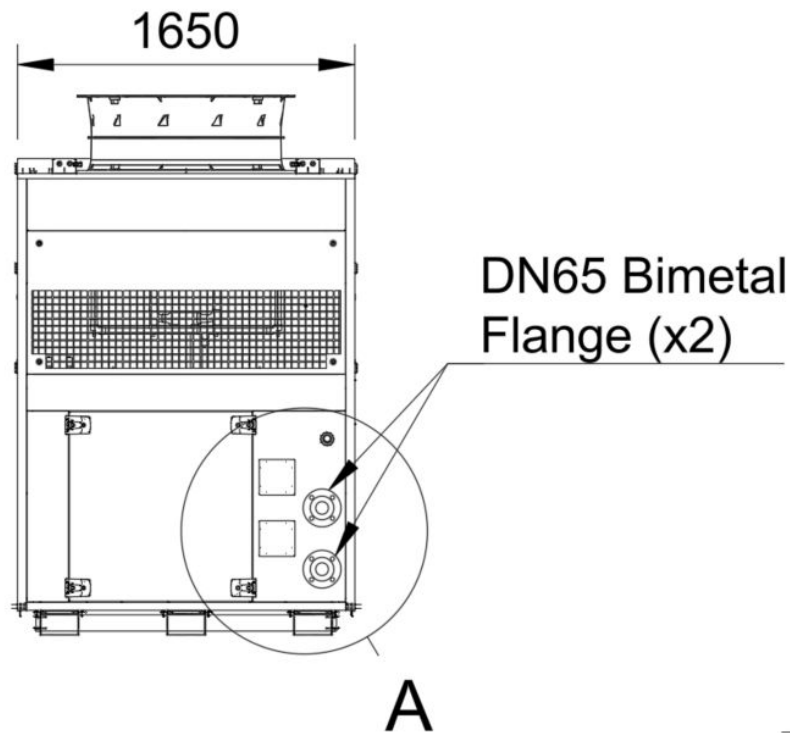
## 2.3 Dimensions Standard & Low Noise



| Unit           | Height 'A'<br>(mm) | Length 'B'<br>(mm) | Depth 'C'<br>(mm) | Shipping Weight<br>(kg) |
|----------------|--------------------|--------------------|-------------------|-------------------------|
| Standard Noise | 2636               | 2400               | 1700              | 1845                    |
| Low Noise      | 2636               | 2400               | 1700              | 2171                    |

## 2.4 Service Connections

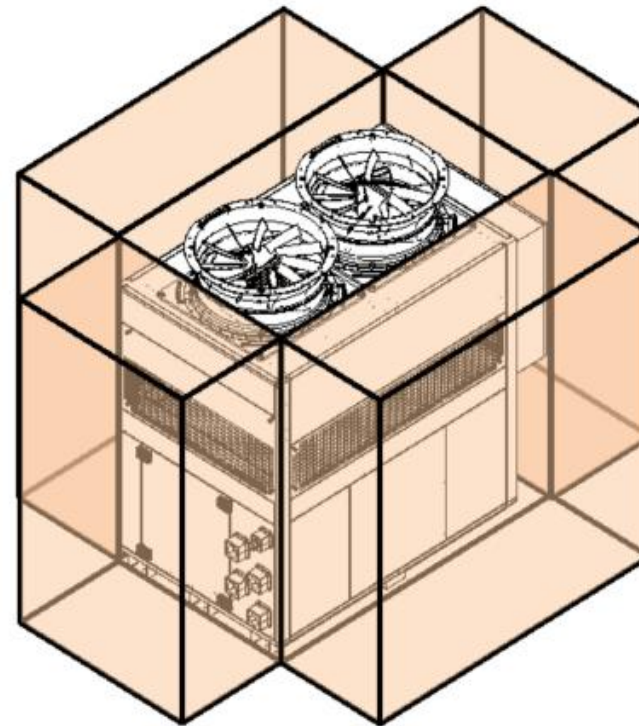
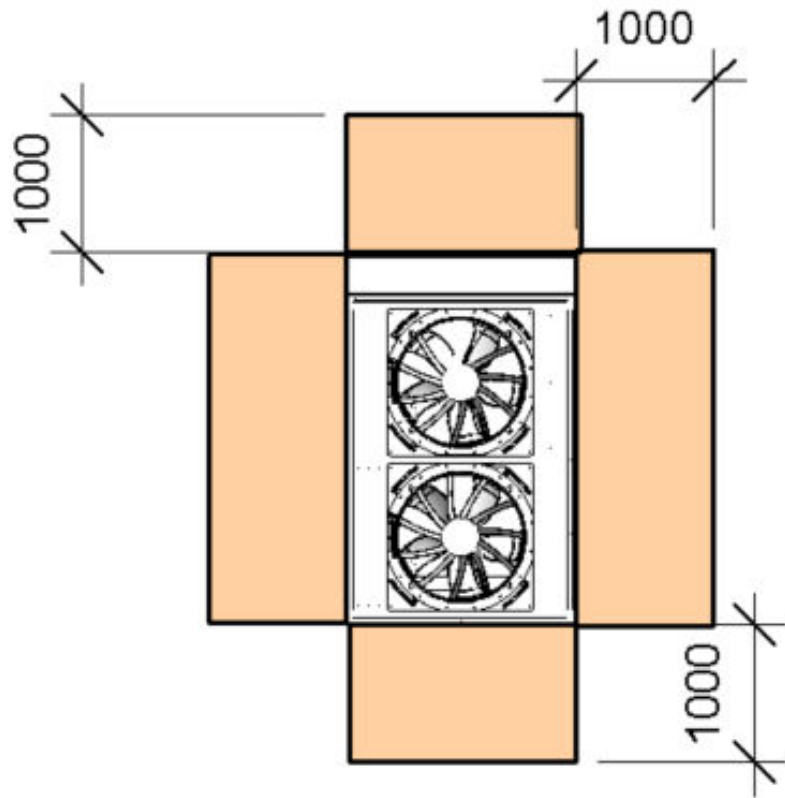
When selecting a location for the unit(s) consideration of the service connection positions is required. Each module has its own water service connections which are located on the right hand side panel. The electrical cabinet and termination point are located at the opposite side to the water connections.



## 2.5 Installation Space Requirements

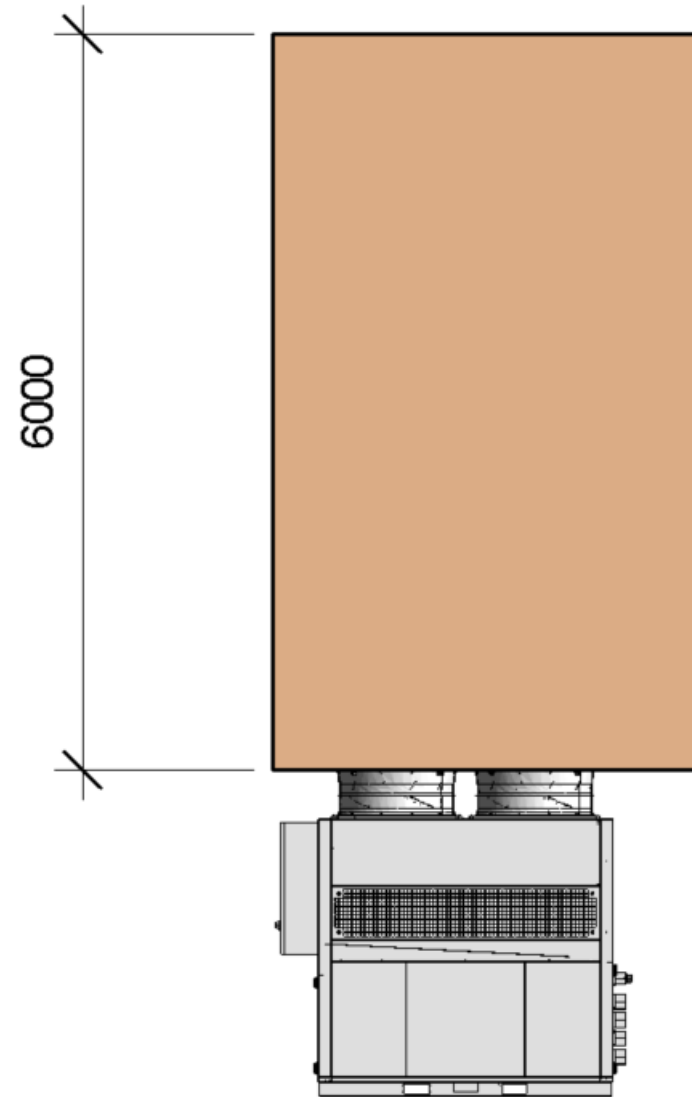
It is essential that the space requirements detailed in this section are strictly followed. Inadequate clearance will restrict airflow and compromise unit performance. Insufficient space will also obstruct access for routine maintenance, repairs, or replacement of components, which may result in warranty being void. Clearance here must also account for “bounce-back” space, which is a health and safety requirement to ensure safe working conditions during servicing. Wall height of the ASHP enclosure also impacts space requirements and can be seen in section 2.5.4

### 2.5.1 Single Unit Installation



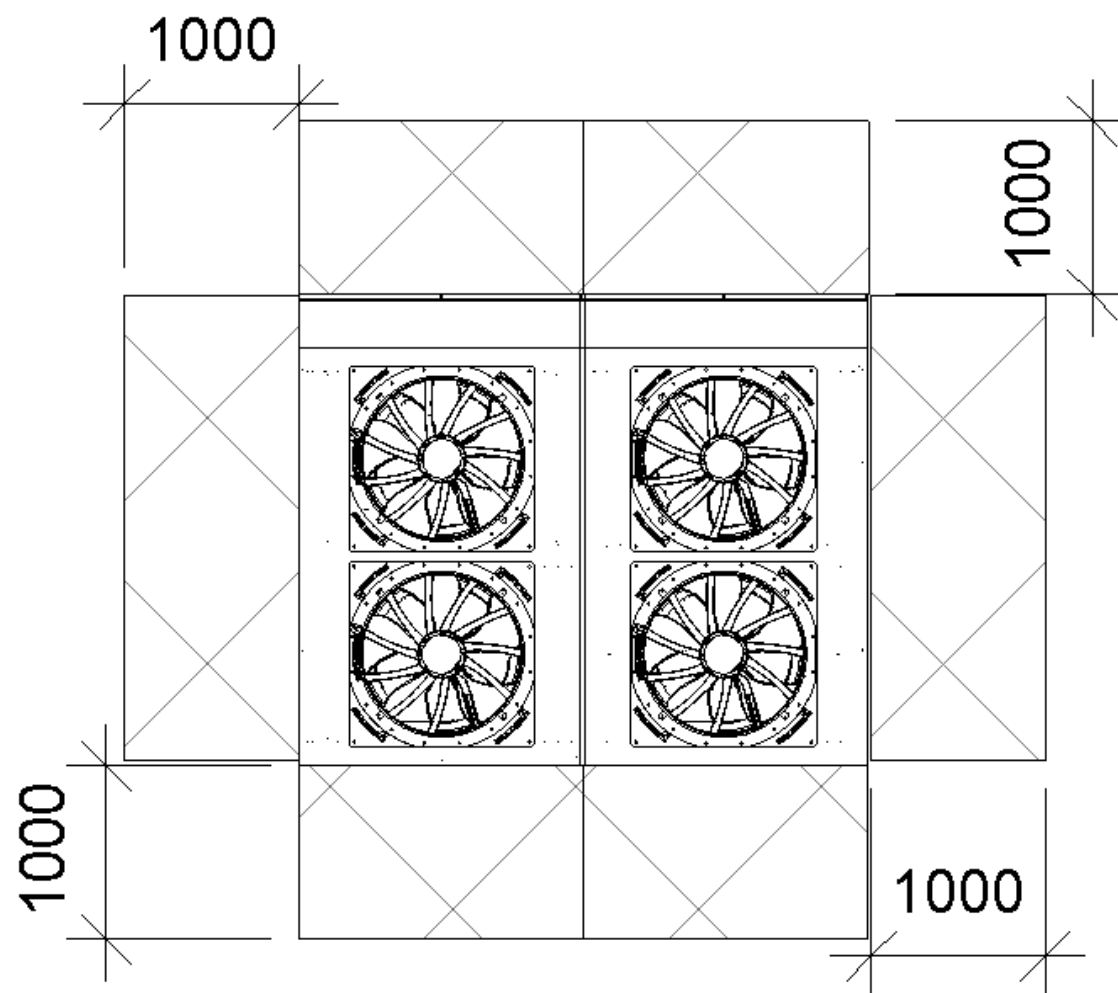
### 2.5.2 Clearance Above the Unit

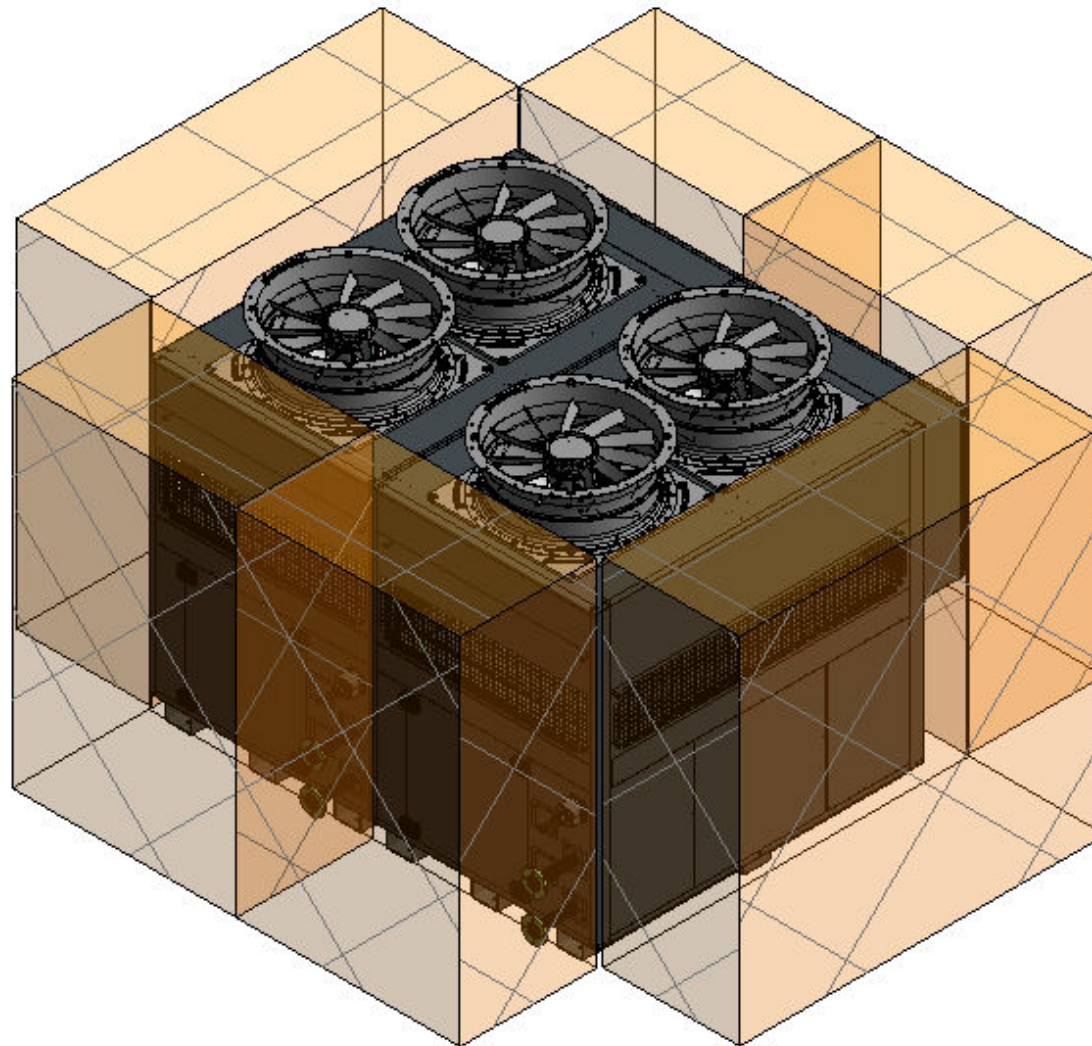
For maximum airflow and therefore better performance, Clade requires at least 6m clearance above the unit.



### 2.5.3 Multiple Unit Installation

When installing multiple units, make sure to take into consideration factors such as providing enough space for people to pass through, ample space between blocks of units, and sufficient space for airflow. Rowan 3 Plus heating units can be placed side by side with a **50mm gap** between each other to maximise space efficiency as below:



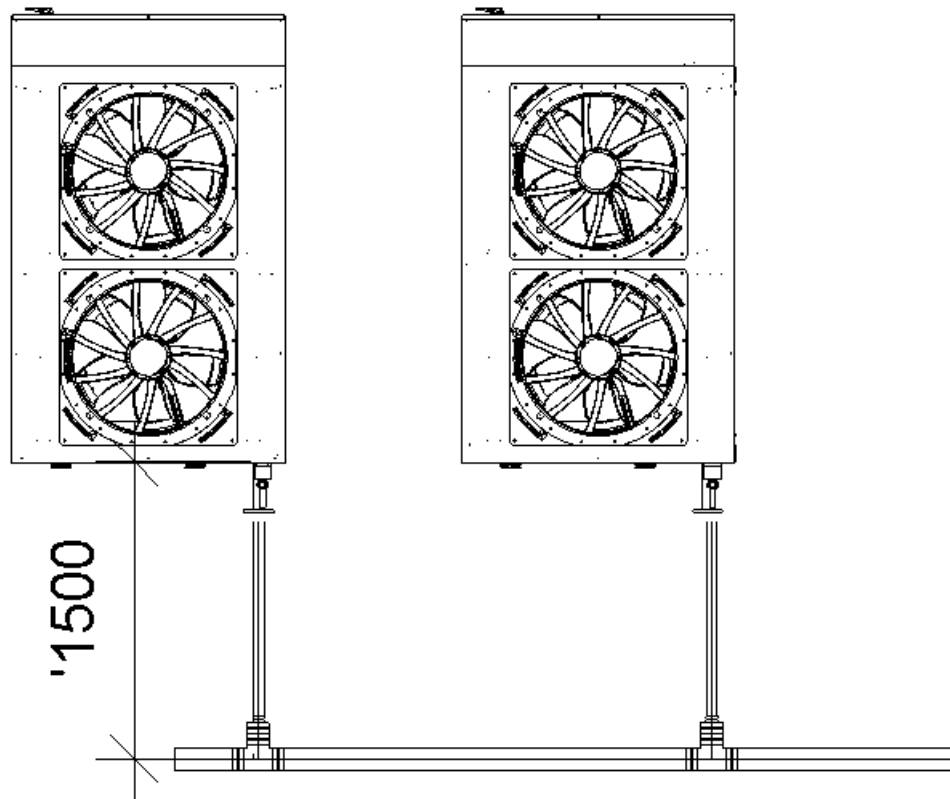


There must be a 50mm gap between units to allow for removal of lifting straps once the unit has been placed down after lifting.

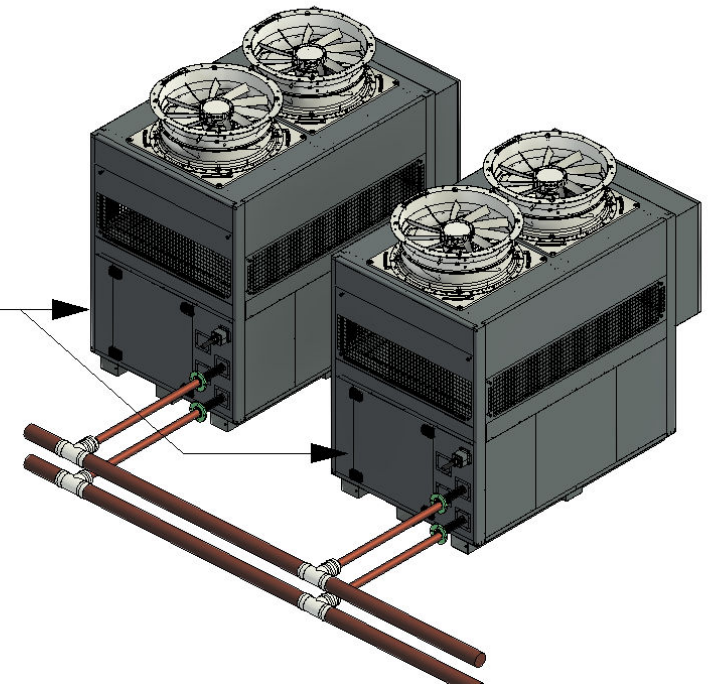


#### 2.5.4 Space Requirements from Header

Where a common header is installed in front of the unit, a minimum clear distance of 1500 mm must be maintained between the header and the front access panel of each unit. This clearance provides the swing arc of the hinged access panel through its full opening, safe standing and working space for an engineer at the open panel, and withdrawal space for components removed through the front aperture. The 1500 mm is measured horizontally from the front face of the access panel in the closed position to the nearest point of any part of the header installation. This includes insulation, valve bodies, handwheels and actuators, strainer bodies, drain and vent points, and pipe supports or brackets.

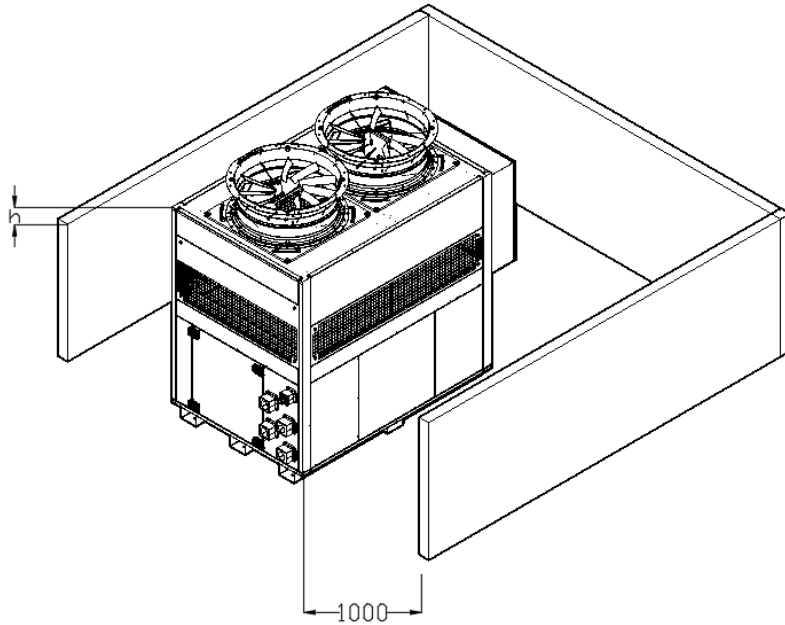


Hinged  
Access  
Panel

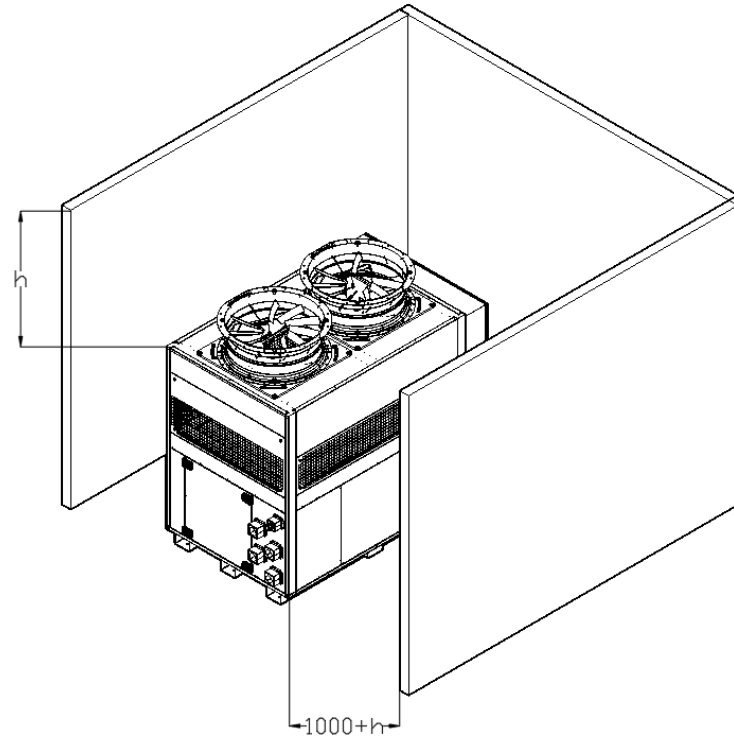


## 2.5.5 Wall Heights

(1)



(2)



The required clearances around the unit are affected by the height of any adjacent walls or structures. The following scenarios must be used to determine the correct minimum clearances for the installation site.

(1) Walls around the unit do not exceed the unit height.

Where all adjacent walls or structures are equal to or lower than the height of the unit, a minimum clearance of 1000 mm must be maintained on all sides.

(2) One or more walls exceed the unit height

Where one or more adjacent walls or structures exceed the height of the unit, the standard 1000 mm clearance is no longer sufficient. The required clearance must be increased on the affected side(s) by the amount  $\langle h \rangle$ , where  $\langle h \rangle$  is the height by which the wall exceeds the top of the unit.

## 3 Technical Data

### 3.1 Performance Data

| Rowan 3 Plus                                         |       |
|------------------------------------------------------|-------|
| Heating performance data to EN14511 (A7/W60) 10K TD  |       |
| Rated heating output kW                              | 120.9 |
| Coefficient of Performance (COP)                     | 2.85  |
| Heating performance data to EN14511 (A-5/W60) 10K TD |       |
| Rated heating output kW                              | 92.5  |
| Coefficient of Performance (COP)                     | 2.35  |

For more detailed and extensive performance data please see the Clade ASHP Performance Program

#### 3.1.1 Variable Supply SCOPs

System seasonal efficiency can be significantly improved by varying the water flow temperature in response to external ambient temperature, a strategy known as weather compensation. The table below shows the SCOP achievable at different design flow temperatures for each standard array configuration.

| Rowan 3 Plus                          | Heating |
|---------------------------------------|---------|
| SCOP - Variable Supply Temp - W65 (1) | 3.20    |
| SCOP - Variable Supply Temp - W55 (1) | 3.60    |
| SCOP - Variable Supply Temp - W45 (1) | 3.84    |
| SCOP - Variable Supply Temp - W35 (1) | 4.18    |

- (1) COP / EER figures provided in this table are calculated in line with EN14511 (SCOP/SEER in line with EN14825) at the stated ambient conditions and design water flow and return temperatures. Figures shown relate to specific design conditions which in physical application may vary significantly due to changes and fluctuations in conditions such as ambient temperature, humidity and fluctuations to system temperatures, flow rates etc. As such all COP / EER figures are subject to variation and should be taken as maximum achievable instantaneous figures at the design condition.
- (2) SCOP figures represent the maximum achievable seasonal efficiency at the stated design condition. Actual in-service performance will vary with ambient temperature, humidity, system flow rates, and the degree to which weather compensation control is implemented. These figures should not be used as guaranteed energy consumption values for building regulations compliance calculations without applying appropriate correction factors.

## 3.2 Construction Table

| Rowan 3 Plus 120/90 kW              |         |                       |      |
|-------------------------------------|---------|-----------------------|------|
| REFRIGERATION SIDE                  |         |                       |      |
| Compressor Type                     | -       | Reciprocating         |      |
| Compressor Qty                      | Pcs.    | 1                     |      |
| Refrigerant                         | -       | Propane (R290)        |      |
| Refrigerant Circuits                | Pcs.    | 1                     |      |
| Variable speed drive (VSD)          | Pcs.    | 1                     |      |
| Refrigerant charge                  | kg      | 7.3                   |      |
| Max Operating Pressure — LP Side    | bar     | 16.2                  |      |
| Max Operating Pressure — HP Side    | bar     | 40                    |      |
| Evaporators Type                    | -       | Fin/Tube Air Coil     |      |
| Fin Material (Air Coil)             | -       | AL/MG                 |      |
| Defrost Type                        | -       | Hot Gas               |      |
| Defrost medium                      | -       | R290                  |      |
| DIMENSIONS & NOISE                  |         |                       |      |
| Colour                              | -       | RAL7016 Anthracite    |      |
| Height                              |         | 2636                  |      |
| Length                              |         | 2400                  |      |
| Depth                               |         | 1700                  |      |
| Low Noise (LN)                      |         |                       |      |
| Unit Weight (Shipped)               | kg      | 2136                  |      |
| Sound Power Level Lw(A)             | dB      | 68                    |      |
| Standard Noise (SN)                 |         |                       |      |
| Unit Weight (Shipped)               | kg      | 1845                  |      |
| Sound Power Level Lw(A)             | dB      | 84                    |      |
| ACCESS                              |         |                       |      |
| Minimum free space side             | mm      | 1000                  | 1000 |
| Minimum free space front            | mm      | 1000                  | 1000 |
| Minimum free space back             | mm      | 1000                  | 1000 |
| Minimum free space above            | mm      | 6000                  | 6000 |
| WATER SIDE                          |         |                       |      |
| Type of internal exchangers         | -       | Stainless steel plate |      |
| No. of Plate Heat Exchangers        | Pcs.    | 1                     |      |
| Exchanger Water Volume              | L       | 27.3                  |      |
| Connections waterside inlet/outlet  | mm (OD) | 67                    |      |
| Control Methodology                 | -       | PICV (Danfoss AB-QM)  |      |
| Total Waterside Pressure Drop (Max) | kPa     | 56.1                  |      |
| Max System Water Flow Rate          | l/s     | 3.10 at W40/30 10K TD |      |

|                                  |                   |                                 |
|----------------------------------|-------------------|---------------------------------|
| Min Water Flow Rate              | l/s               | 0.95                            |
| <b>FANS SECTION</b>              |                   |                                 |
| Fans type                        | -                 | Axial                           |
| N° fans                          | Pcs.              | 2                               |
| Total System Airflow (Max)       | m <sup>3</sup> /s | 9.5                             |
| Evaporator Airside Pressure Drop | Pa                | 212                             |
| Fan Input Power (Max)            | kW                | 3.9                             |
| Fan regulation                   | -                 | 0-10V                           |
| <b>ELECTRICAL DATA</b>           |                   |                                 |
| Electrical supply                | -                 | 3~ 400V 50 HZ                   |
| Total Absorbed Power (Max)       | kW                | 54.0                            |
| Total Current per phase (FLC)    | A                 | 84.7                            |
| Max Operating Current (MOC)      | A                 | 109.9                           |
| Max Start-Up Current             | A                 | 43.9                            |
| Max Inrush Current               | A                 | 329.7                           |
| Total kVA (Max)                  | kVA               | 58.7                            |
| Mains Isolator                   | A                 | 125                             |
| Communication protocol           | -                 | BACNET over IP (optional extra) |
| IP-Class                         | -                 | IP24                            |

## 3.4 Noise

Noise attenuation is built into the Low Noise (LN) Rowan 3 Plus heat pump. The LN heat pump is designed with upgraded housing to minimise noise. Standard Noise (SN) Rowan 3 units have no additional attenuation to the evaporator fans or housing.

### 3.4.1 Vibration Isolation

- **Flexible connections** must be fitted on all water connections at the unit on both flow and return. Braided stainless steel flexible connectors are recommended.
- **Anti-vibration measures** should be fitted between the unit base frame and the supporting structure, particularly on rooftop installations or where the unit is mounted on a lightweight steel or concrete frame
- **Pipework supports** must be independent of the unit housing, do not fix pipe supports, brackets, cable trays, or any other external element directly to the unit panels or frame. Doing so creates a rigid acoustic bridge that will transmit compressor and fan vibration directly into the building structure, negating any isolation measures elsewhere in the system
- **Inertia bases** should be considered on sensitive installations such as directly above occupied spaces

### 3.4.2 Installation Acoustic Corrections

It should also be noted that our noise test data is based on a hemispherical measurement approach, which assumes free-field conditions without additional reflective surfaces. In cases where equipment is suspended, like the proposed frame, or installed in proximity to reflective structures, the acoustic environment is altered, and corrections must be applied. This includes consideration of increased tonality penalties, particularly where additional surfaces amplify low-frequency emissions.

### 3.4.3 Noise Calculation

Noise details are detailed below for the Rowan 3 heat pump range. Data includes units with optional silencers installed as well as a low noise housing option with silencers for comparison. Reported in accordance with BS EN ISO 4871: 2009 and Measured in Accordance with BS EN ISO 9614 - Part 1: 2009

| Rowan 3 Plus Range                        | Heating |    |
|-------------------------------------------|---------|----|
|                                           | SN      | LN |
| Sound Power Level, $L_{W(A)}$ (dB) (1)(2) | 84      | 68 |
| Sound Pressure Level at 10m (dB) (3)      | 52      | 36 |
| Uncertainty (dB)                          | 4       |    |

| Unit               | Octave Band Centre Frequency (Hz) |     |     |     |      |      |      |      |     |     |
|--------------------|-----------------------------------|-----|-----|-----|------|------|------|------|-----|-----|
|                    | 63                                | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Lin | (A) |
| Heating SN Lw (dB) | 95                                | 98  | 81  | 81  | 74   | 64   | 59   | 49   | 100 | 84  |
| Heating LN Lw (dB) | 79                                | 80  | 67  | 64  | 60   | 54   | 50   | 42   | 85  | 68  |

(1) The sum of a measured noise emission value and its associated uncertainty represents an upper boundary of the range of values which is likely to occur in measurements

(2) The sound levels refer to a unit operating under conditions that guarantee a thermal capacity equal to that declared at an outdoor air temperature of 7°C DB (6°C WB), according to EN 14825:2022

(3) Assumed 10m parallelpiped sound propagation

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### 3.5 Glycol use correction factors

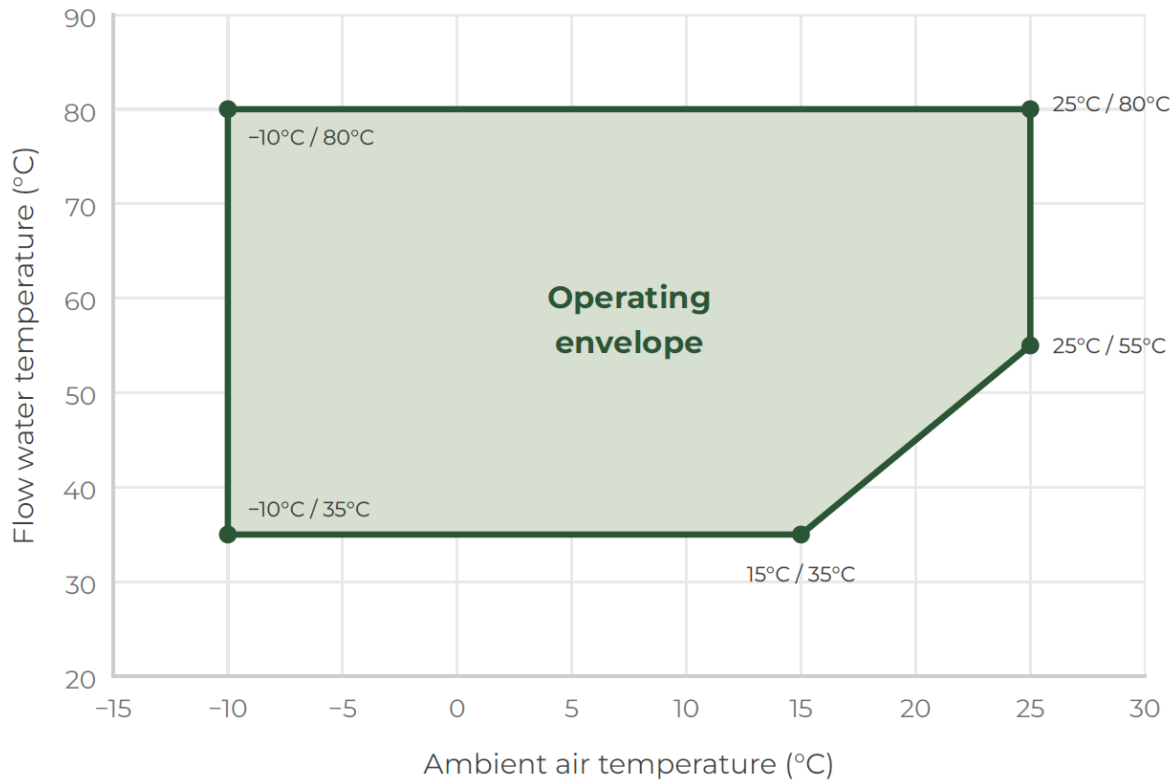
| % propylene glycol by weight                |    | 0% | 10%   | 20%   | 30%   |
|---------------------------------------------|----|----|-------|-------|-------|
| Freezing point                              | °C | 0  | -3    | -8    | -14   |
| Correction factor for flow rate             | Nr | 1  | 1.020 | 1.045 | 1.074 |
| Correction factor for system pressure drop  | Nr | 1  | 1.019 | 1.042 | 1.071 |
| Correction factor for unit heating capacity | Nr | 1  | 1.000 | 1.000 | 1.001 |

The correction factors shown refer to water and propylene glycol mixes used to prevent the formation of frost on the exchangers in the water circuit during inactivity in winter. Glycol has no impact on kW output of the Rowan 3 Plus units, instead the unit modulates flow rate.

## 3.6 Operating Ranges

### 3.6.1 Heating

Maximum return water temperature 70°C



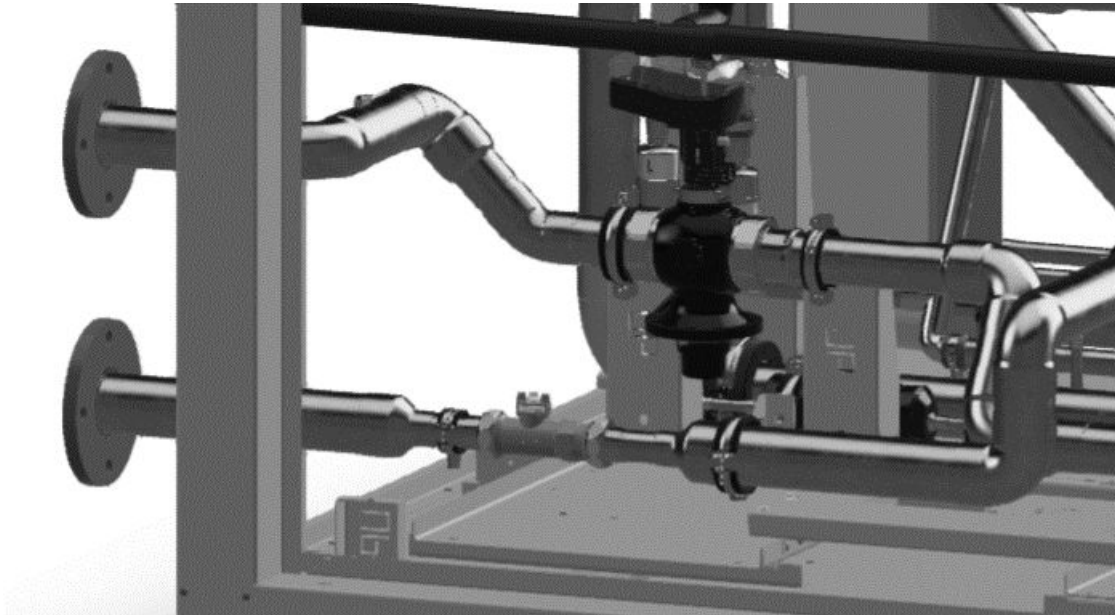
The Rowan 3 Plus unit is rated for a maximum return water temperature of 70 °C. The permissible flow/return temperature differential ( $\Delta T$ ) varies as follows:

- **At 70 °C return:** Minimum  $\Delta T$  is 10 K
- **Below 70 °C return:** Minimum  $\Delta T$  is 5 K.
- **Across all operating conditions:** Maximum  $\Delta T$  is 20 K.

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## 3.7 Pressure Independent Control Valves

All Rowan 3 Plus units are factory-fitted with Danfoss AB-QM NovoCon Pressure Independent Control Valves on the water circuits. The Rowan 3 Plus is fitted with a DN50 on the heating water circuit and does not include an internal circulating pump. Instead, the water circulating pump for the system must be sized, sourced, and installed by a third party; Clade does not supply a circulating pump as part of the standard heat pump offering.



The PICVs are engineered to regulate the flow through the plate heat exchanger by varying the pressure drop across the valve independently of the inlet pressure. This design ensures that the system-side flow balance remains unaffected. Moreover, the design flow rate is directly set in the actuator in built software, eliminating the need for manual valve presetting since the actuator automatically manages the valve's operating envelope.

### 3.7.1 Primary Pump Control

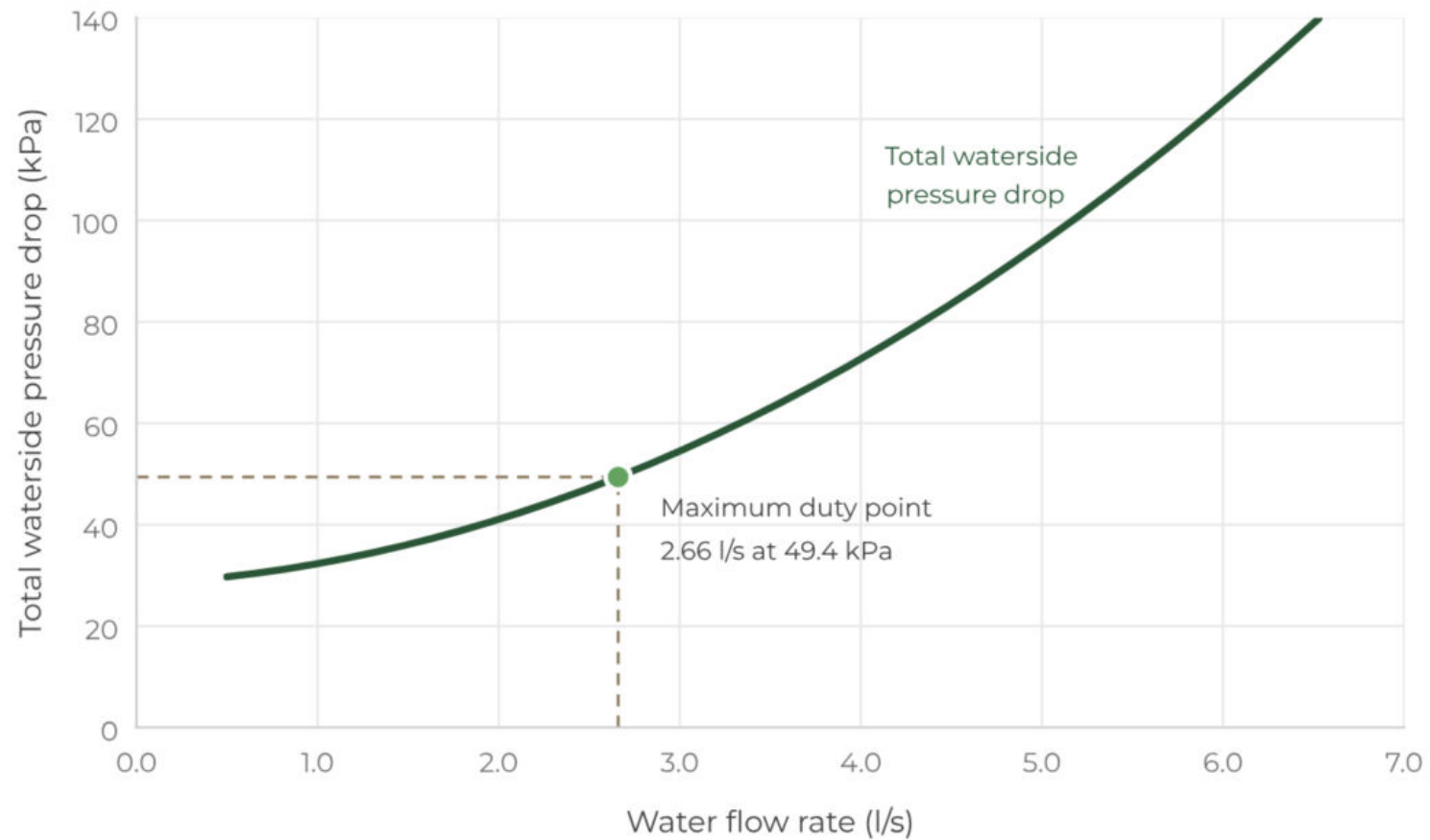
The system circulating pump must be configured to operate in **constant pressure (constant differential pressure) mode**. Variable pressure, constant flow or proportional pressure pump control modes must not be used with this system.

## 3.8 Internal Exchanger Pressure Drops and Admissible Water Flow Rates

### 3.8.1 Heating

#### Total waterside pressure drop

Heating at W80/70 (10 K TD)



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### **3.9 Performance data**

The performance data presented here reflects testing under the controlled parameters outlined in EN 14511 and is intended for ideal conditions only. Actual performance may differ due to variables such as installation specifics, operational settings, and climatic variations. Customers should verify requirements for each individual application, recognizing that local conditions in the United Kingdom can markedly influence real-world results.

### 3.9.1 Rowan 3 Plus Heating

| Model name | Water Temp (°C) | -10°C External |         |     | -5°C External |         |     | 0°C External |         |     | 5°C External |         |     | 7°C External |         |     | 10°C External |         |     | 15°C External |         |     |
|------------|-----------------|----------------|---------|-----|---------------|---------|-----|--------------|---------|-----|--------------|---------|-----|--------------|---------|-----|---------------|---------|-----|---------------|---------|-----|
|            |                 | QH (kW)        | PI (kW) | COP | QH (kW)       | PI (kW) | COP | QH (kW)      | PI (kW) | COP | QH (kW)      | PI (kW) | COP | QH (kW)      | PI (kW) | COP | QH (kW)       | PI (kW) | COP | QH (kW)       | PI (kW) | COP |
| ROWAN 3+   | 80/70           | 77.9           | 46.1    | 1.7 | 87.5          | 49.3    | 1.8 | 96.1         | 51.2    | 1.9 | 107.2        | 53.5    | 2.0 | 111.5        | 54.0    | 2.1 | 111.5         | 52.7    | 2.1 | 111.5         | 50.5    | 2.2 |
|            | 75/65           | 78.8           | 43.6    | 1.8 | 88.8          | 46.5    | 1.9 | 97.9         | 48.3    | 2.0 | 109.3        | 50.4    | 2.2 | 113.9        | 50.8    | 2.2 | 113.9         | 49.6    | 2.3 | 113.9         | 47.4    | 2.4 |
|            | 70/60           | 79.9           | 41.3    | 1.9 | 90.0          | 44.0    | 2.0 | 99.7         | 45.7    | 2.2 | 111.4        | 47.5    | 2.3 | 116.2        | 47.8    | 2.4 | 116.2         | 46.7    | 2.5 | 116.2         | 44.5    | 2.6 |
|            | 65/55           | 80.9           | 39.1    | 2.1 | 91.2          | 41.6    | 2.2 | 101.5        | 43.2    | 2.4 | 113.5        | 44.8    | 2.5 | 118.6        | 45.1    | 2.6 | 118.6         | 44.0    | 2.7 | 118.6         | 41.8    | 2.8 |
|            | 60/50           | 82.0           | 37.2    | 2.2 | 92.5          | 39.4    | 2.3 | 103.3        | 40.8    | 2.5 | 115.6        | 42.3    | 2.7 | 120.9        | 42.4    | 2.8 | 120.9         | 41.4    | 2.9 | 120.9         | 39.3    | 3.1 |
|            | 55/45           | 83.1           | 35.3    | 2.4 | 93.8          | 37.4    | 2.5 | 105.1        | 38.7    | 2.7 | 117.7        | 39.9    | 3.0 | 123.2        | 40.0    | 3.1 | 123.2         | 39.0    | 3.2 | 123.2         | 36.9    | 3.3 |
|            | 50/40           | 84.2           | 33.6    | 2.5 | 95.1          | 35.5    | 2.7 | 106.9        | 36.6    | 2.9 | 119.7        | 37.7    | 3.2 | 125.4        | 37.7    | 3.3 | 125.4         | 36.7    | 3.4 | 125.4         | 34.6    | 3.6 |
|            | 45/35           | 85.3           | 32.0    | 2.7 | 96.3          | 33.7    | 2.9 | 108.7        | 34.7    | 3.1 | 121.7        | 35.5    | 3.4 | 127.6        | 35.5    | 3.6 | 127.6         | 34.5    | 3.7 | 127.6         | 32.5    | 3.9 |

## 4 Electrical Installation

### 4.1 Electrical data

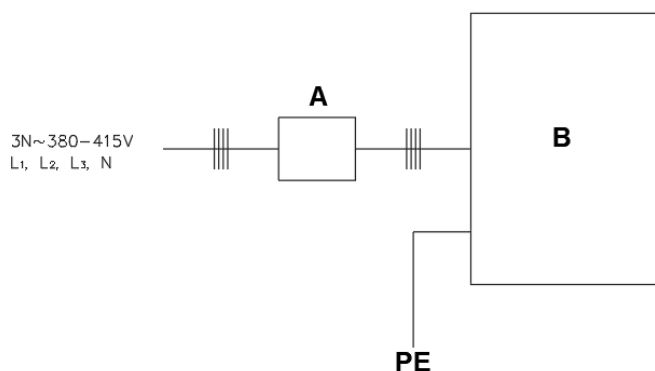
#### 4.1.1 Supply voltage 400/3/50+N

| Rowan 3 Plus                                                        |    | Heating |
|---------------------------------------------------------------------|----|---------|
| F.L.A. - Full load current at max admissible conditions (per phase) |    |         |
| F.L.A. - Total                                                      | A  | 84.7    |
| M.O.C. - Max Operating Current                                      |    |         |
| M.O.C. - Total                                                      | A  | 109.9   |
| F.L.I. - Full load power input at max admissible conditions         |    |         |
| F.L.I. - Total                                                      | kW | 54.0    |
| M.I.C. - Maximum inrush current                                     |    |         |
| M.I.C. - Total                                                      | A  | 329.7   |

Power supply 400/3/50 (+ NEUTRAL) +/- 10%. Maximum Phase Unbalance: 2%.

For non-standard voltage please contact Clade technical office

### 4.2 Mains Supply Installation



A: Upstream Protection (by others)

B: ASHP

#### 4.2.1 Power Supply Details

| SN + LN      | External power supply |                    |                  |
|--------------|-----------------------|--------------------|------------------|
|              | Power supply          | Switch manual      | Local Protection |
| Rowan 3 Plus | 380-415V 3N~ 50Hz     | 125A (pre mounted) | 125A             |

Each Rowan 3 Plus ASHP requires a dedicated 400/3/50 +N power supply with tolerance  $\pm 10\%$  and a maximum allowable phase imbalance of 2%.

- Each unit is supplied with its own local isolator and MCB 10KA C Curve 3 Pole protection device protection device.
- Upstream protection must be provided by the installer and correctly sized to suit the unit's full load and inrush currents (see Section 4.1).
- Cable sizing must consider local climatic conditions, service routes, ambient temperature, installation method, and grouping factors.
- The electrical installation must comply with BS 7671:2018 (IET Wiring Regulations) or the equivalent national wiring regulations in the country of installation.

**CAUTION**

- Always use correctly rated fuses or breakers. Incorrectly sized protective devices may result in malfunction, overheating, or fire.
- Ensure cables are adequately supported and that no external mechanical stress is imparted on terminations. Loose or stressed connections can cause overheating and arcing.

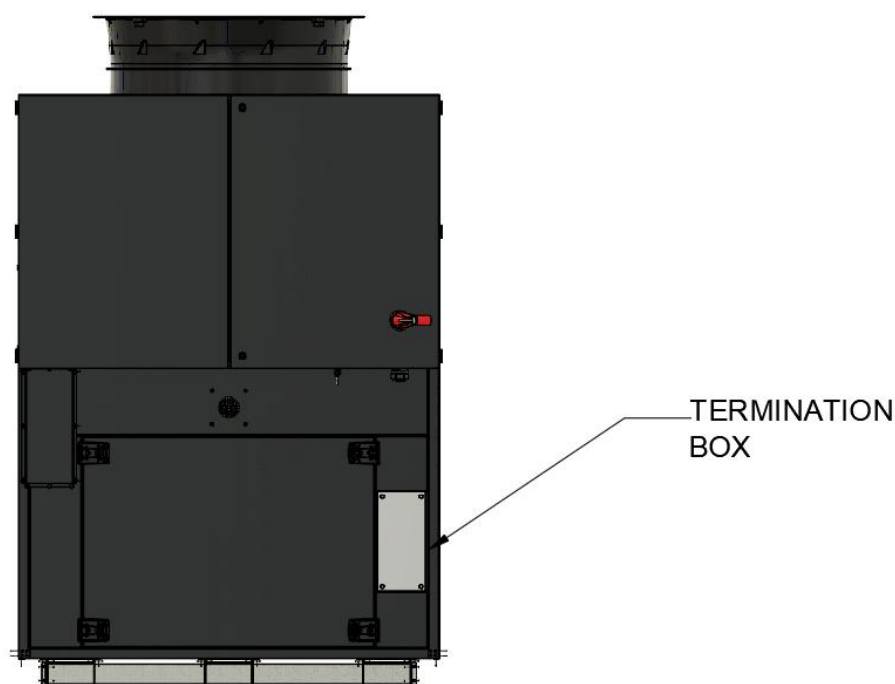
## 4.2.2 Terminal Block Arrangement

Each Rowan 3 Plus heat pump is fitted with glanding for the incoming mains supply. The termination entry point is identical across the entire Rowan 3 Plus range and is positioned on the rear, right-hand side of the unit (refer to the illustration below).

- Route supply conductors through the bottom of the factory-installed termination box which is indicated in the figure below.
- Size all supply cables in accordance with the full load current (FLA) of the unit (see Electrical Data section).
- Tighten all terminals to the torque values specified on the terminal-strip label.
- There is then cable gland directly above the termination box to route cable into the unit.

**CAUTION**

Earth tabs must be reconnected prior to refitting access panels



### 4.2.3 Maximum Cable Sizes

Maximum copper conductor cross-sections for the mains supply terminations are as follows. These are the maximum sizes the terminal blocks can accept – actual cable size must be determined by the installing electrician in accordance with BS 7671:2018.

| Model SN + LN | Maximum Cu cable cross-section (mm <sup>2</sup> ) |
|---------------|---------------------------------------------------|
| Rowan 3 Plus  | 50                                                |

#### **WARNING**

Be sure to use specified wires and ensure no external force is imparted to terminal connections. Loose connections may cause overheating and fire.

#### **CAUTION**

Only use properly rated breakers and fuses. Using a protection device of the wrong size may cause the unit to malfunction or set fire.

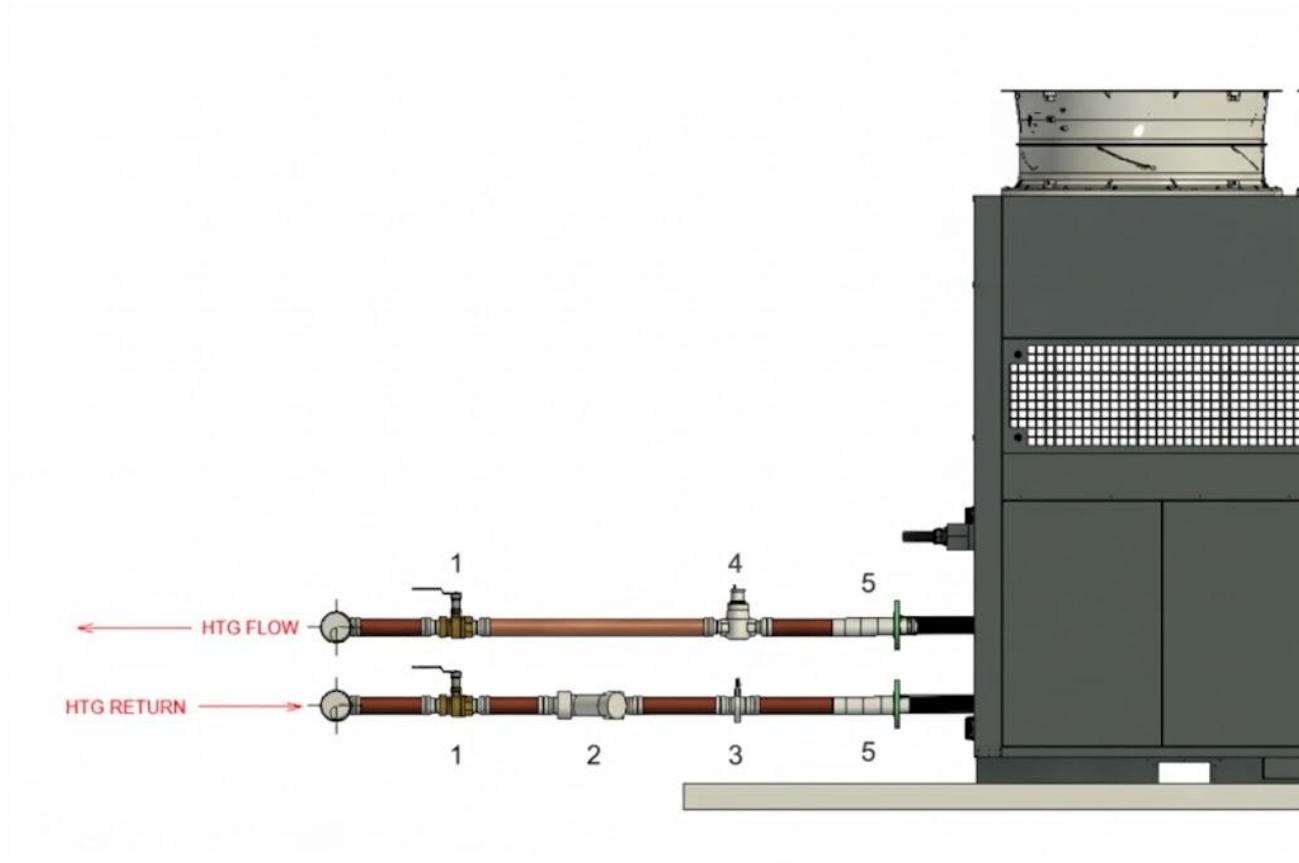
### 4.2.4 Control Connections

The following control cable specifications are required:

|                                     |                                                                                           |
|-------------------------------------|-------------------------------------------------------------------------------------------|
| Remote controller cable size        | 0.3 - 1mm <sup>2</sup><br>Shielded cable recommended to minimise electrical interference. |
| Cable between units and controllers | Cat 5/6 data cable                                                                        |

## 5 Hydraulics

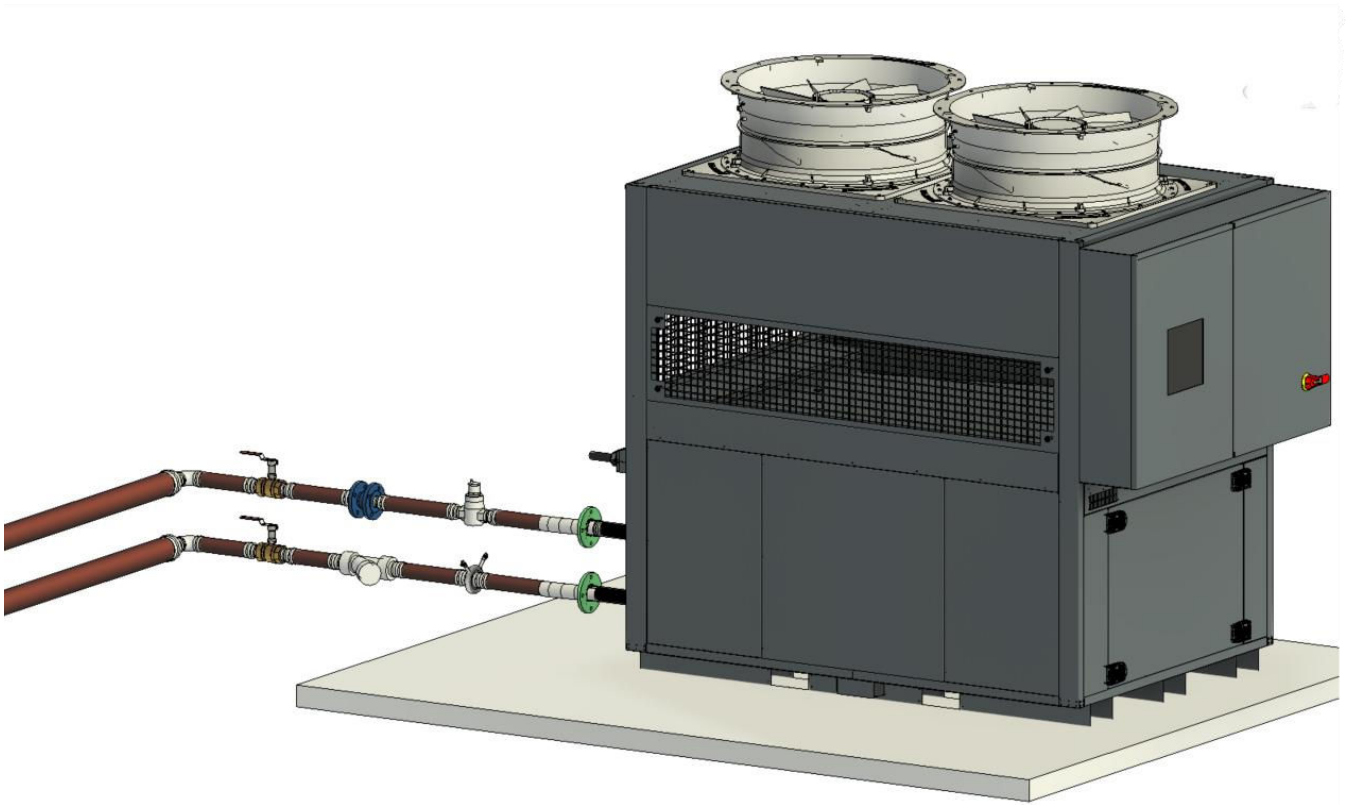
### 5.1 Piping Connections



Each UNIT must be fitted with the above ancillaries before tying into the main header. The abbreviations on the diagram can be seen below.

|   |                     |                                                    |
|---|---------------------|----------------------------------------------------|
| 1 | Isolation Valve     | Allow for isolation for maintenance                |
| 2 | Strainer            | Prevents addition of debris into the unit          |
| 3 | Orifice Plate       | Flow rate measurement and verification             |
| 4 | Auto Air Vent       | Required to release air accumulating within system |
| 5 | Flexible Connection | Mitigates noise/vibration through pipework         |

**Note – Water-side pressure relief :** This connection detail does not include a water-side safety (pressure relief) valve. The provision, sizing, setting and correct location of pressure relief for the closed water circuit is the responsibility of the system designer and installing contractor.



### 5.1.1 Pipe Connection Sizes

| Connection Type | Rowan 3 Plus           |
|-----------------|------------------------|
| Heating Flow    | 65mm Bimetallic Flange |
| Heating Return  | 65mm Bimetallic Flange |
| Condensate      | 32mm Gland             |

### 5.1.2 Header Kits



Clade offers pre-manufactured header kits as an optional accessory, supplied alongside Rowan 3 air source heat pump units. These kits allow several units to be hydraulically combined into a single common flow and return arrangement, removing the need for the installer to fabricate bespoke headers on site.

Each kit is supplied as a factory-assembled section complete with all ancillaries required for connection to its associated unit (see 5.1). Sections are modular: they are available individually (single-unit) or as twin (two-unit) sections and may be bolted together to form a combined header serving **up to six units**. Header sections are combined to suit the number of units on the installation. The table below summarises the standard build-up.

| Units served | Section combination           |
|--------------|-------------------------------|
| 1            | 1 × single section            |
| 2            | 1 × twin section              |
| 3            | 1 × twin + 1 × single section |
| 4            | 2 × twin sections             |
| 5            | 2 × twin + 1 × single section |
| 6            | 3 × twin sections             |

### 5.1.3 Freezing Protection

In areas prone to freezing, fit each exterior pipe with a freeze-prevention heater to stop ice from forming. After installing the heater, verify that the pipe joints on the heat pump's inlet and outlet remain at roughly +25°C—even if the outdoor temperature drops to -25°C—to ensure the joints don't fall below 0°C. For different types of pipe materials, consider a self-regulating heater or an equivalent solution that prevents both freezing and overheating.

## 5.2 Defrost

The ASHPs come with their own hot gas frost protection cycle. This shuts off the internal LTHW flow through the ASHPs and directs hot gas through the evaporation coils removing any ice build-up. If required, the buffer should be adequately sized to maintain heating service to the building. See section 5.5. 2.

### 5.2.1 Minimum Free Flowing Water Content

In order to protect the integral components of the unit, the primary system requires a minimum water content. This volume ensures the compressor cannot exceed six starts per hour when the unit is running at minimum turndown.

|                                                     |         |
|-----------------------------------------------------|---------|
| Minimum water volume per Rowan 3 Plus unit (liters) | Heating |
|                                                     | 600     |

**Please Note:** This is the minimum volume to protect the compressor and extend the lifespan of the units. If the units are to be controlled on capacity control, there will need to be more volume in the vessel to allow for stratification control.

### 5.2.2 Optimal Buffer Sizing

While the minimum buffer sizes ensure basic heat pump protection and operational stability, optimally sized buffers enhance system efficiency, reduce cycling frequency, and improve overall performance. Buffer vessel sizing ultimately rests with the system designer however, the following recommendations provide guidance on selecting the ideal buffer capacity to maximise energy efficiency and maintain consistent heating output.

**Defrost Cycle Management:** Air source heat pumps undergo periodic defrost cycles, during which the heat pump uses hot gas to clear ice from the evaporator. During this period, the buffer vessel provides stored thermal energy to maintain heating supply to the building. The vessel must be sized to cover the full heat load during defrost to prevent temperature drops. Clade recommends a minimum of 15 minutes storage to cover this.

**Peak Load Consideration:** The buffer volume should accommodate the total peak kWh heating demand of the building while accounting for variations in heat pump output due to defrost.

**Building Load Profiles:** CIBSE Guide A shows how to perform detailed analysis of building heating load profiles. Factors such as occupancy patterns, thermal mass, and intermittent heating requirements should be evaluated to determine the total time the peak load is required and the necessary storage capacity.

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### 5.2.3 Buffer Design Considerations

To ensure optimal performance and efficiency in heat pump systems, proper buffer vessel design is crucial. A well-designed buffer enhances stratification, maximises usable volume, and provides precise control for charging and discharging cycles. Key aspects of an effective buffer design include:

- **Height-to-Width Ratio:** A buffer vessel should have a minimum height-to-width ratio of 2.5:1. This geometry promotes better thermal stratification by reducing the potential for mixing between layers, ensuring a stable temperature gradient within the vessel.
- **Sparge Pipes:** Increases the useable volume of the vessel.
- **External Combined Headers:** One in one out header based on CIBSE Cp1. Prevents mixing and maintains stratification and is sized to achieve less than 0.3 m/s velocity into the vessel. The header helps maintain stable pressure conditions across both the primary and secondary circuits. This is essential for variable flow systems and avoids issues with fluctuating demand.
- **Temperature sensors:** Five temperature sensors distributed vertically within the buffer need to be distributed properly for precise monitoring and adjustments to maintain optimal conditions. When there are multiple buffers, these need to be spread across the vessels evenly. Four additional sensors on the primary and secondary flow and return pipework from the buffer.

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## 5.3 System Pressure

All mechanical/LTHW systems require pressure relief equipment to maintain the safe working condition of the system. This will be designed and specified by the system designer/installer.

### 5.3.1 Safety Valves

Safety valves on the low-temperature hot-water side are compulsory on all Rowan 3 Plus installations. Their role is to prevent system pressure from rising above the maximum allowable working pressure, thereby protecting pipework, heat exchangers and ancillary equipment from over-pressure incidents. It is the system designer's or installer's responsibility to select, size and install these valves in accordance with the national standards ensuring correct set pressure, sufficient discharge capacity and proper discharge piping.

### 5.3.2 Propane Removal Device

In the rare event of a propane leak from the plate heat exchanger into the heating water circuit, there must be a means of separating propane from the heating water and safely venting it to atmosphere. This can be achieved using a degasser, an automatic air vent (AAV), or another device capable of releasing entrained gas from the system.

As contaminated water circulates, dissolved propane comes out of solution and forms gas bubbles at high points and points of pressure drop within the system. The removal device collects this gas and directs it to a vent that discharges safely to the outside atmosphere. This prevents propane from recirculating within the system or accumulating indoors, where it could pose a fire or health hazard.

For systems using propane refrigerant and a plate heat exchanger, it is strongly recommended to provide a reliable means of gas removal at appropriate locations in the circuit. Any device used must be suitable for the duty, and the vent line must comply with EN 378 and terminate in a safe, well-ventilated outdoor location.

## 5.4 Frost Protection

To prevent freezing of the water circuit, a frost protection strategy is implemented in all Clade units without internal circulating pumps. The primary circulating pump is enabled when all three of the following conditions are simultaneously met: ambient temperature falls below 4 °C, the unit flow sensor (P11) reads below 10 °C, and the unit return sensor (P12) reads below 10 °C. Once active, frost protection will terminate when any one of the following conditions is satisfied: ambient temperature rises above 6 °C, P11 exceeds 12 °C, or P12 exceeds 12 °C. This control logic assumes that heat is available within the external pipework from trace heating, which must be designed, installed, and maintained by the system designer/contractor.

**Trace Heating Responsibility:** Clade does not supply or control external trace heating. It is the designer's responsibility to ensure that pipework is correctly insulated and equipped with trace heating to maintain minimum fluid temperature during periods of low ambient conditions or unit inactivity.

### **When Primary Pumps Are Not Controlled by Clade:**

If the primary pump(s) are controlled by an external BMS or by-site strategy, Clade cannot guarantee frost protection of the unit. In this scenario, the BMS designer must ensure that the pumps are enabled in synchronisation with the frost thresholds defined above or provide an equivalent strategy to maintain water temperatures above 7 °C. Failure to run the pumps as described may result in localised freezing of the heat exchanger and external pipework, potentially causing permanent damage. Such damage is outside the scope of Clade warranty.

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## 6 Unit Installation

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### 6.1 General Installation notes

#### 6.1.1 Site Selection Criteria

##### Access and Maintenance

- Select a location that provides safe and unobstructed access for commissioning, routine maintenance, and emergency intervention
- Maintain the minimum clearances specified, 1000mm to all four sides and 6000mm above the unit. These clearances must be maintained permanently and must not be compromised by subsequent installation of plant, pipework, fencing, or structural elements
- Ensure the electrical panel access face has sufficient clear space for safe door swing and working distance in accordance with BS 7671:2018.

##### Airflow

- Avoid siting in corners, against tall walls, beneath overhangs, or in recesses where discharge air can stagnate or recirculate back to the evaporator inlet. Air recirculation causes the unit to reduce output and efficiency and potentially triggering high-pressure faults
- Avoid locations subject to strong prevailing winds directed at the evaporator face – wind pressure can impede fan operation and cause unpredictable airflow patterns across the coil
- Where multiple units are installed in an array, refer to Section 2.5 for array spacing requirements to prevent inter-unit recirculation
- Keep the evaporator coil free from debris accumulation such as leaves, litter, and windblown material will progressively block the coil face, reducing airflow and performance. Consider the proximity of vegetation at maturity, not at the time of installation.

##### Environmental

- Avoid flood-prone areas. Where flood risk cannot be eliminated, raise the unit on a plinth of sufficient height to keep electrical connections and the refrigerant circuit above the maximum credible flood level
- Account for maximum anticipated snow depth at the installation location, the unit must remain accessible, and the evaporator airflow path must remain unobstructed under maximum snow conditions. Where significant snowfall is expected, provide adequate plinth height and consider snow guards or baffles
- Avoid siting near sources of contaminated air such as chimneys, flues, cooling tower discharge, vehicle exhausts, or industrial emissions. Contaminated intake air will degrade coil performance and may cause accelerated corrosion of the aluminium fins and copper coil
- Consult the unit's declared sound power level (dBA) in the technical specifications. Use this to model expected sound pressure levels at neighbouring facades and property boundaries.
- When the unit is close to a coastal or saline environment, Blygold coating of the evaporator is suggested in order to protect the evaporator from corrosion.

##### Utilities & Drainage

- Confirm that electrical connection runs do not exceed the maximum allowable distance specified by the manufacturer.
- Provide a dedicated condensate drainage system to prevent standing water beneath the unit.
- Ensure water from the unit can be drained properly at all times.

##### Security & Safety

- If there is a risk of unauthorised access (children, vandalism, wildlife), install appropriate barriers or fencing.
- This unit is designed for outdoor installation only and must not be enclosed indoors.
- Do not install adjacent to open flame sources, gas fired plant flues, or equipment that generates sparks or sustained ignition sources at low level
- The refrigerant leak detection and ventilation fan fitted within the unit are active safety measures ensure the ventilation outlet is not obstructed and that the discharge from the ventilation fan cannot be directed towards an ignition source
- Ensure the installation location provides adequate natural ventilation at low level in accordance with EN 378-3. The unit must not be installed in a fully enclosed plant room without specific ventilation provision assessed against the R290 charge quantity.

Adherence to these guidelines will ensure safe installation, effective airflow, and long-term reliability of the outdoor unit

### 6.1.2 Structural Requirements

- Concrete bases are the preferred foundation type, providing stable, level support and effective mass for vibration damping
- All support points must be verified as level before the unit is positioned. An unlevel installation increases vibration, causes uneven loading on the frame, and may affect oil return in the compressor.
- The foundation must be structurally capable of supporting the unit operating weight. For roof installations, verify that the roof structure supports both the unit operating weight and the additional maintenance load.
- Separate the unit foundation from the building structure wherever possible to limit transmission of compressor and fan vibration. This is particularly important on rooftop installations where the structure provides a direct acoustic path to occupied spaces below.
- Use the factory-provided lifting centres, do not improvise alternative lifting or fixing arrangements
- Mount the unit above ground level to facilitate condensate drainage and to reduce moisture ingress into the base frame, a minimum 150mm plinth height is recommended.

### 6.1.3 Minimising Vibration

The Rowan 3 Plus is factory-fitted with TICO S/PA anti-vibration pad beneath the refrigeration pack base frame, internal to the housing at four corner positions. This pad, a blend of cork particles and polychloroprene acrylonitrile elastomers, 12.5mm thickness, isolates the compressor and refrigeration circuit from the unit housing, reducing structure-borne vibration transmission into the pipework and enclosure panels.

TICO S/PA (red material) must be used in all cases. Incorrect pad specification will affect the isolation characteristics and may increase vibration transmission.

*Please note - Clade do not supply or install vibration mitigation solutions for our heat pumps specifically for limiting vibration transmission from the housing to the building structure. However, TICO pad is supplied within the heat pump housing.*

#### TYPICAL PROPERTIES

|                                      |                       |                                                                                                                                                                                                        |
|--------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tensile Strength</b>              | 2.1 MN/m <sup>2</sup> | Tested in accordance with BS 903                                                                                                                                                                       |
| <b>Elongation at Break</b>           | 50%                   |                                                                                                                                                                                                        |
| <b>Hardness</b>                      | 69 + 5°               | IRHD                                                                                                                                                                                                   |
| <b>Thermal Conductivity</b>          | 0.1<br>0.7            | W/m°C<br>Btu x in/ft <sup>2</sup> x h x °F                                                                                                                                                             |
| <b>Damping Factor</b>                | 0.1                   |                                                                                                                                                                                                        |
| <b>Co-efficient of Friction</b>      | 0.65<br>0.5           | TICO to concrete<br>TICO to bright mild steel                                                                                                                                                          |
| <b>Temperature Range</b>             | -40° to +100° C       | TICO S will operate satisfactorily over the indicated range and is suitable for both arctic and tropical climates                                                                                      |
| <b>Maximum Load-bearing Capacity</b> | 0.5 MN/m <sup>2</sup> | TICO S will withstand very high dynamic and static loads without physical breakdown. In machinery mounting applications, the recommended max. static load should not be exceeded without consultation. |

Figure 1 – Tico Pad Specification

# TICO S/PA

## GRAPHICAL DATA

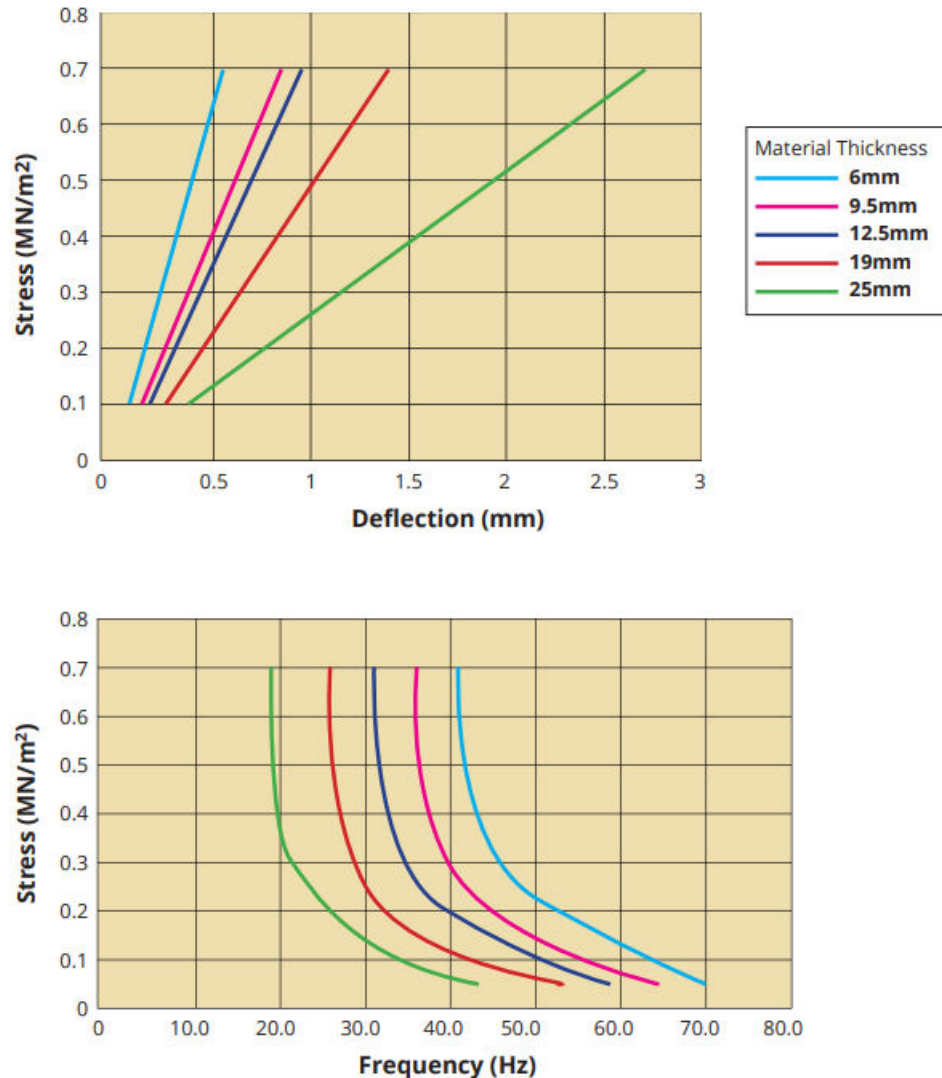


Figure 2 – Tico Pad Performance Curves

Please note that Tico S/PA MUST be specified in all cases. This is the red Tico material.

If Tico pad is used externally, the Tico pad supplied MUST be the same width as the width of the support channel to mitigate bending of the support channel and structural damage to the heat pump housing. Clade would recommend an S/PA pad with thickness 12.5mm (see above for further details) and these are to be in the corners of the heat pump between the support channels and the concrete or mounting structure.

Flexible connections must be fitted on all water pipework connections at the unit – refer to Section [5.1]. Do not rigidly fix pipework to the unit housing.

### 6.1.4 Charging lines

Where heat pumps are installed at roof level, ensure that dedicated charging lines are provided. These lines must allow for safe and efficient charging of refrigerant, either during commissioning when pre-charging is not feasible, or for subsequent top-ups during maintenance. The charging lines should be easily accessible from ground or plant level, designed to minimise pressure drop, and clearly identified to avoid confusion with other services.

### 6.1.5 Pressure Relief Valve Refrigerant Side

PRVs are included on the refrigerant loop within the unit.

**WARNING:** Do not cap, plug, or restrict the outlet of any refrigerant PRV under any circumstances. Blocking a PRV discharge creates a risk of catastrophic pressure vessel failure. Any evidence of PRV discharge must be investigated immediately, do not simply replace or reset the heat pump or the PRV without identifying and resolving the root cause of the over-pressure condition.

### 6.1.6 Condensate

The Rowan 3 Plus produces significant volumes of condensate during defrost cycles in heating mode. Condensate drainage must be designed and installed before commissioning.

- Route condensate away from pedestrian areas, vehicle access routes, and building entrances where pooling water could freeze and create a slip hazard
- Install a continuously falling drainpipe from the unit drain point, do not create traps or horizontal sections where water can pond and freeze within the pipework
- In locations where ambient temperatures regularly fall below 0°C, fit self-regulating trace heating cables to the condensate drain pipework to prevent ice blockage.
- Where the unit is on a roof, confirm the roof drain capacity is sufficient to handle defrost condensate volumes in addition to rainfall, defrost cycles can produce substantial water volume in a short period during cold weather operation

### 6.1.7 Freezing Prevention

All external water pipework must be protected against freezing. Failure to provide adequate freeze protection will cause damage to the plate heat exchangers, pipework, and ancillary components, this damage is not covered under the manufacturer's warranty.

The following measures must be implemented:

**Glycol dosing:** The system water circuit must be dosed with inhibited propylene glycol at a concentration providing frost protection to a minimum of -10°C, or to the minimum expected ambient temperature at the installation location plus a 5°C safety margin, whichever gives the lower freeze point

**Trace heating:** Self-regulating trace heating cables must be installed beneath the insulation on all external water pipework exposed to ambient temperatures below 0°C. Cables must be rated to maintain fluid temperature above 0°C at the minimum design ambient temperature of -25°C. Select self-regulating cable type, fixed-output cables create hot spots and may overheat insulation. Verify cable performance under worst-case conditions after commissioning.

**Pump failure protection:** In the event of circulating pump failure, the system will lose the heat input that prevents freezing during cold ambient conditions. A pump failure alarm must be connected to a BMS or monitoring system capable of alerting site personnel or a remote monitoring service. Where the system may remain unattended for extended periods in cold weather, a drain-down and isolation procedure must be established and documented.

## 6.2 Fire Safety

The insulation materials used in the construction of the Rowan 3 Plus range are classified in accordance with EN 13501-1, the European standard for reaction-to-fire performance of construction products.

EN 13501-1 classifies materials across three performance criteria:

- Combustibility – the extent to which a material contributes to a fire, rated A1 (non-combustible) through to F (no performance determined)
- Smoke production – rated s1 (low) through to s3 (high)
- Flaming droplets/particles – rated d0 (none) through to d2 (high)

### 6.2.1 Rowan 3 Plus Standard Noise (SN)

The acoustic insulation material used in the Standard Noise variant is classified:

| Criterion        | Rating | Meaning                                                                                                                  |
|------------------|--------|--------------------------------------------------------------------------------------------------------------------------|
| Combustibility   | B      | Very limited contribution to fire – will not significantly fuel a fire, though the material is not fully non-combustible |
| Smoke production | s3     | High smoke output under fire conditions                                                                                  |
| Flaming droplets | d0     | No flaming droplets or particles – will not drip burning material                                                        |

### 6.2.2 Rowan 3 Plus Low Noise (LN)

The acoustic insulation material used in the Low Noise variant is classified:

| Criterion        | Rating | Meaning                                                                                          |
|------------------|--------|--------------------------------------------------------------------------------------------------|
| Combustibility   | A1     | Non-combustible – the highest possible classification                                            |
| Smoke production | –      | No smoke emission (A1 classification inherently carries no smoke or droplet sub-classifications) |
| Flaming droplets | –      | Not applicable                                                                                   |

The LN variant uses a fully non-combustible material with zero smoke emission, making it the preferred selection for fire-sensitive applications or where planning or building regulations impose restrictions on combustible materials in plant areas.

---

## 6.3 Water quality

### 6.3.1 General Requirements

The water quality of the system directly affects the service life of the plate heat exchangers, circulating pump, PICV actuators, and all other water-side components. Poor water quality is one of the most common causes of premature heat exchanger fouling, corrosion, and component failure, none of which are covered under the manufacturer's warranty.

The system must be maintained in accordance with BSRIA BG 50/2021 (Water Treatment for Closed Heating and Cooling Systems) and BS 8552 throughout its operational life. Water quality must be verified at commissioning and checked at every annual service. Records of water quality test results must be retained on site.

### 6.3.2 New Systems

Before commissioning any new installation, the entire water circuit must be thoroughly flushed to remove installation debris including weld spatter, flux residue, jointing compounds, mineral oils, pipe preservatives, and swarf. Failure to flush adequately will result in debris entering the plate heat exchangers and PICV valves, causing fouling, blockage, and damage. After flushing, drain and refill with clean mains water dosed with the correct inhibitor and glycol concentration.

### 6.3.3 Existing Systems

When connecting the Rowan 3 Plus to an existing system, or when replacing an existing heat source, the condition of the system water must be assessed before the unit is connected. Connecting to a contaminated system will void the warranty.

- Obtain a water sample from the existing system and test against the parameters in Section 6.2.7 before proceeding
- Drain and flush all existing pipework before installing the new unit – flush each section of the system separately, paying particular attention to low-flow areas such as dead legs, bypass circuits, and the bases of vertical risers where sludge accumulates
- Where the existing system contains significant magnetite sludge, indicated by black discolouration of the sample water a full power flush is mandatory before connection. Consider whether the existing system condition warrants replacement of heavily corroded sections of pipework before connecting the new unit
- After flushing, refill and dose accordingly.

### 6.3.4 Water Filter

A minimum **30-mesh (0.6mm aperture) strainer** must be installed on the return pipework at the inlet to each Rowan 3 Plus module. The strainer must be:

- Positioned upstream of the unit isolation valve so it can be cleaned with the unit isolated
- Accessible for routine cleaning without draining the system
- Cleaned after initial system fill, after the first 48 hours of operation, and at every annual service thereafter
- Inspected and cleaned more frequently during the initial weeks of operation on a new system, as heat cycling mobilises further installation debris

### 6.3.5 Anti-freeze Solutions

Adding antifreeze increases system pressure drop and only inhibited (non-corrosive) glycol compatible with the circuit should be used. Do not use different glycol mixtures (i.e. ethylene with propylene).

| % PROPYLENE GLYCOL BY WEIGHT | 5%   | 10%  | 15%   | 20%   | 25%   | 30%   | 35%   | 40%   | 45%   | 50%   |
|------------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Freezing temperature (°C)    | -1.6 | -3.3 | -5.1  | -7.6  | -9.6  | -12.7 | -16.4 | -21.1 | -27.9 | -33.5 |
| Safety temperature (°C)      | -7.0 | -8.0 | -10.0 | -13.0 | -15.0 | -18.0 | -21.0 | -26.0 | -33.0 | -39.0 |

### 6.3.6 Minimum Water Quality Requirements for Rowan 3 Plus Units

The system water must be maintained to BS 8552 throughout the operational life of the installation. Poor water quality is one of the most common causes of premature heat exchanger degradation, corrosion, and fouling all of which will void the product warranty if found to be the root cause of a fault. Parameters must be tested at commissioning and at every annual service interval using calibrated test equipment. All results must be recorded and retained on site for inspection.

#### Standard Parameters

| Parameter                                           | ≤ 60°C System | > 60°C System |
|-----------------------------------------------------|---------------|---------------|
| pH (at 25°C)                                        | 7.0 - 8.0     | 7.0 - 8.0     |
| Electric conductivity (μS/cm at 25°C)               | 300 or less   | 300 or less   |
| Chloride ion (mg Cl/L)                              | 50 or less    | 30 or less    |
| Sulfate ion (mg SO <sub>4</sub> /L)                 | 50 or less    | 30 or less    |
| Acid consumption – pH 4.8 (mg CaCO <sub>3</sub> /L) | 50 or less    | 50 or less    |
| Total hardness (mg CaCO <sub>3</sub> /L)            | 70 or less    | 70 or less    |
| Calcium hardness (mg CaCO <sub>3</sub> /L)          | 50 or less    | 50 or less    |
| Ionic silica (mg SiO <sub>2</sub> /L)               | 30 or less    | 30 or less    |

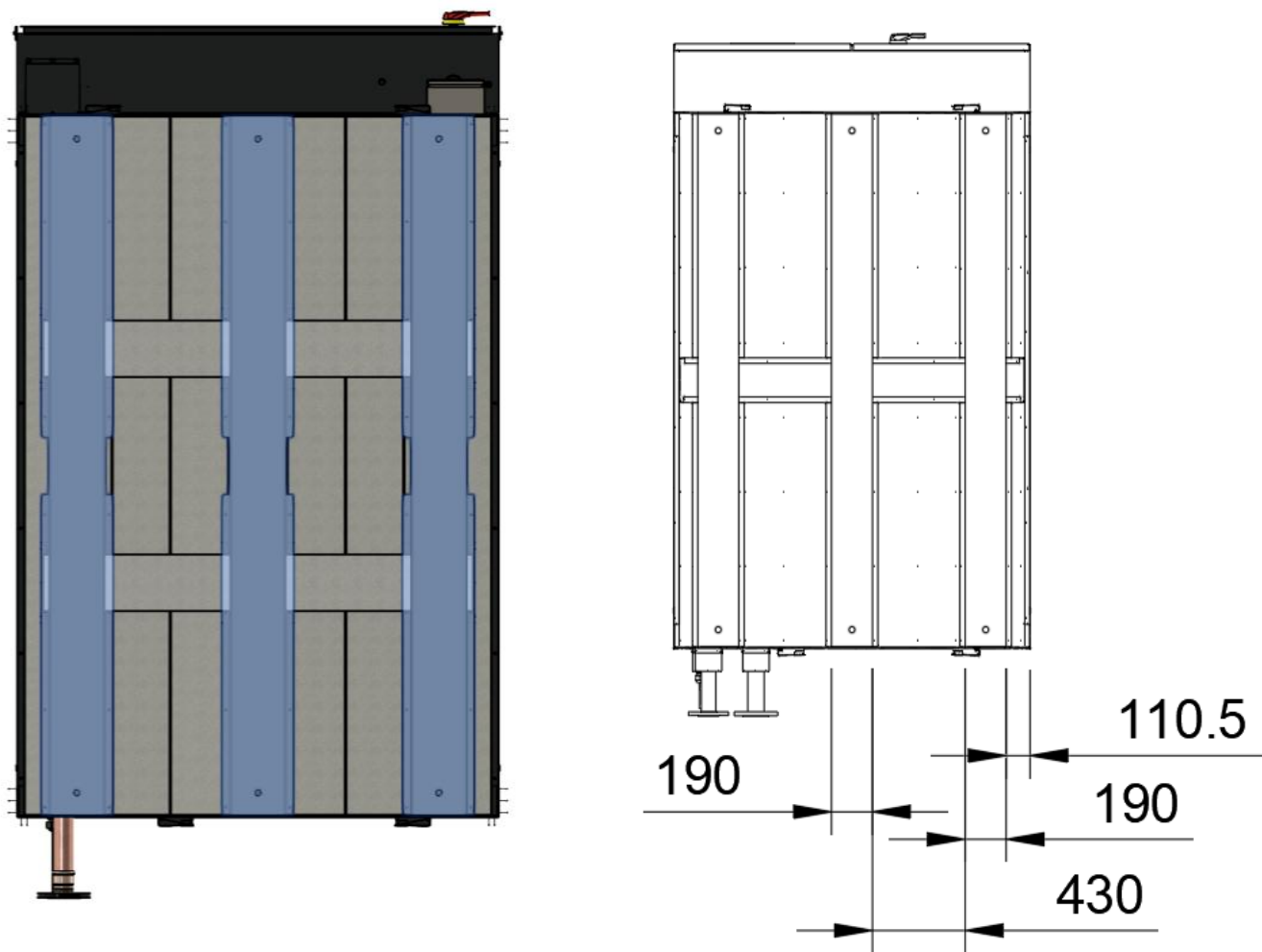
#### Reference Parameters

| Parameter                                         | Recirculating water | Make-up water      |
|---------------------------------------------------|---------------------|--------------------|
| Iron (mg Fe/L)                                    | 1.0 or less         | 0.3 or less        |
| Copper (mg Cu/L)                                  | 1.0 or less         | 1.0 or less        |
| Sulfide ion (mg S <sup>2-</sup> /L)               | Not to be detected  | Not to be detected |
| Ammonium ion (mg NH <sub>4</sub> <sup>+</sup> /L) | 0.3 or less         | 0.1 or less        |
| Residual chlorine (mg Cl/L)                       | 0.25 or less        | 0.3 or less        |
| Free carbon dioxide (mg CO <sub>2</sub> /L)       | 0.4 or less         | 4.0 or less        |
| Ryznar Stability Index                            | To be assessed      | To be assessed     |

## 6.4 Lifting Centers and Structural Loading Points

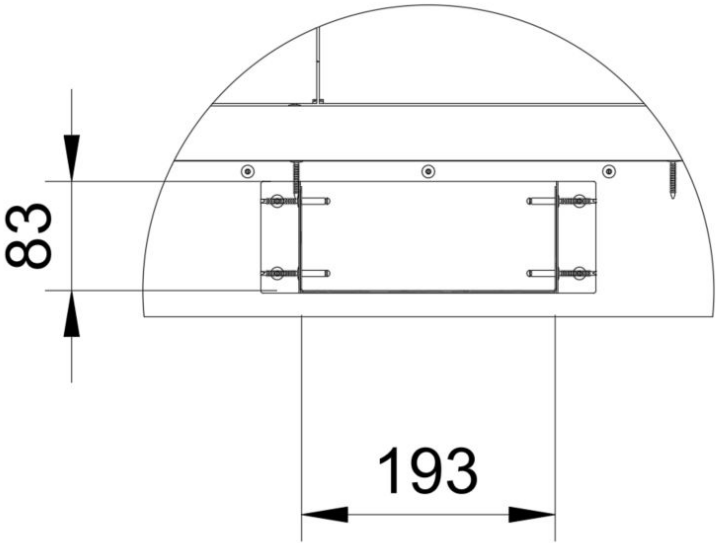
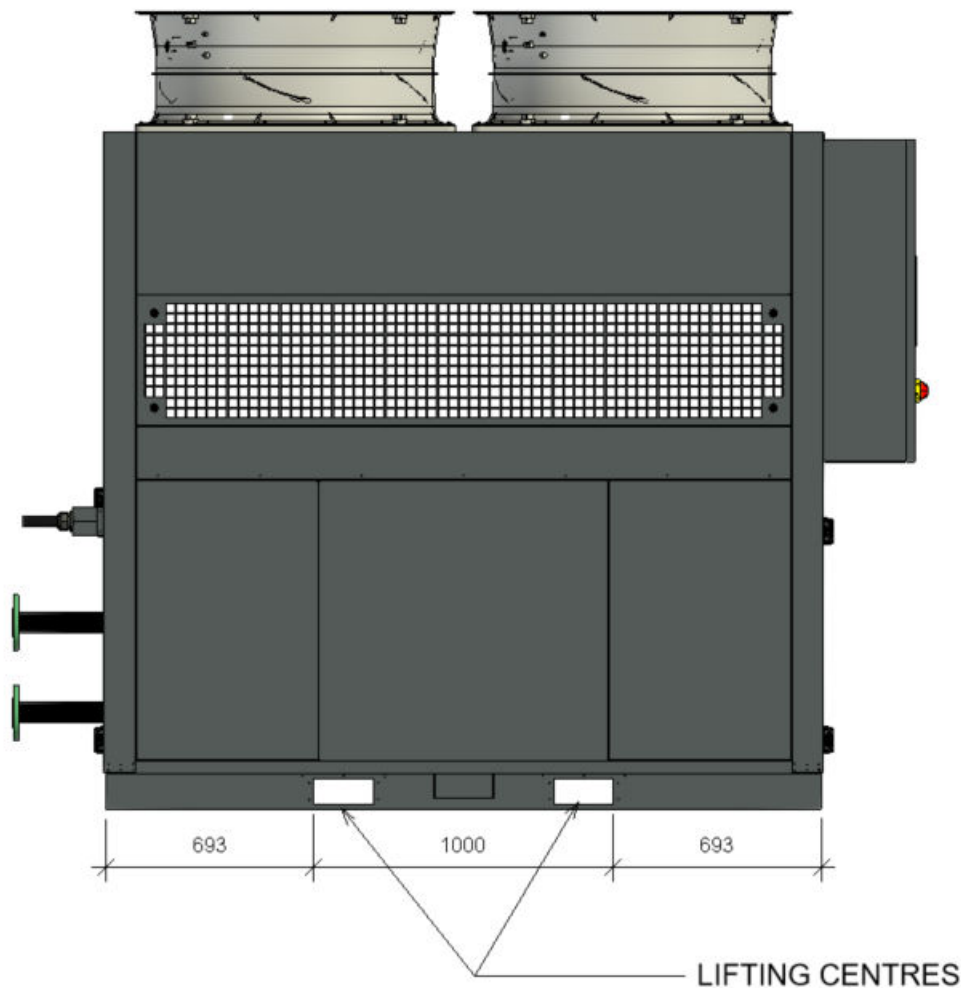
### 6.4.1 Structural Loading Points

The Rowan 3 Plus must be supported at the designated structural loading points only. These are indicated in blue on the drawing below and correspond to the reinforced sections of the base frame where the unit's operating weight is intended to be transferred to the supporting structure. Supporting steelwork or mounting frames must be designed to bear at these points specifically. Do not attempt to support the unit at any other location on the base frame. The frame sections between the loading points are not designed to carry the full unit weight and may deform under load, causing misalignment, increased vibration, and potential structural damage to the unit housing.



6.4.2      **Lifting Centers**

The Rowan 3 Plus has two designated lifting points located on the base frame, as shown in the drawing below. These are the only permitted lift points do not attempt to lift the unit from any other location on the frame or housing. Lifting must be carried out using Fork Trucks or Lifting straps. Forks must be inserted through the two lifting point apertures in the base frame. Lifting straps must pass through the two lifting point apertures and be rated for the full unit weight with the appropriate safety factor applied



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## **6.5 Maintenance and Serviceability**

### **6.5.1 Maintenance Requirement**

The unit requires planned preventative maintenance at a minimum interval of six months, with a full annual service. Maintenance must be carried out by an engineer competent in the refrigerant concerned, and is a condition of the Clade product warranty. Records must be kept and produced on request.

The full scope of works, competence requirements and evidence requirements are set out in the installer manual. This section addresses the provisions the designer must make so that the required maintenance can be carried out safely and without disruption to the installation. The Clade product warranty is conditional upon the unit being maintained in accordance with the installer manual and upon that maintenance being evidenced. Clade will not accept warranty liability for failures caused by, or contributed to by, a failure to maintain – including fouled coils, blocked strainers, low flow, deterioration of water quality, loss of inhibitor or glycol concentration, encroachment on the stated clearances, or untested gas detection and ventilation provision.

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## 7 System Configuration

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### 7.1 System Schematics

The unit must be installed in a configuration that allows correct hydraulic balance between primary and secondary systems. It is recommended that a buffer vessel is installed in the following configuration, allowing each system to operate independently at different flow conditions.

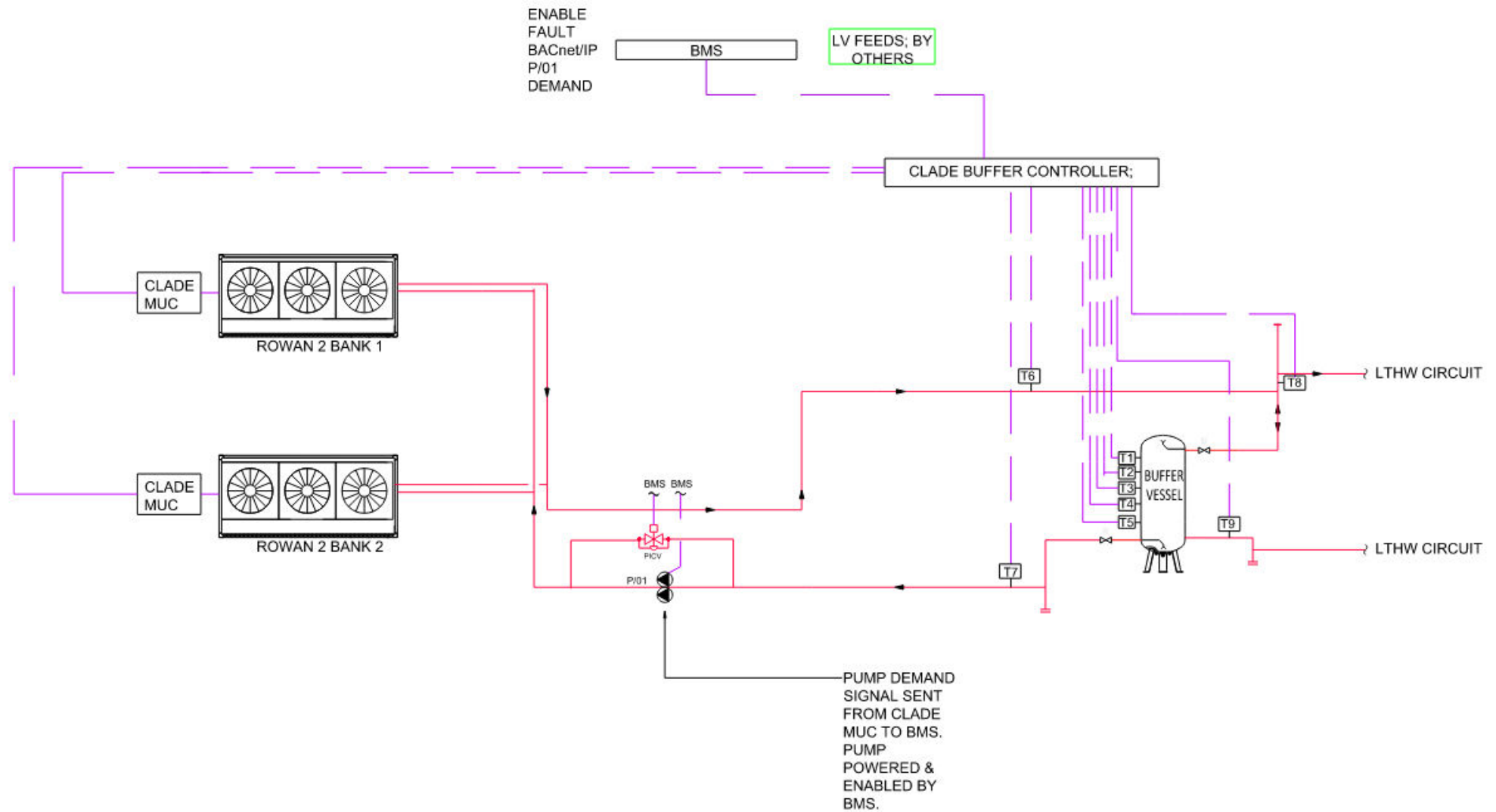
It is important that the secondary system is designed to operate at the correct flow and return temperatures. For detailed schematics please refer to Clade's Schematic Pack document.

The Rowan 3 Plus can be used for heating and DHW applications and combined systems.

Buffer temperature sensors can be used to modulate heat pump output, see Section 8 for further details of controls.

## 7.1.1

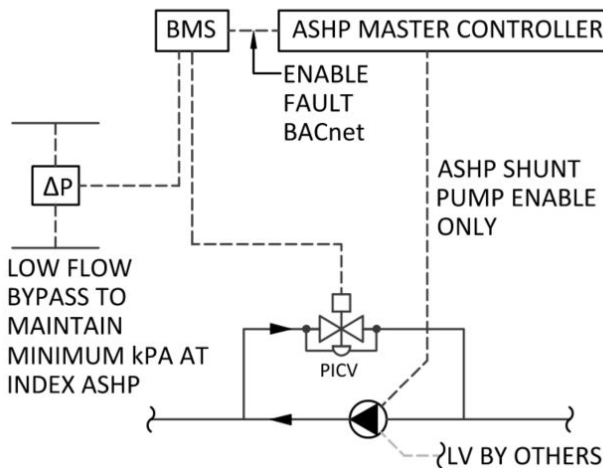
## General Arrangement Heating Mode



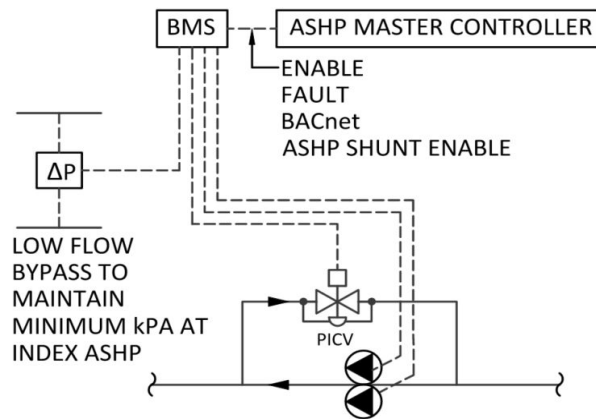
## ASHP Shunt Pump and Low flow Bypass

The primary ASHP shunt pump can be controlled via an enable via the Clade controller (option A) or via the BMS (option B) with an enable from the Clade controller. Option B is mandatory for twin-head duty/standby or duty/assist pump sets, as the Clade controller provides only one enable output and cannot manage automatic head change-over:

**OPTION A: DIRECT ENABLE FROM MASTER CONTROLLER**



**OPTION B: CONNECTED TO BMS WITH ENABLE FROM MASTER CONTROLLER TWIN HEADED PUMP**



**Please note: Pump motor power circuits shall be provided, protected and wired by others; the Clade controller supplies control signals only.**

The primary circulation pump shall be fitted with a dedicated low-flow bypass loop incorporating a pressure-independent control valve (PICV) sized based on the system's minimum bypass flow requirement. This configuration ensures that, under minimum pump speed and flow conditions, the hydraulically most distant air-source heat pump module still experiences the requisite  $\Delta P$  and volumetric flow rate for stable operation at its lowest modulation point.

## 8 Controls

### 8.1 Controls Overview

The Rowan 3 Plus unit does not contain a standalone programmable logic controller. Each heat pump is fitted with a local I/O panel that manages all field-level instrumentation, safety interlocks, and actuator outputs for the refrigerant circuit. This panel communicates to an external Multi Unit Controller that executes the control logic.

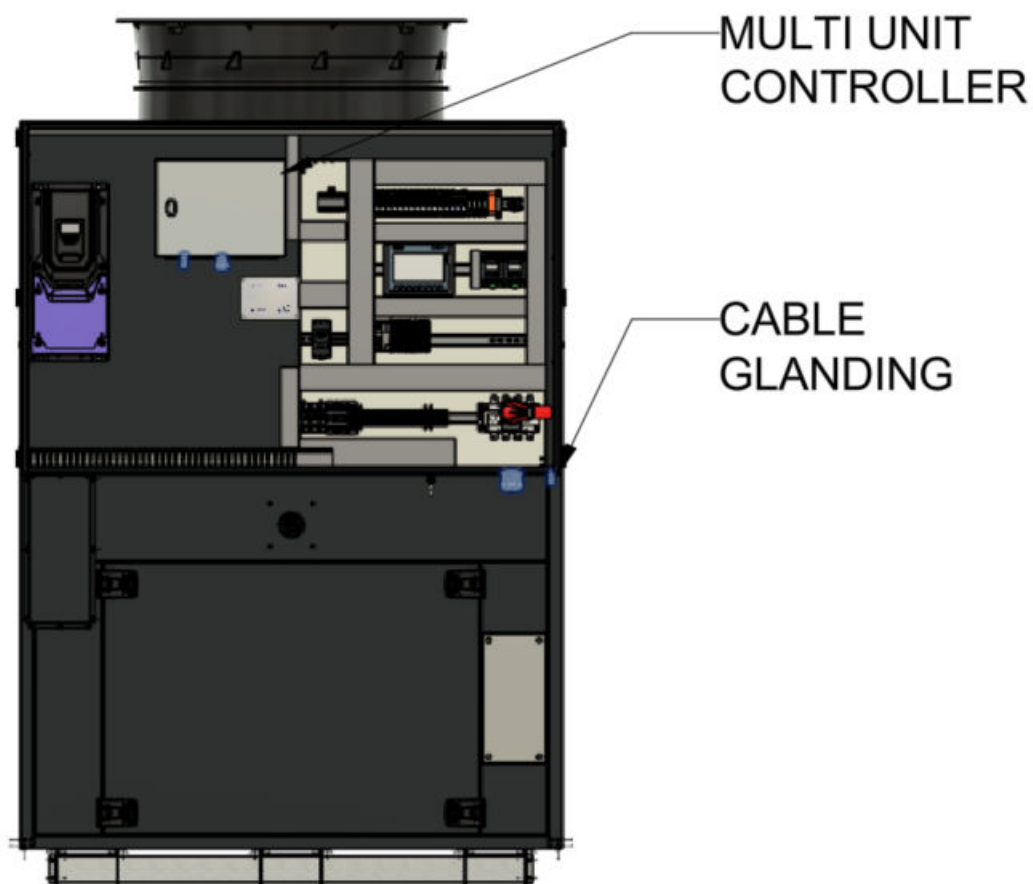
#### 8.1.1 Clade Multi Unit Controller (MUC)

Every Rowan 3 Plus installation must include a MUC. The panel provides master connectivity for up to six heat pumps, setpoint adjustment, alarm management and parameter configuration, and external analog inputs for 0-10V control signals. The Rowan 3 Plus cannot operate in standalone local mode without an external control signal. The MUC also provides the local HMI for system monitoring and parameter adjustment

The panel requires a 230V single-phase supply and is typically installed in the plant room or externally inside the electrical cabinet end of the unit. **IP rating to be specified on purchase for external use.**

Each Rowan 3 Plus is factory-fitted with dedicated mounting points inside the unit electrical panel for the Clade Multi Heat Pump Controller. Although mounting points are provided on every unit in an array, the controller should be installed in the leftmost unit of each bank as standard practice.

The cable entry gland plate shown in the drawing provides the designated entry point for network cables into the unit enclosure. All data cables connecting the controller to adjacent units or to a BMS must be routed through this gland plate.



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### 8.1.2 Off/On Switch

The Off/On switch selects the operation of the heat pump. Selecting the on position will start the heat pump. Selecting the Off position will instigate a stop sequence and stop the heat pump from running. The heat pump will continue to run for a short period until it has completed the stop sequence.

#### CAUTION

|                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------|
| The Off/On switch should not be used in an emergency. Any emergency isolation should be carried out at the local isolator. |
|----------------------------------------------------------------------------------------------------------------------------|

|                                                                                                 |
|-------------------------------------------------------------------------------------------------|
| The inverter should be fully discharged, prior to removal of the compressor terminal box cover. |
|-------------------------------------------------------------------------------------------------|

## 8.2 Control Type

Three options of system-level control are available:

**Option 1:** BMS/External control via the Clade Multi Unit Controller (no BACnet data visibility) (max 6 units)

**Option 2:** BMS/External control via the Clade Multi Unit Controller with additional communication module (BACnet data visibility) (max 6 units)

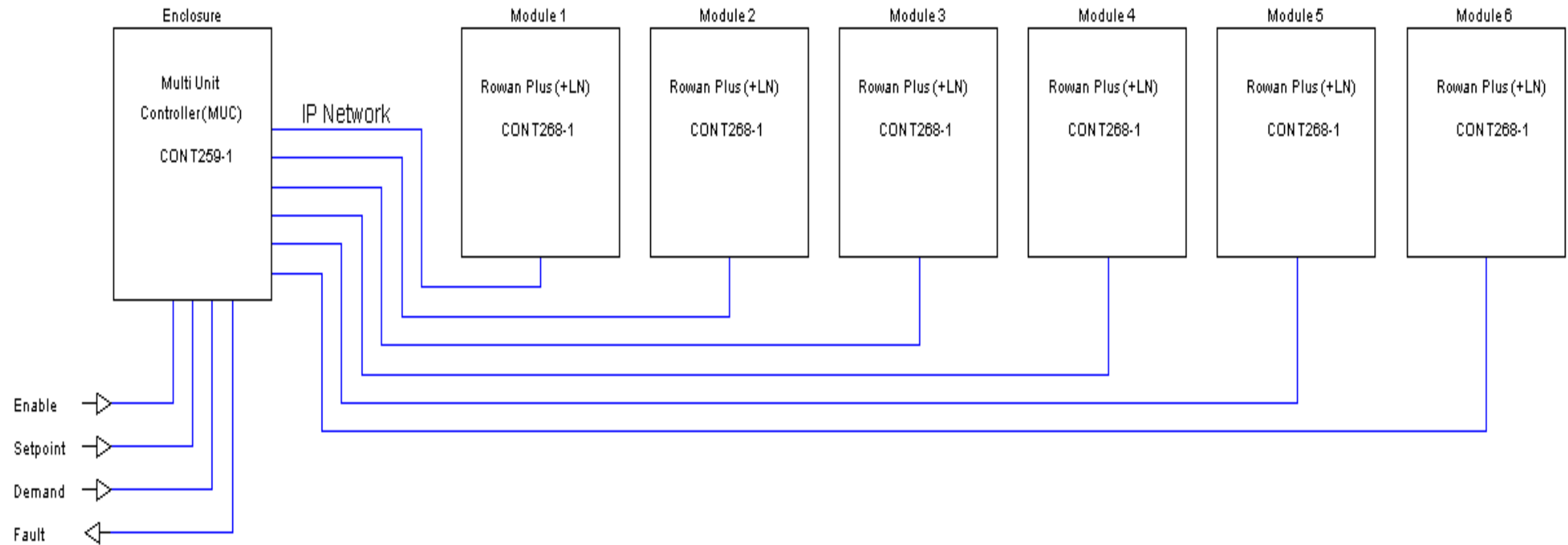
**Option 3:** Clade Buffer Controller allows full data visibility and sequencing and control of up to 24 units

These are visualised on the next pages

## 8.2.1 Controls Options

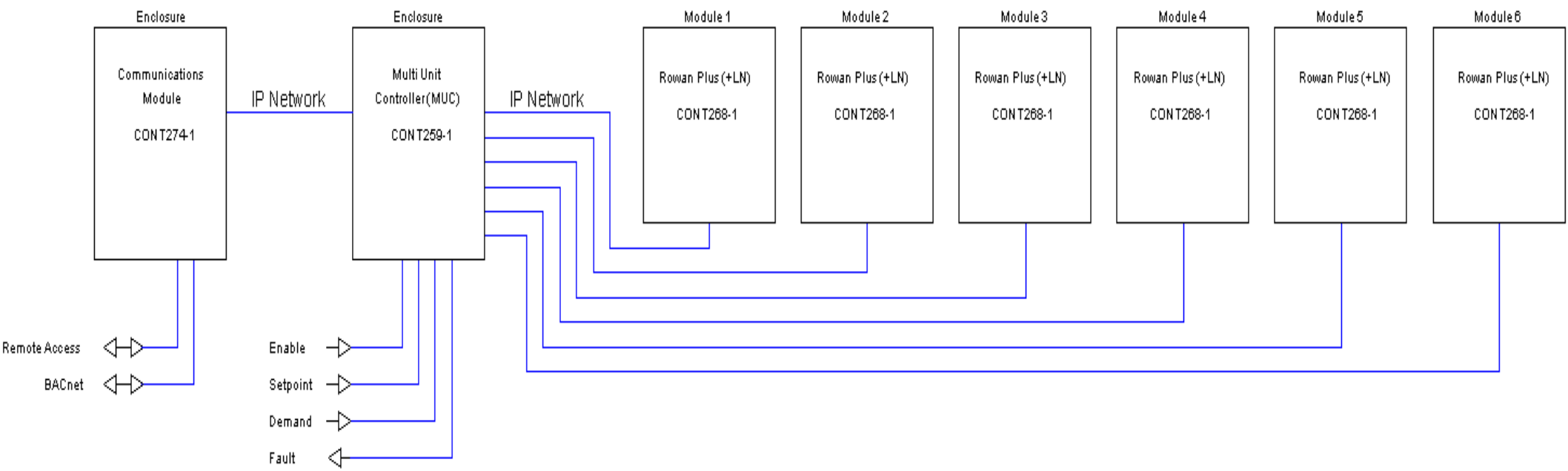
### Option 1

Rowan Plus (+LN) - MUC Control - Up To 6 Modules



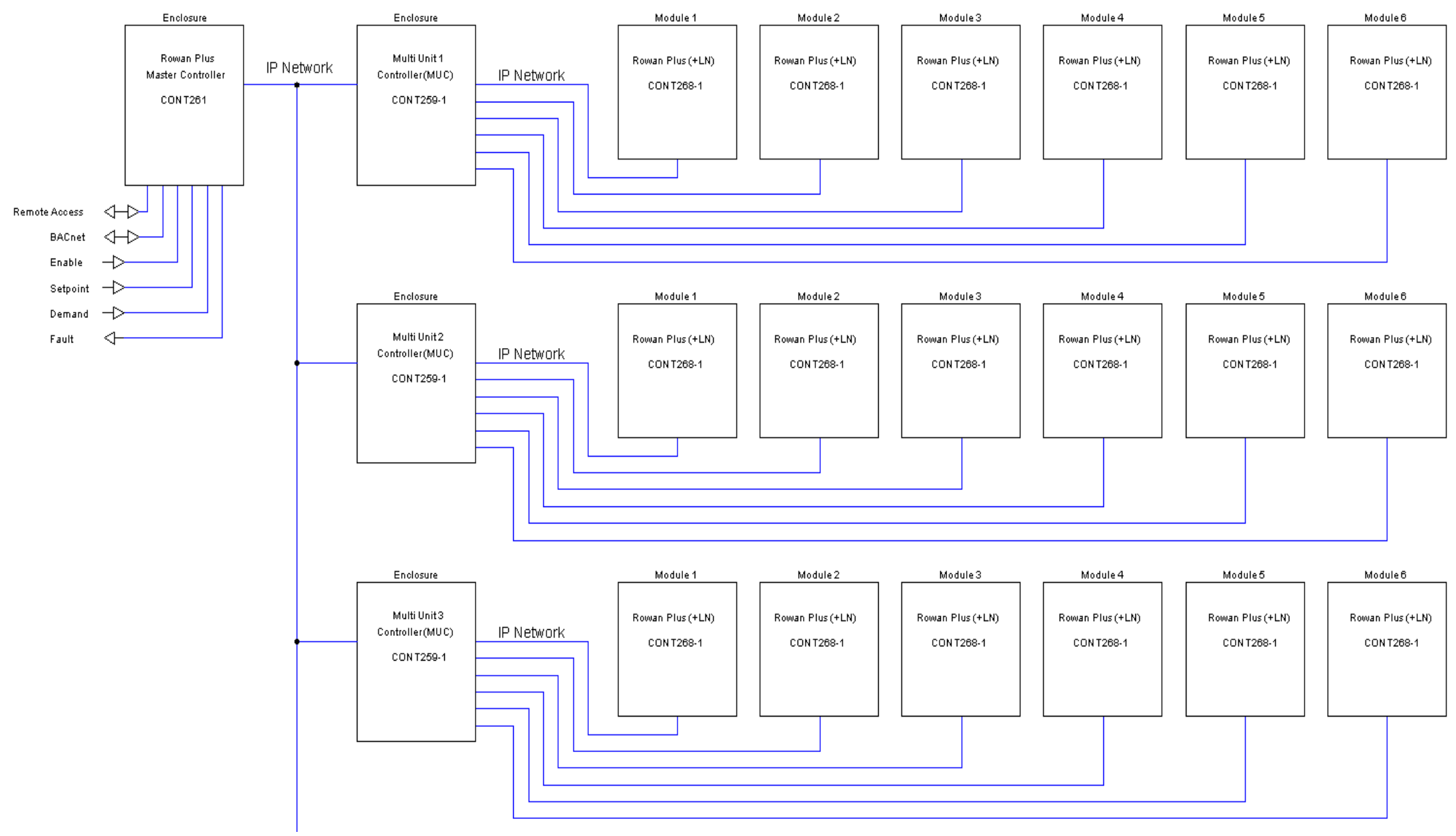
Option 2

Rowan Plus (+ LN) - MUC Control + Communications Module - Up To 6 Modules



Option 3

Rowan Plus (+ LN) - MUC Control + Communications Module - Up To 24 Modules



## **8.3 Clade Buffer Controller**

### **8.3.1 Control**

The Clade Buffer Controller should be used when the heat pumps serve a buffer vessel and centralised system management is required. It is supplied as a standalone panel and installed in the plant room by the contractor. The controller generates a demand signal (0-100%) and distributes it to the heat pumps via the Multi Heat Pump Controller to stage units in and out in line with the instantaneous thermal load. This control method is shown as Option 3 in the previous section.

#### **Heating Mode**

The controller uses multi-point temperature sensing within the heating buffer vessel to estimate the vessel's usable thermal charge. This is blended with return temperature monitoring to produce a single demand signal that stages heat pumps progressively as load increases. As the buffer approaches its target condition, demand tapers to prevent overshooting. If the monitored return temperature approaches the protected limit, capacity is progressively reduced to keep return water within the safe operating envelope of the heat pumps.

An optional weather compensation function is available within the controller. By progressively lowering the flow temperature setpoint in response to higher outdoor temperatures, this mode optimises seasonal efficiency.

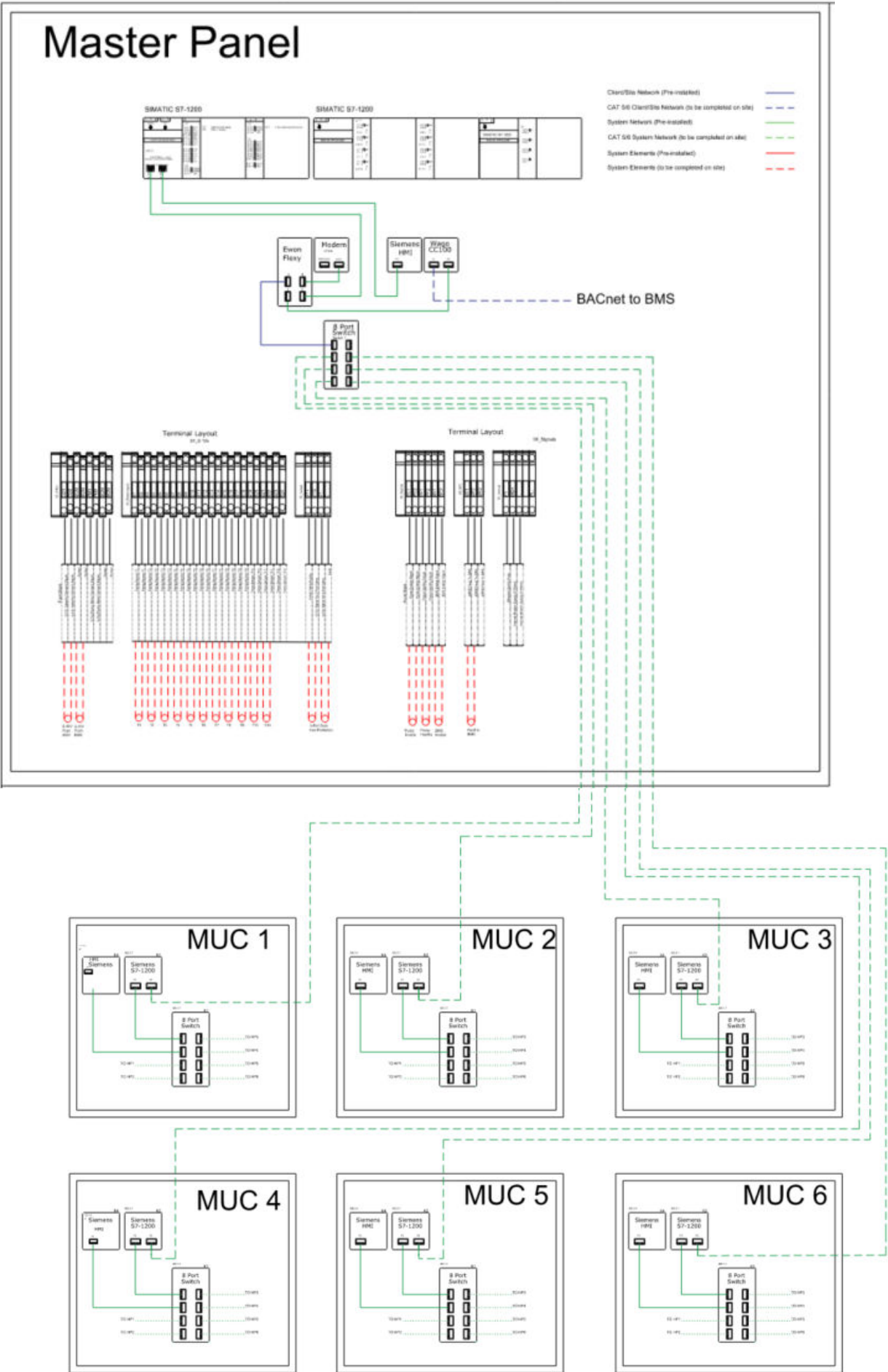
#### **Cooling Mode**

When operating in cooling mode, the controller monitors the chilled water buffer temperature and stages units to maintain the target cooling setpoint. The control strategy is simplified compared to heating mode, with units staged on and off based on buffer temperature against the cooling setpoint.

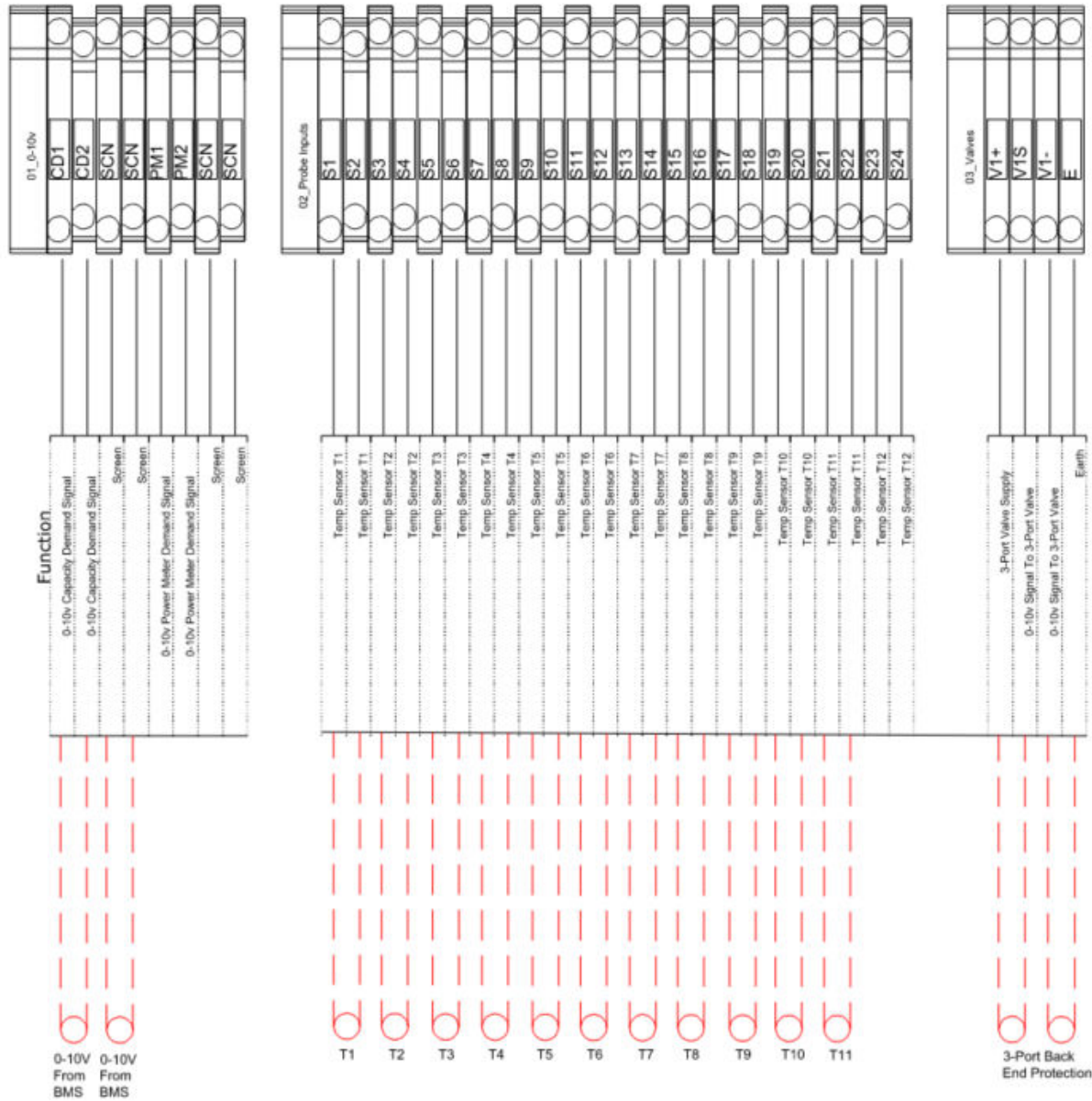
### **8.3.2 Installation**

The Clade Buffer Controller is installed as a standalone unit in the plant room. All interconnections between the controller, the Clade Multi Unit Controller, buffer vessel sensors, system pump, BMS, and ancillary devices are made by the installing contractor. A site-specific wiring diagram and terminal schedule are supplied with every panel. All temperature sensors back to the Buffer Controller must be **PT1000**.

Buffer Controller Wiring Diagram

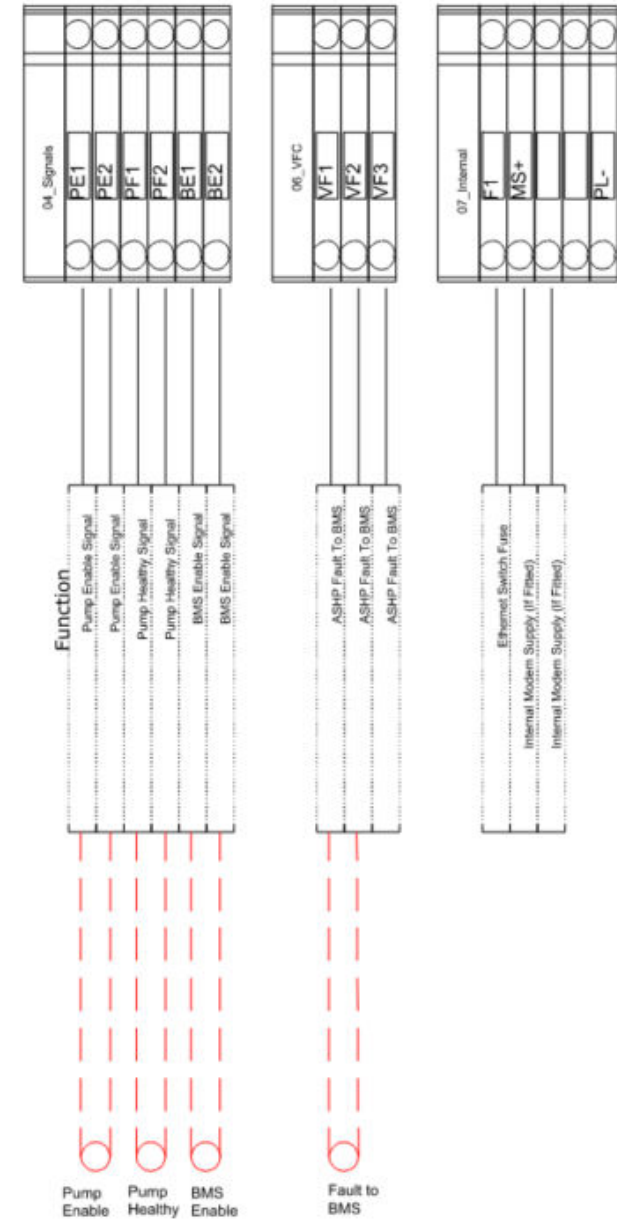


Terminal Layout  
01\_0-10v



Terminal Layout

04\_Signals



### 8.3.3 Heat Pump Data

A single connection to the Clade Buffer Controller is all that is required to access all connected heat pump data. If the client wishes to monitor or log this data via their Building Management System, the Clade controller can be integrated through its BACnet interface. The table below details the data points available via the BACnet connection from the Clade buffer controller:

| BACnet Register (Siemens Master) |             |                                      |                                                                                           |            |
|----------------------------------|-------------|--------------------------------------|-------------------------------------------------------------------------------------------|------------|
| Device Name                      |             | Heat Pump                            |                                                                                           |            |
| Obj. Type                        | Object Name | Description                          | Unit                                                                                      | Read/Write |
| AI                               | obj_1       | Ambient Temperature                  |                                                                                           | R          |
| AI                               | obj_2       | Water Temperature Setpoint           | °C                                                                                        | R          |
| AI                               | obj_3       | Water Return Temperature Setpoint    | °C                                                                                        | R          |
| AI                               | obj_4       | Water Average Temperature            | °C                                                                                        | R          |
| AI                               | obj_5       | Water Average Return Temperature     | °C                                                                                        | R          |
| AI                               | obj_6       | System Heating Kilowatts             | Kw                                                                                        | R          |
| AI                               | obj_7       | Coefficient Of Performance (Heating) | COPH                                                                                      | R          |
| AI                               | obj_8       | Buffer Temperature                   | °C                                                                                        | R          |
| AI                               | obj_9       | HP1 Average Water Temperature        | °C                                                                                        | R          |
| AI                               | obj_10      | HP1 Average Return Temperature       | °C                                                                                        | R          |
| AI                               | obj_11      | HP1 Module 1 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_12      | HP1 Module 2 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_13      | HP1 Module 3 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_14      | HP1 Module 4 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_15      | HP2 Average Water Temperature        | °C                                                                                        | R          |
| AI                               | obj_16      | HP2 Average Return Temperature       | °C                                                                                        | R          |
| AI                               | obj_17      | HP2 Module 1 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_18      | HP2 Module 2 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_19      | HP2 Module 3 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_20      | HP2 Module 4 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_21      | HP3 Average Water Temperature        | °C                                                                                        | R          |
| AI                               | obj_22      | HP3 Average Return Temperature       | °C                                                                                        | R          |
| AI                               | obj_23      | HP3 Module 1 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_24      | HP3 Module 2 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_25      | HP3 Module 3 Status                  | *Status Table                                                                             | R          |
| AI                               | obj_26      | HP3 Module 4 Status                  | *Status Table                                                                             | R          |
| BO                               | obj_27      | Heartbeat In                         | Eco signal from the customer ( Heartbeat IN value must be copied into Hearbeat Out value) | W          |
| BI                               | obj_28      | Heartbeat Out                        | Eco signal to customer                                                                    | R          |
| BI                               | obj_29      | HP1 System Heat Pump Status          | 0=Off / 1=On                                                                              | R          |
| BI                               | obj_30      | HP1 System Key Status                | 0=Alarm / 1=OK                                                                            | R          |
| BI                               | obj_31      | HP1 Leak Detection Status            | 0=Alarm / 1=OK                                                                            | R          |
| BI                               | obj_32      | HP2 System Heat Pump Status          | 0=Off / 1=On                                                                              | R          |
| BI                               | obj_33      | HP2 System Key Status                | 0=Alarm / 1=OK                                                                            | R          |
| BI                               | obj_34      | HP2 Leak Detection Status            | 0=Alarm / 1=OK                                                                            | R          |
| BI                               | obj_35      | HP3 System Heat Pump Status          | 0=Off / 1=On                                                                              | R          |
| BI                               | obj_36      | HP3 System Key Status                | 0=Alarm / 1=OK                                                                            | R          |
| BI                               | obj_37      | HP3 Leak Detection Status            | 0=Alarm / 1=OK                                                                            | R          |

| *Status Table    |
|------------------|
| 0=Not Configured |
| 1=Off            |
| 2=Running        |
| 3=Defrost        |
| 4=Standby        |
| 5=Initializing   |
| 6=Alarm          |
| 7=Satisfied      |
| 8=Leak Alarm     |

---

## 8.4 BMS/External Control

This control type must be selected when there is no Clade Buffer Controller on site. This is seen as option 1 and 2 in section 8.2.2. This option will allow the heat pumps to operate on a 0-10v input signal from the BMS.

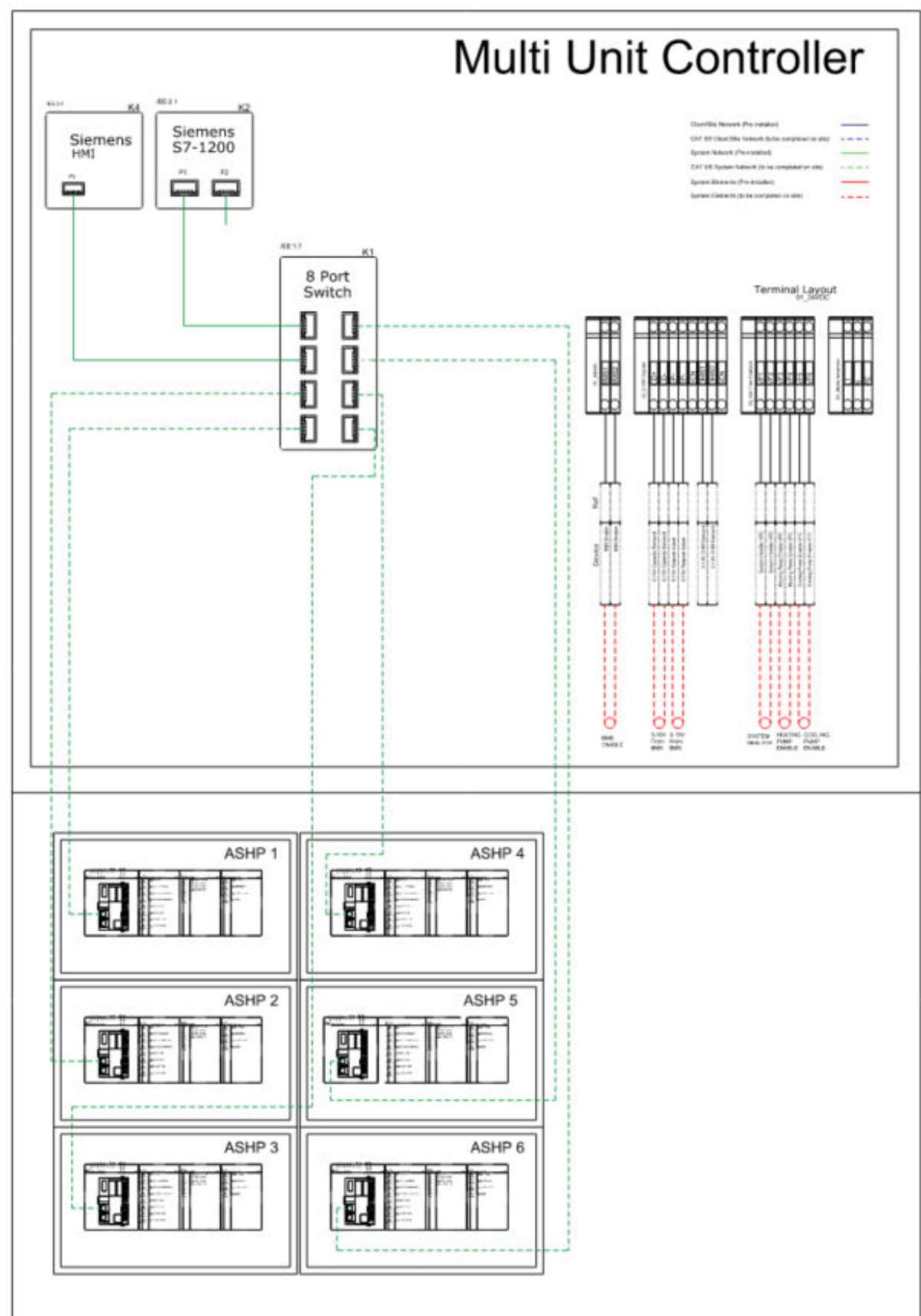
A 0-10V signal allows the heat pump to be controlled to a desired capacity (QH) based on a percentage of maximum capacity. The 0-10V signal must then arrive to the Clade Multi Unit controller where the capacity signal is distributed to the installed number of heat pumps.

The following connections are made at the MUC by the installing contractor:

- BMS Enable (24VDC volt-free contact) enables or disables the system from the BMS/Clade Buffer Controller
- 0-10V Capacity Demand – external demand signal from BMS if units are controlled via BMS
- 0-10V Setpoint Adjust – Optional external flow temperature setpoint trim
- System Healthy (volt-free contact) indicates system health to the BMS/Clade Buffer Controller
- CAT 5/6 Ethernet cables to each heat pump

**Where BACnet integration with the building management system is required, a Clade Buffer Controller or an additional communications module must also be provided.**

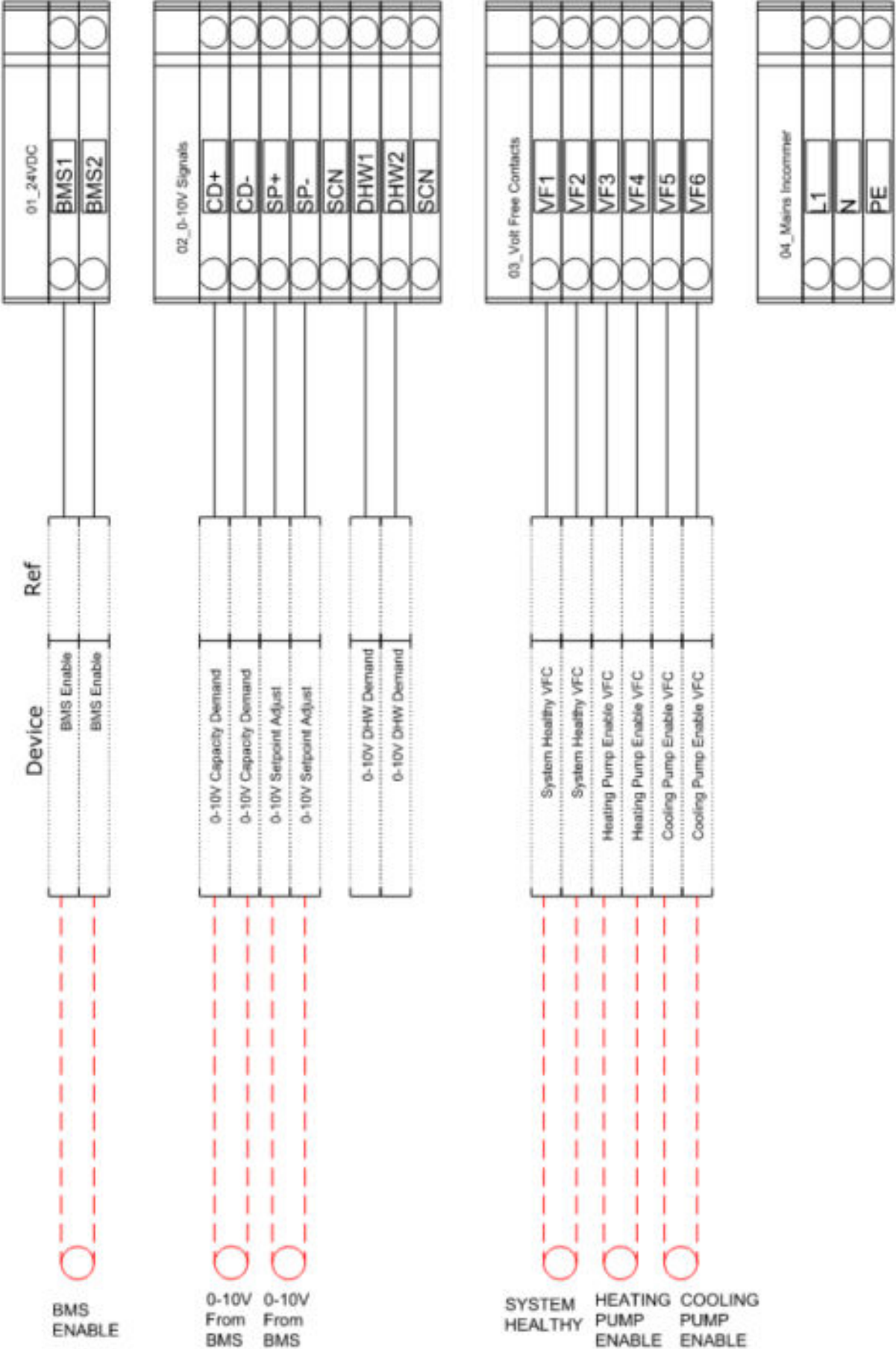
8.4.1 Multi Unit Controller/BMS Control Wiring Diagram



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# Terminal Layout

01\_24VDC





**CLADE**

**Head Office & Registered Office**

Bristol & Bath Science Park, Dirac Crescent, Emersons Green, BRISTOL BS16 7FR

**The Technology Centre**

Unit R3 Gildersome Spur Industrial Estate, Stone Pits Lane, Morley, LEEDS LS27 7JZ

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