CLADE

Maple

260/200kW

390/300kW

520/400kW

650/500kW

Planner Manual

PD-Maple-03

Version: 1.1

Contents

Revision	Change Notes	Date
1.2	Change from CAT 5e to CAT 6 connections between units and general updates	06/06/25

1 General Specifications

1.1 Features and benefits

1.1.1 Energy Efficiency

The unit has been evaluated for performance and reliability against stringent industry standards, ensuring consistent, verified results.

SCOP - Achieves a high Seasonal Coefficient of Performance of 3.0*

Energy Label A++: Designed to exceed typical regulatory requirements for energy labeling, reducing overall operational costs and environmental impact.

1.1.2 Functionality

Wide Operating Range: Suitable for a broad range of outdoor temperatures, from extremely low ambient conditions to warmer climates. This flexibility ensures year-round heating reliability.

Minimum/Maximum Outdoor Temperatures: -15°C to +40°C

Minimum/Maximum Flow Water Temps: From 55°C up to 70°C

1.1.3 Modular design

Cascade Operation: Multiple units can be linked together to increase total capacity or provide redundancy. The system's modular architecture allows for phased installations or expansions.

Load-Sharing Logic: When multiple heat pumps operate in cascade mode, run-hours and capacity demands are automatically balanced, optimizing efficiency and extending equipment life.

1.1.4 Technology

DC inverter technology on compressors and fans: Ensures precise load matching, smoother ramp-ups, and more stable temperatures. Reduces energy consumption and noise by adjusting speed according to actual demand.

Electronic expansion valve: Maintains optimal refrigerant flow for higher efficiency and better control of discharge/evaporating temperatures, enhancing reliability and performance.

Hydrophilic coil: Allows moisture to drain off smoothly, reducing potential ice build-up and improving heat transfer.

External Header & Pump Arrangement: Each Maple module is designed to work with an external header system arranged in reverse return for balanced water flows. This external pump design allows for more accurate sizing of the pump to specific site demands, and it can be phased in alongside additional modules as needed.

* Average Climate, Flow 65°C, inlet 15°C

2 Technical Specification

2.1 Standard Unit Technical Specifications

2.1.1 Minimum and Maximum kW output:

Model	Min Compressor kW (-10°C)	Max Compressor kW (+7°C)
Maple 200/260 kW	168kW	246kW
Maple 300/390 kW	252kW	369kW
Maple 400/520 kW	337kW	492kW
Maple 500/650 kW	421kW	615kW

Structure: Built on a heavy-duty FeZn 15/10 galvanized steel frame, the Maple 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 IP54 protection

Internal exchanger: A stainless-steel plate heat exchanger is employed on the water side for optimised heat transfer and improved corrosion resistance. Its compact footprint and turbulent flow path contribute to higher efficiency, lower pressure drop, and prolonged service life.

External exchanger: The Maple's fin-and-tube coil arrangement is designed for CO_2 (R744) operation. Constructed with copper tubing and aluminium fins, the coil maximizes heat transfer within a compact space. Options such as hydrophilic fin coating may be added to reduce ice build-up and enhance condensate drainage.

Fans: High-performance EC (electronically commutated) axial fans, typically classified as IE5 for motor efficiency, deliver precise airflow control with reduced energy consumption. Their smart speed modulation matches fan speed to real-time load demands, helping to reduce operating noise and extend component life.

Refrigeration circuit: The state-of-the-art refrigeration system is engineered for CO_2 (R744) operation, ensuring superior thermal performance and ultra-low GWP (Global Warming Potential).

Electrical Panel: A Siemens-based control system provides advanced monitoring, diagnostics, and remote-connectivity capabilities. Seamless BMS integration (BACnet or similar protocols) allows central oversight of performance, alarms, and setpoints.

2.2 Refrigerant Information

2.2.1 Characteristics of R744 refrigerant

The Maple heat pumps manufactured by Clade Engineering Systems are equipped with carbon dioxide (CO_2). Carbon dioxide is also known as R744 in the refrigeration industry. Carbon dioxide is classified as low toxicity and non-flammable therefore belongs to the A1/L1 safety category.

CO_2 is toxic at high concentrations, being an odorless gas and heavier than air it displaces oxygen and can cause serious harm to the body if the concentration of CO_2 is high. In addition, due to the high-pressure environment it has hazards which other refrigerants do not and must be handled appropriately.

All personnel involved with the specification, installation, operation, and maintenance of the unit must be fully qualified, competent and hold any certifications required to conduct the work involved.

The unit has been evacuated and pre-charged in the factory with the correct amount of refrigerant, no addition charge is required. The refrigerant charge can be found on the PED label.

If due to component failure or in the event of a leak, it is recommended that the system is stopped, and the charge or remaining charge is vented to atmosphere in a controlled manner. See system maintenance manual for access points and isolation procedures. Once the issue has been rectified the system would need to evacuated and re-charged with the correct amount of refrigerant as recorded on the PED label.

Model	Refrigerant (Kg)	Equivalent CO_2 tonnes (tCO_2e)
Maple 200/260 kW	20	0.02
Maple 300/390 kW	30	0.03
Maple 400/520 kW	40	0.04
Maple 500/650 kW	50	0.05

Physical characteristics of the R744 refrigerant	
Safety class (ISO)	A1 (Non-toxic, Non-flammable)
GWP (kg.CO_2e)	1
Low flammability limit (LFL) (Kg/m^3 @ 60°C)	Non-Flammable
Burning velocity (BV) (cm/s)	0 cm/s (Non-flammable)
Boiling point (°C)	-78.5 (Sublimation point at atmospheric pressure)
GWP (100 yr ITH)	1
Ozone Depletion	0
Self-ignition temperature (°C)	Non-Flammable

2.2.2 Gas Leak Detection

The Maple 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.

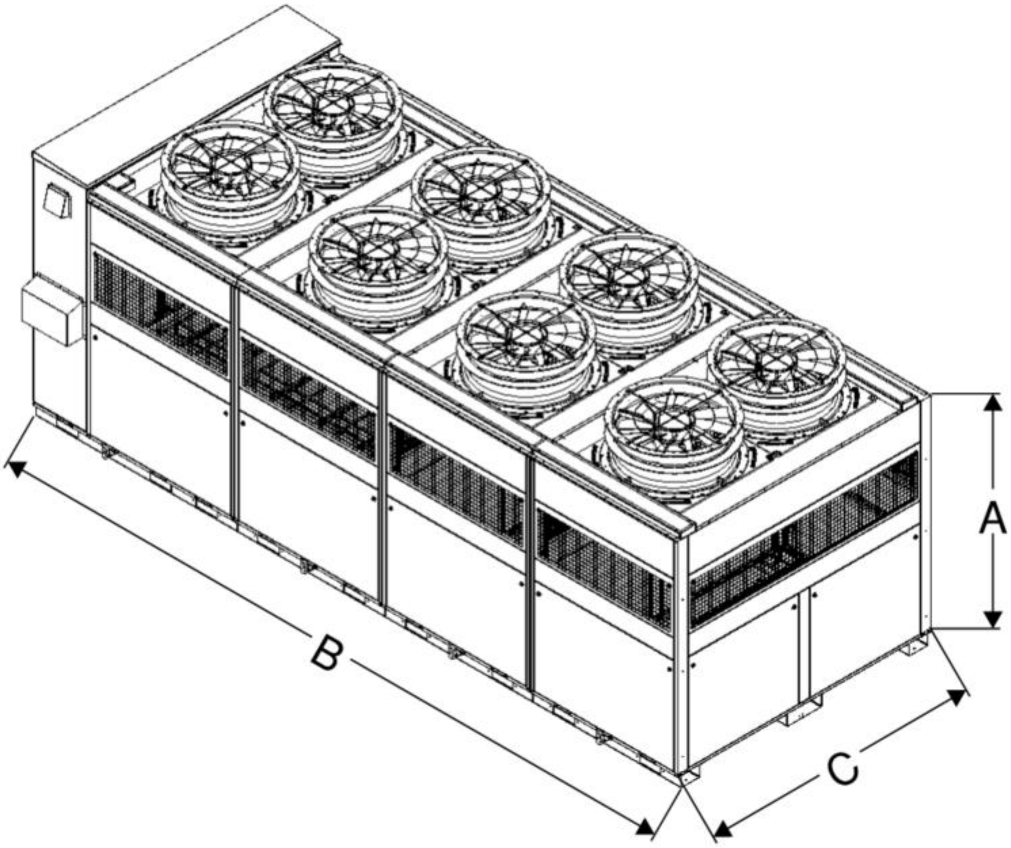
The system will require a manual reset in the event of a gas leak shut down event. This is to ensure the system cannot be restarted until the cause of the leak or leak alarm is fully investigated and resolved.

See system maintenance manual for access points and isolation procedures. Once the issue has been rectified the system would need to 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

2.3 Dimensions

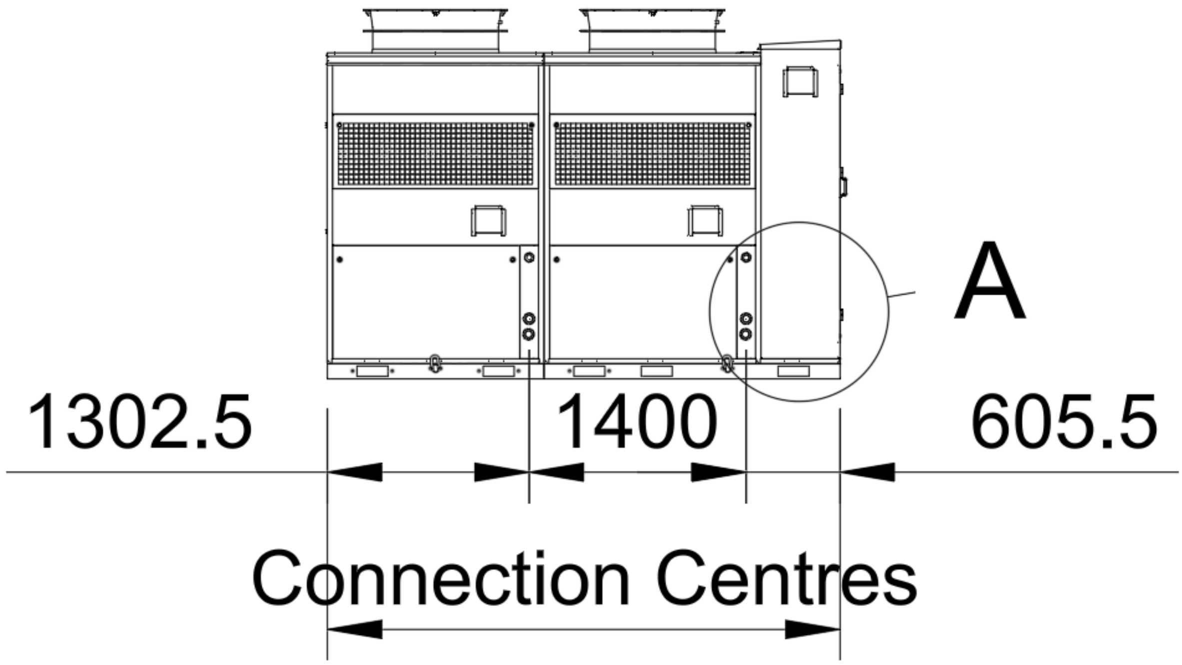


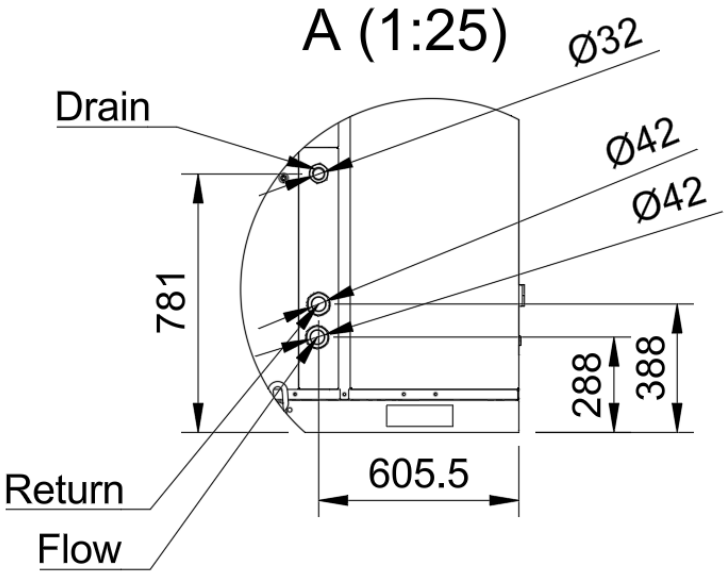
Unit	Height 'A' (mm)	Width 'B' (mm)	Depth 'C' (mm)	Operating Weight (kg)	Shipping Weight (kg)
Maple 200/260 kW	2382	3315	2646	2574	2573
Maple 300/390 kW	2382	4715	2646	3906	3851
Maple 400/520 kW	2382	6155	2646	5238	5164
Maple 500/650 kW	2838	7517	2646	6569	6478

2.4 Service Connections

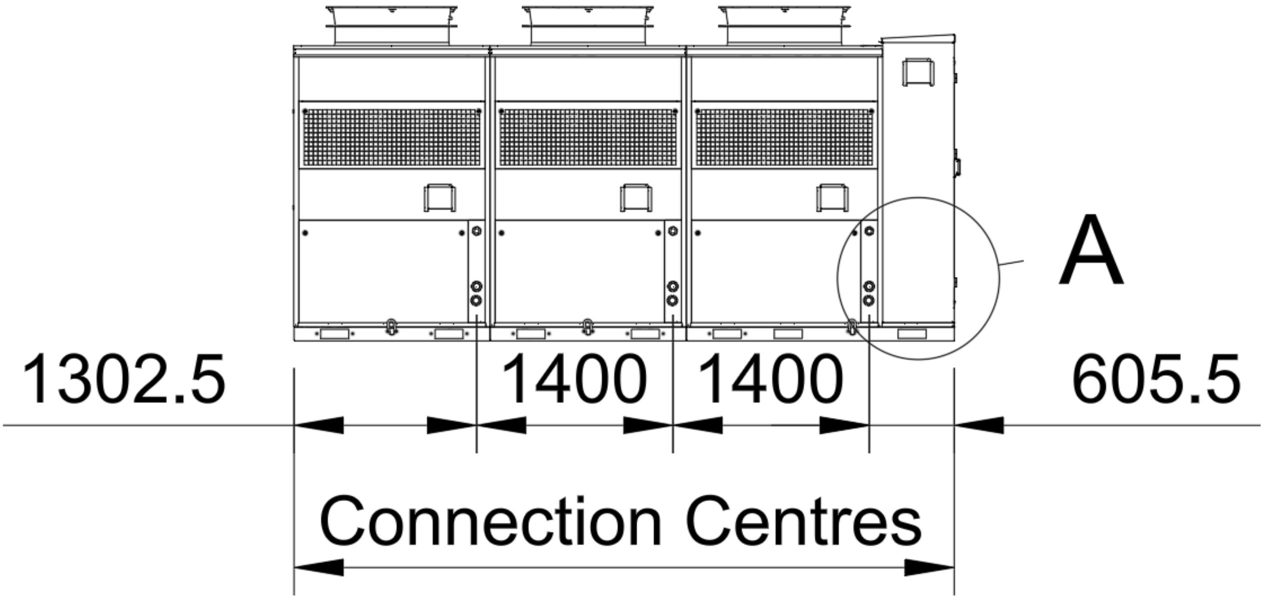
When selecting a location for the unit(s) consideration of the service connection positions is required. Each module has its own water service connections which are located on the right hand side panel. The electrical cabinet and termination point are at the back of the heat pump.

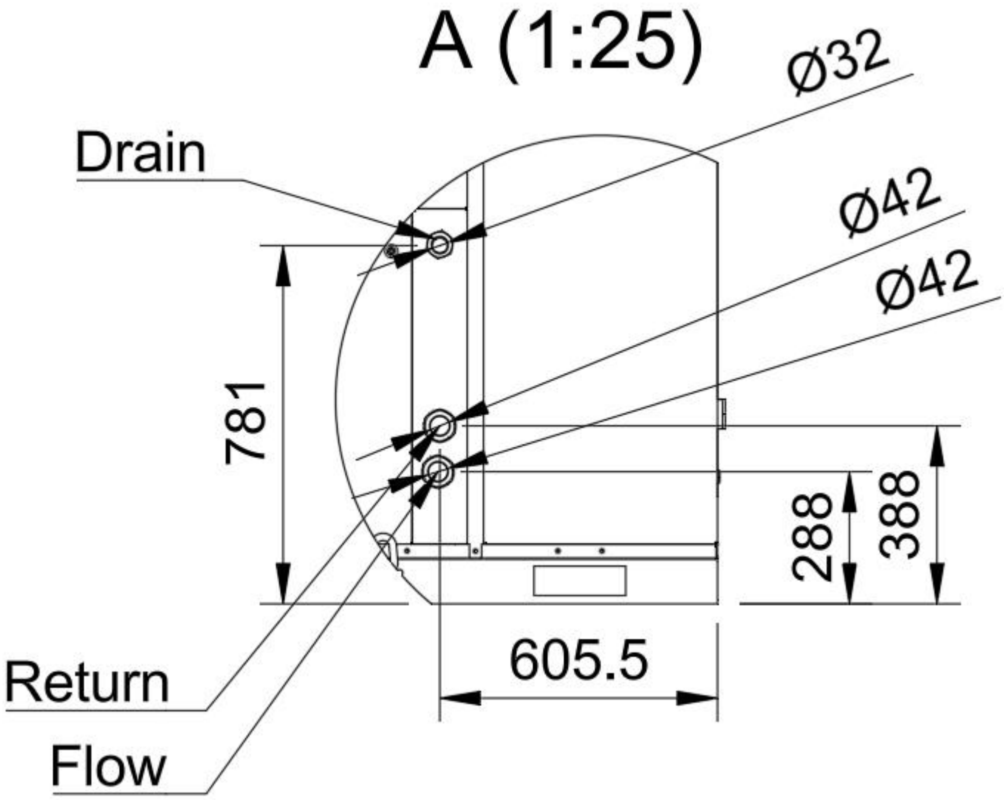
2.4.1 Maple 200/260 kW



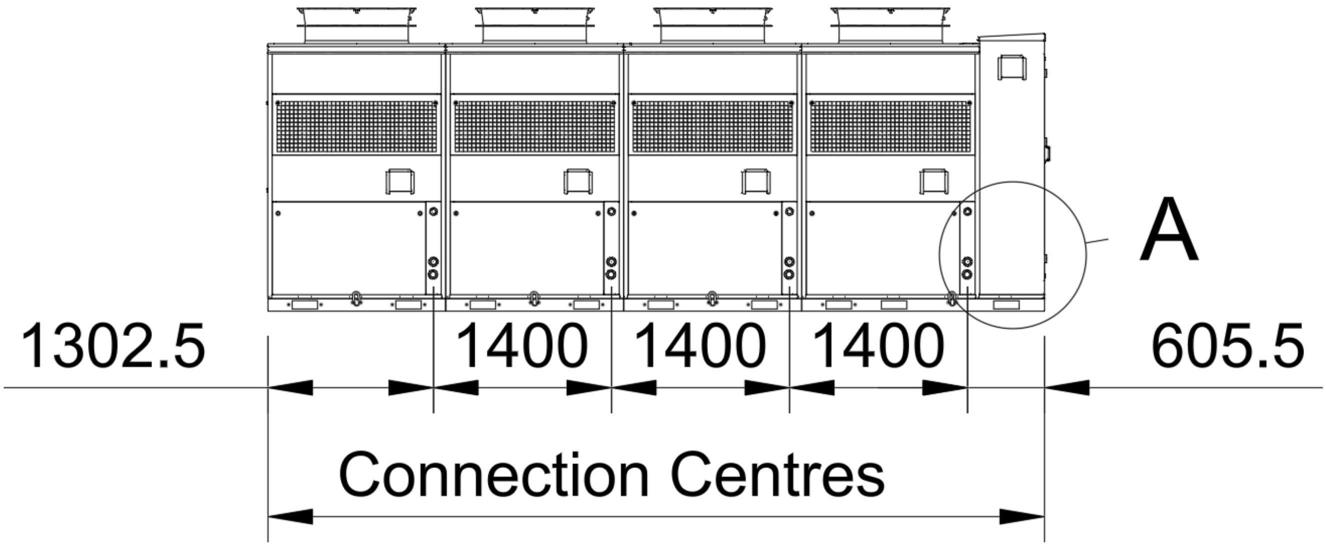


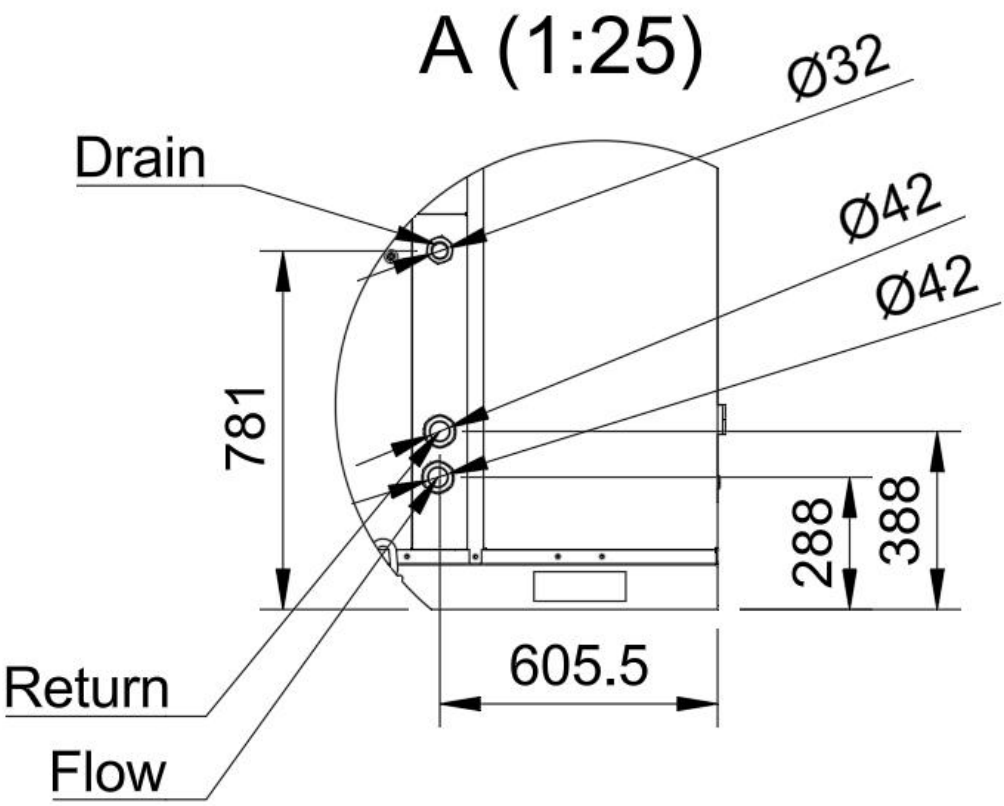
2.4.2 Maple 300/390 kW



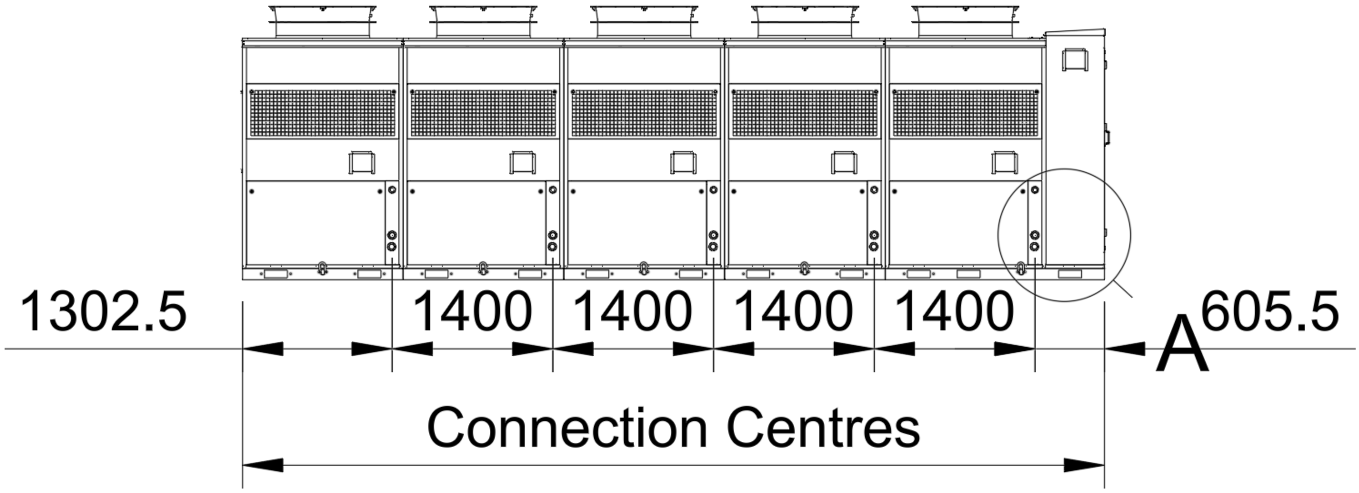


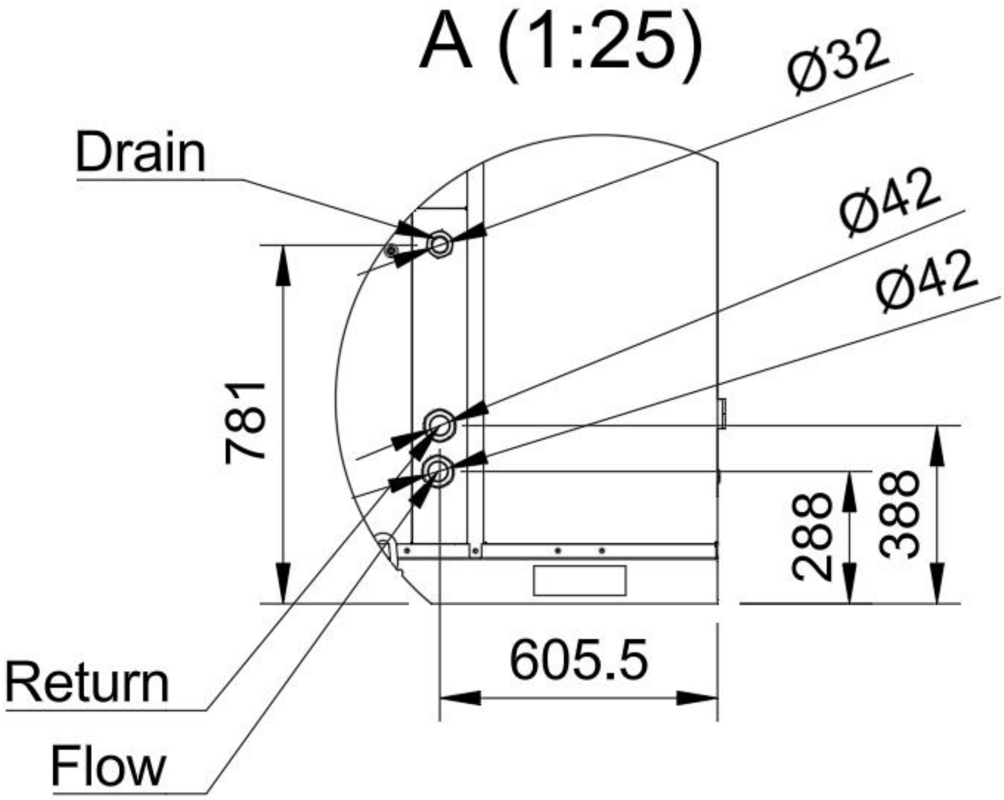
2.4.3 Maple 400/520 kW





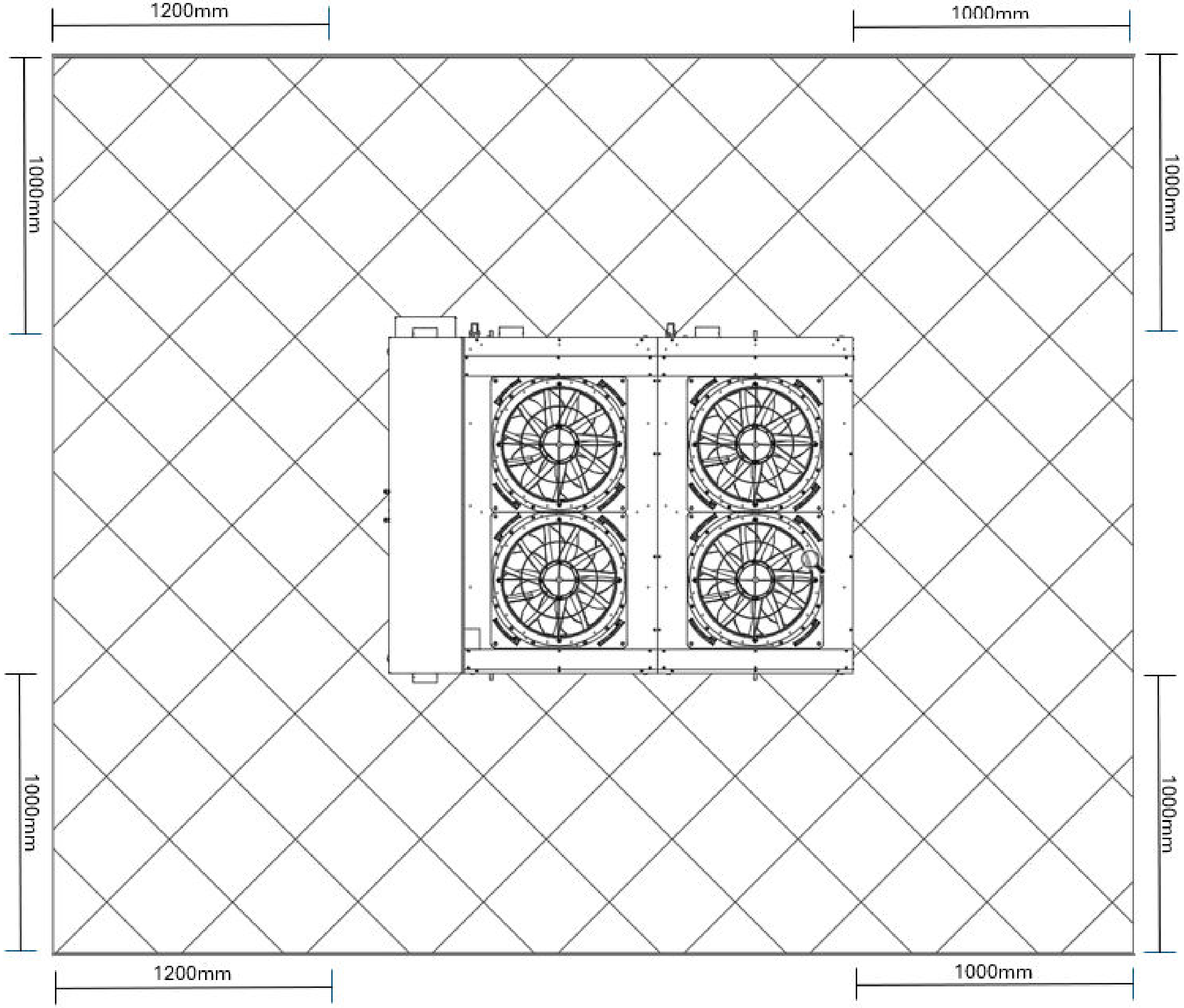
2.4.4 Maple 500/620 kW



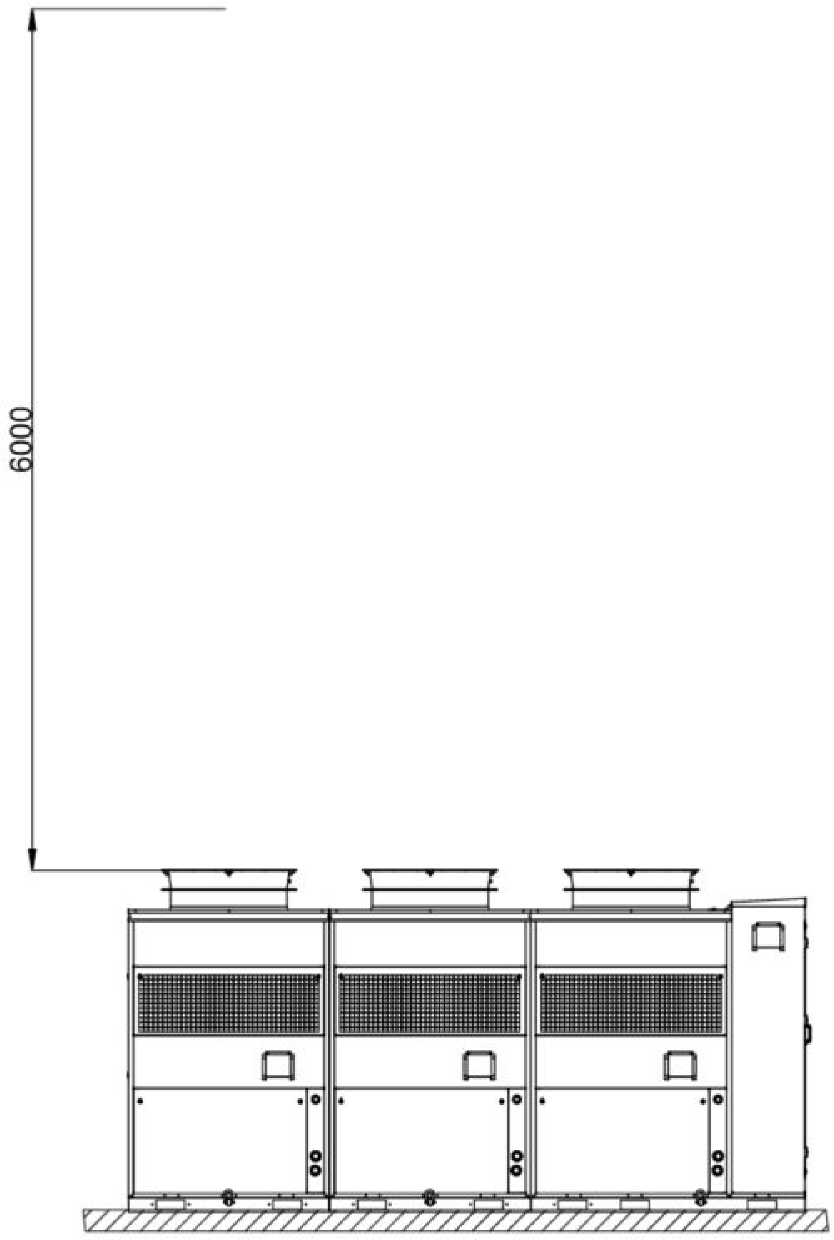


2.5 Installation Space Requirements

2.5.1 Single Unit Installation

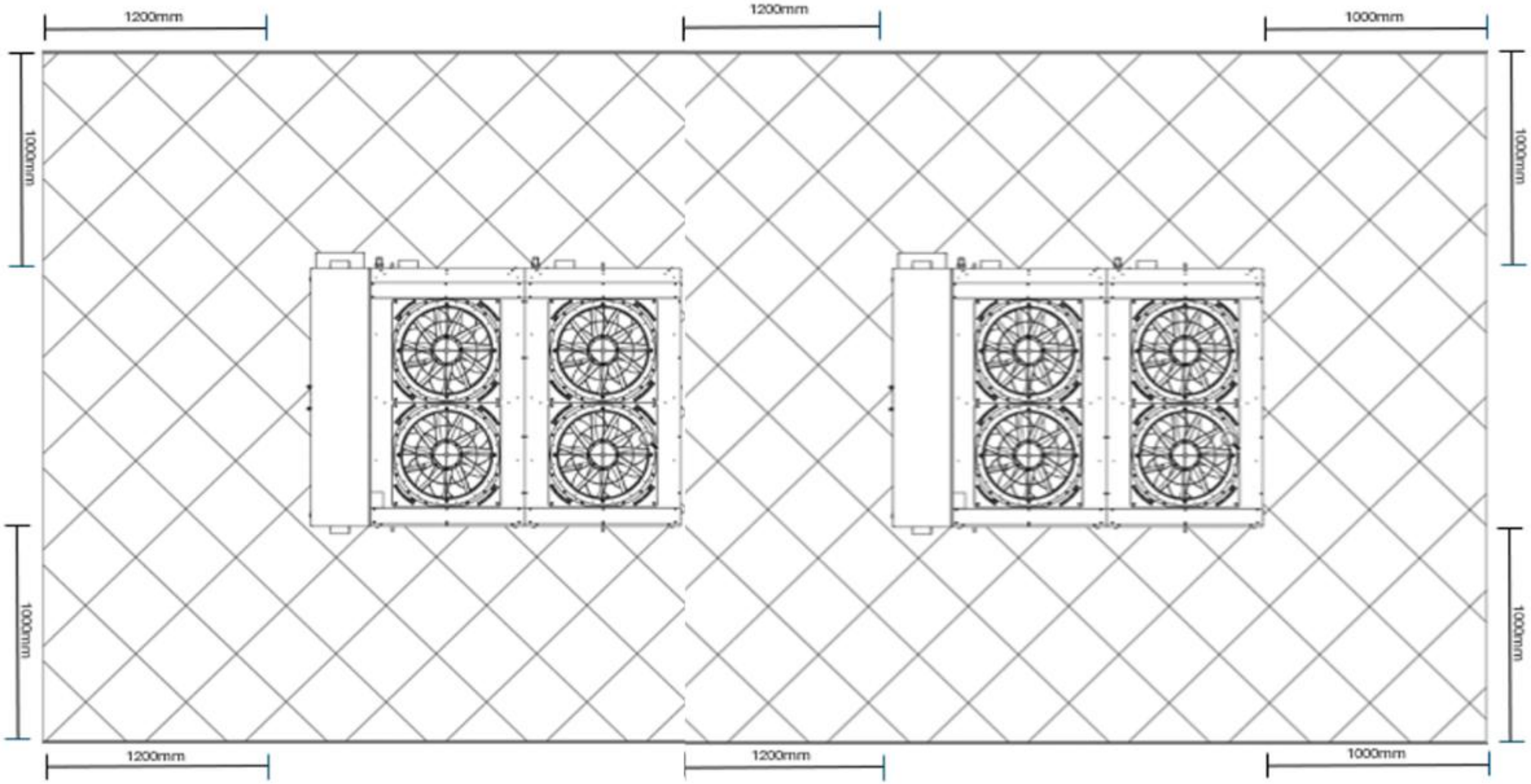


2.5.2 Clearance Above the Unit

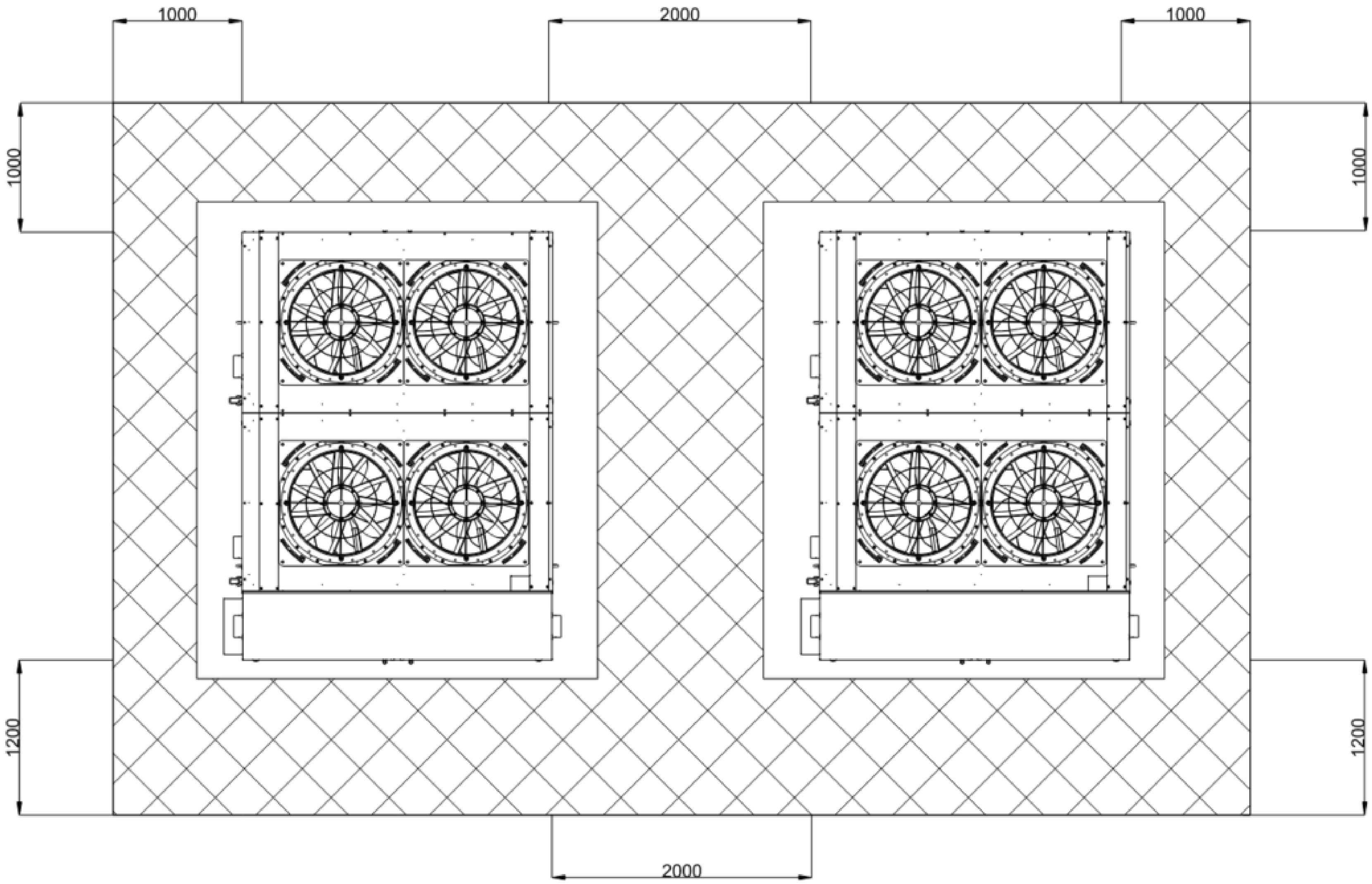


2.5.3 Multiple Unit Installation

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.



Side by side installation, allow access to side of each unit for access. Ensure there is at least 2m between each unit. This allows ample room for pipework and access to the compressor in case of repair.



3 Technical Data

3.1 Performance Data

Maple Range		200/26kW	300/390kW	520/400kW	650/500kW
Heating performance data to EN14825 (A-5/W70) 40K TD					
Rated heating output	kW	189.6	284.4	379.2	474.0
Power Consumption	kW	94.9	142.3	189.7	237.1
Current Input	A	172.7	259.0	345.4	431.3
Coefficient of Performance (COP)		2.4	2.4	2.4	2.4
Seasonal Coefficient of Performance (SCOP)		2.6	2.6	2.6	2.6
Heating performance data to EN14825 (A7/W70) 40K TD					
Rated heating output	kW	245.8	368.8	491.7	614.6
Power Consumption	kW	102.5	153.8	205.1	256.4
Current Input	A	186.8	280.2	373.6	467.0
Coefficient of Performance (COP)		2.8	2.8	2.8	2.8
Seasonal Coefficient of Performance (SCOP)		2.6	2.6	2.6	2.6
Temperature Range	Minimum Inlet water temp	20°C			
	Maximum Outlet water temp	70°C			
	Outdoor temp range	-15°C to 40°C			

3.3 Construction Table

Maple Range		200/26kW	300/390kW	520/400kW	650/500kW
REFRIGERATION SIDE					
Compressor Type	-	Reciprocating			
Compressor Qty	Pcs.	2	3	4	5
Refrigerant	-	CO_2	CO_2	CO_2	CO2
Refrigerant Circuits	Pcs	2	3	4	5
Variable speed drive (VSD)	Pcs.	2	3	4	5
Refrigerant charge (CO_2)	kg	20	30	40	50
No. evaporators	Pcs.	2	3	4	5
Evaporators Type	-	Flat bed			
Fin Material	-	AL/MG			
Defrost Type	-	Hot Gas CO_2			
Defrost medium	-	CO_2			
Electrical supply	-	3~ 400V 50 HZ			
DIMENSIONS & NOISE					
Colour	-	RAL7016 Anthracite			
Unit Weight (empty)	kg	2537.3	3850.7	5164.2	6477.6
Unit Weight (operational)	kg	2574.1	3905.9	5237.8	6569.6
Sound Power Level $L_{W(A)}$ (dB)*	dB	90	93	95	97
ACCESS					
Minimum free space side	mm	1000	1000	1000	1000
Minimum free space front	mm	1000	1000	1000	1000
Minimum free space back	mm	1200	1200	1200	1200
Minimum free space above	mm	6000	6000	6000	6000
WATER SIDE					
Type of internal exchangers	-	Stainless steel plate heat exchanger			
Number of internal heat exchangers	l	2	3	4	5
Exchanger Water Content (per module)	l	8.4			
Connections waterside inlet/outlet	DN	42mm Copper	42mm Copper	42mm Copper	42mm Copper
Connections waterside pressure rating	PN	6			
Factory pressure test rating	PN	6			
Waterside Burst Disk (supplied by installer)	PN	6			
Control Methodology	-	PICV			
Pressure Drop Across Each Module (A7/W70) 40K TD	kPa	61.2			

Maple Range		200/26kW	300/390kW	520/400kW	650/500kW
WATER FLOW RATES					
PER MODULE					
Nominal dT 40 K	l/s	0.73			
Nominal dT 35 K	l/s	0.84			
Nominal dT 30 K	l/s	0.98			
Minimum Water Flow Rate	l/s	0.25			
PER UNIT					
Nominal dT 40 K	l/s	1.46	2.19	2.92	3.65
Nominal dT 35 K	l/s	1.68	2.52	3.36	4.2
Nominal dT 30 K	l/s	1.96	2.94	3.92	4.9
Minimum water volume in heating	l	443	443	443	443
Total internal water volume	l	16.8	25.2	33.6	42.0
FANS SECTION					
Fans type	-	Axial fans			
N° fans	Pcs.	4	6	8	10
Standard air-flow	m^3/s	16	24	32	40
Additional Static Pressure Available	Pa	0	0	0	0
Fan regulation	-	0-10V			
Fan Power Input	kW	5.6	8.5	11.8	14.1
ELECTRICAL DATA					
Total Absorbed Power (at 7°C ambient)	kW	102.5	153.8	205.1	256.4
Total Current per phase	A	186.8	280.2	373.6	467.0
Starting Method	-	Soft Start			
Starting Current (at -5°C ambient)	A	86.7	131.0	174.4	217.5
Total kVA	kVA	129.4	194.1	258.8	323.5
Electrical supply	-	3~ 400V 50 HZ			
Communication protocol	-	BACNET over IP (optional extra)			
IP-Class	-	IP54			

3.4 Electrical data

3.4.1 Supply voltage 400/3/50+N

MAPLE		200/26kW	300/390kW	520/400kW	650/500kW
F.L.A. - Full load current at max admissible conditions (per phase)					
F.L.A. - Total	A	154.0	231.2	308.2	385.3
F.L.I. - Full load power input at max admissible conditions					
F.L.I. - Total	kW	106.0	159.0	211.9	264.9
M.I.C. - Maximum inrush current					
M.I.C. - Total	A	192.5	269.5	346.5	423.5

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

For non-standard voltage please contact Clade technical office

3.4.2 Wiring cross sections and fuse protection

UNIT	External power supply		
	Power supply	Switch manual	Fuses
200/260 kW	380-415V 3N~ 50Hz	200A (pre mounted)	200A
300/390 kW	380-415V 3N~ 50Hz	250A (pre mounted)	250A
400/520 kW	380-415V 3N~ 50Hz	400A (pre mounted)	400A
500/650 kW	380-415V 3N~ 50Hz	500A (pre mounted)	500A

Deviating connection lengths and electrical fuses must be calculated according to the country-specific regulations.

3.5 Noise

To reduce the transmission of vibration and associated noise through pipework and structural elements, flexible connections must be used on all water connections to the unit. Proper isolation and support of attached pipework is also essential to minimise operational noise.

External fixings to the housings, such as pipe supports, fencing, or brackets, will adversely affect vibration and noise performance and are not recommended.

3.5.1 Noise Calculation

Noise details are detailed below for the Maple 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

Maple Range	200/260kW	300/390kW	520/400kW	650/500kW
Sound Power Level, $L_{W(A)}$ (dB)	90	93	95	97
Sound Pressure Level at 10m (dB)	58	61	62	64
Uncertainty (dB)	4	4	4	4

Note:

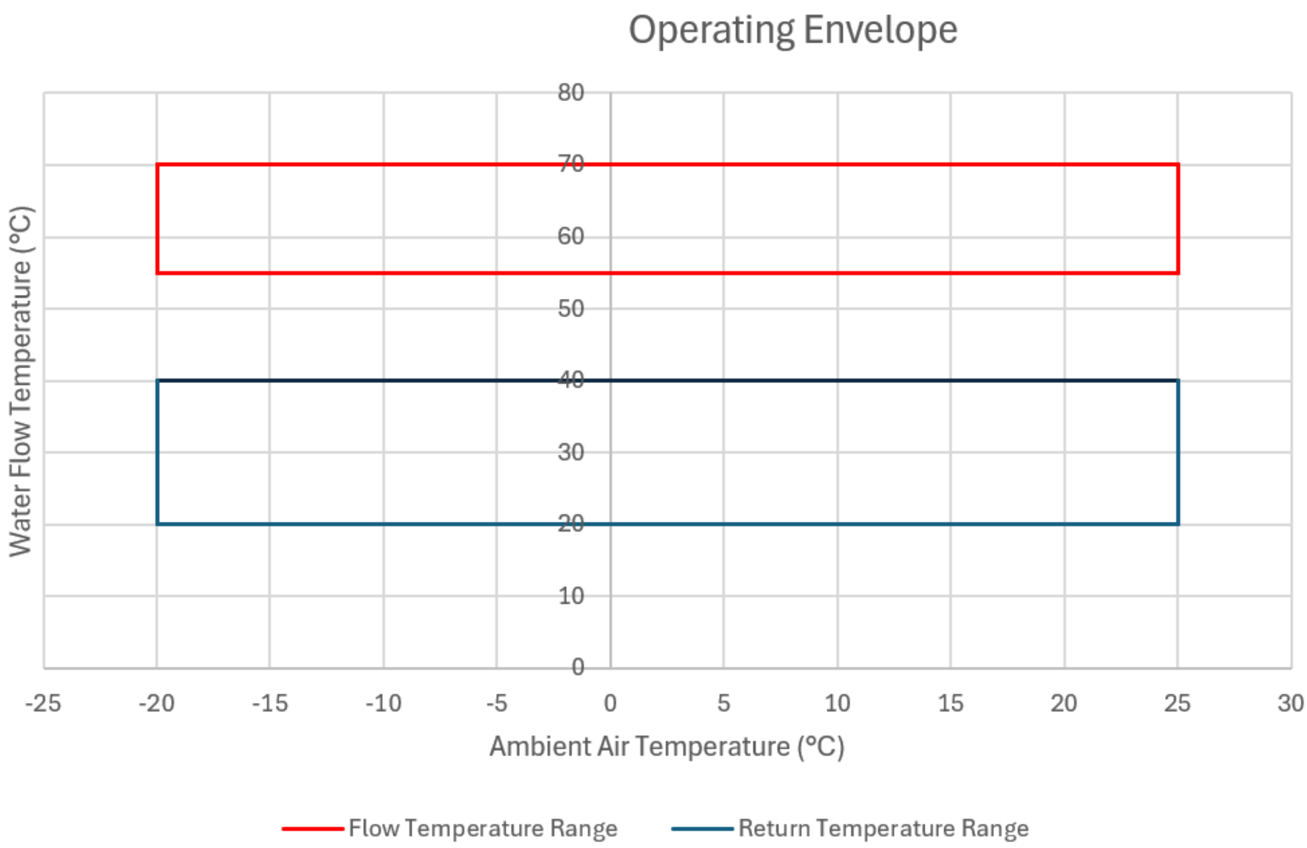
- Values determined in accordance with test standard BS EN ISO 9614 - Part 1: 2009 (survey grade).
- The sum of a measured noise emission value and its associated uncertainty represents an upper boundary of the range of values which is likely to occur in measurements

3.6 Glycol use correction factors

% propylene glycol by weight		0%	10%	20%	30%
Freezing point	°C	0	-4	-9	-16
Correction factor for flow rate	Nr	1	1.025	1.056	1.093
Correction factor for system pressure drop	Nr	1	1.053	1.118	1.200
Correction factor for unit heating capacity	Nr	1	1.005	1.011	1.019

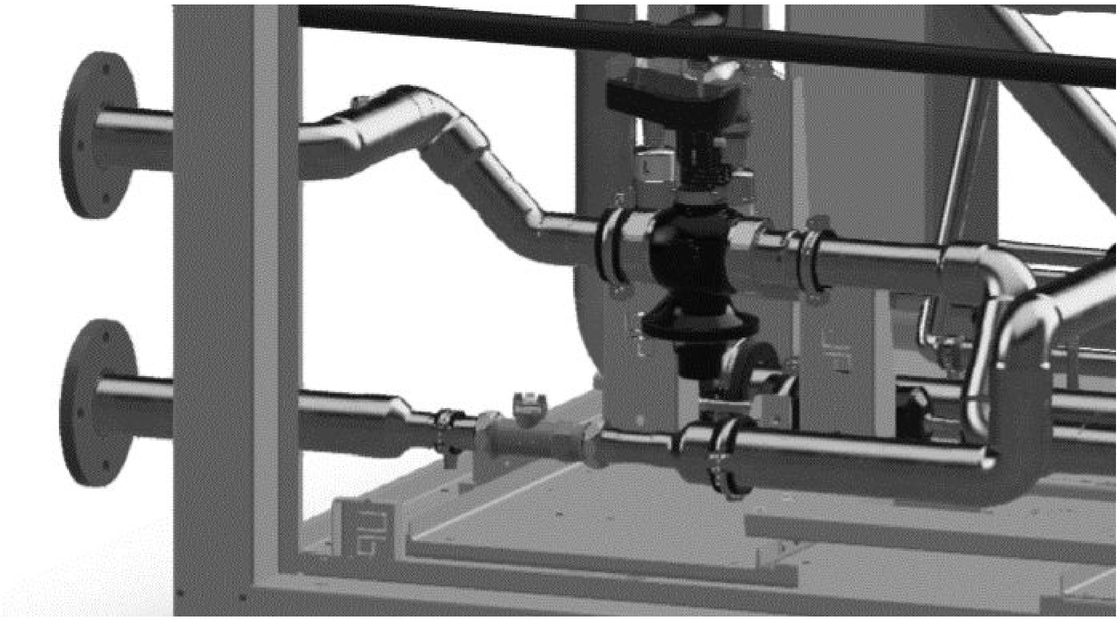
The correction factors shown refer to water and propylene glycol mixes used to prevent the formation of frost on the exchangers in the water circuit during inactivity in winter. Glycol has no impact on kW output of the Maple units, instead the unit modulates flow rate.

3.7 Operating Ranges



3.8 Pressure Independent Control Valves

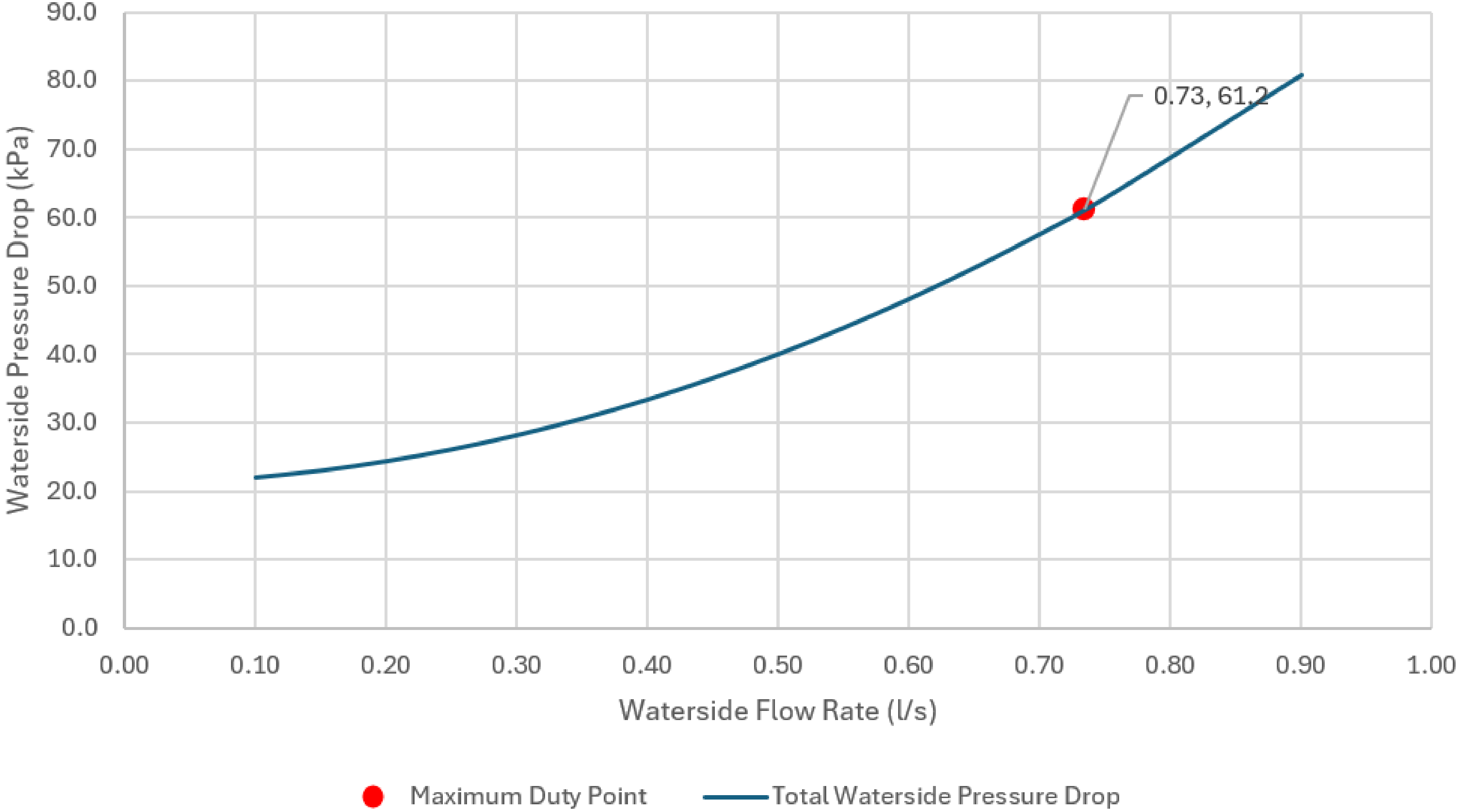
All Maple R744 heat pump systems are equipped with Pressure Independent Control Valves (PICVs) and do not include an internal circulating pump. Instead, the water circulating pump for the system must be sized, sourced, and installed by a third party; Clade does not supply a circulating pump as part of 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 can be set directly in the master controller, eliminating the need for manual valve presetting since the actuator automatically manages the valve's operating envelope.

3.9 Internal Exchanger Pressure Drops and Admissible Water Flow Rates

Maple Range (per module)



3.10 Heating Performances

The performance data presented here reflects testing under the controlled parameters outlined in EN 14825 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.

These units support two operating modes:

1. **Power Mode:** Heat output remains unrestricted up to outdoor temperatures of 7 °C, offering greater capacity in milder conditions, albeit with increased power input.

2. **Efficiency Mode:** Heat output is capped at conditions equivalent to -5 °C, allowing the electrical demand to remain at the same level as -5 °C operation. This is particularly beneficial for installations where electrical capacity is limited.

3.10.1 Maple Range 200/260 kW

POWER MODE (+7°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-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
MAPLE 260/200	**70/35**	**2.4**	158.2	78.7	2.0	178.2	82.2	2.2	199.6	85.5	2.3	221.9	88.3	2.5	231.1	89.4	2.6	231.1	80.8	2.9	231.1	75.2	3.1
	65/35	**2.4**	158.2	78.7	2.0	178.2	82.2	2.2	199.6	85.5	2.3	221.9	88.3	2.5	231.1	89.4	2.6	231.1	80.8	2.9	231.1	75.2	3.1
	60/35	**2.4**	158.2	78.7	2.0	178.2	82.2	2.2	199.6	85.5	2.3	221.9	88.3	2.5	231.1	89.4	2.6	231.1	80.8	2.9	231.1	75.2	3.1
	70/30	**2.6**	168.3	77.1	2.2	189.6	80.6	2.4	212.3	83.8	2.5	236.1	86.6	2.7	245.8	87.6	2.8	245.8	84.1	2.9	245.8	78.3	3.1
	65/30	**2.6**	168.3	77.1	2.2	189.6	80.6	2.4	212.3	83.8	2.5	236.1	86.6	2.7	245.8	87.6	2.8	245.8	84.1	2.9	245.8	78.3	3.1
	60/30	**2.6**	168.3	77.1	2.2	189.6	80.6	2.4	212.3	83.8	2.5	236.1	86.6	2.7	245.8	87.6	2.8	245.8	84.1	2.9	245.8	78.3	3.1
	55/35	**2.4**	158.2	78.7	2.0	178.2	82.2	2.2	199.6	85.5	2.3	221.9	88.3	2.5	231.1	89.4	2.6	231.1	80.8	2.9	231.1	75.2	3.1
	55/30	**2.6**	168.3	77.1	2.2	189.6	80.6	2.4	212.3	83.8	2.5	236.1	86.6	2.7	245.8	87.6	2.8	245.8	84.1	2.9	245.8	78.3	3.1
	70/40	**2.2**	148.1	82.7	1.8	166.9	86.3	1.9	186.8	89.7	2.1	207.7	92.7	2.2	216.3	93.8	2.3	216.3	79.5	2.7	216.3	73.9	2.9
	65/40	**2.2**	148.1	82.7	1.8	166.9	86.3	1.9	186.8	89.7	2.1	207.7	92.7	2.2	216.3	93.8	2.3	216.3	79.5	2.7	216.3	73.9	2.9
	60/40	**2.2**	148.1	82.7	1.8	166.9	86.3	1.9	186.8	89.7	2.1	207.7	92.7	2.2	216.3	93.8	2.3	216.3	79.5	2.7	216.3	73.9	2.9

EFFICIENCY MODE (-5°C CAPACITY CONTROL)

Model name	Water Temp (°C)	SCOP	-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
MAPLE 260/200	70/35	2.5	158.2	78.7	2.0	178.2	82.2	2.2	178.2	72.3	2.5	178.2	67.3	2.6	178.2	65.4	2.7	178.2	62.6	2.8	178.2	58.0	3.1
	65/35	2.5	158.2	78.7	2.0	178.2	82.2	2.2	178.2	72.3	2.5	178.2	67.3	2.6	178.2	65.4	2.7	178.2	62.6	2.8	178.2	58.0	3.1
	60/35	2.5	158.2	78.7	2.0	178.2	82.2	2.2	178.2	72.3	2.5	178.2	67.3	2.6	178.2	65.4	2.7	178.2	62.6	2.8	178.2	58.0	3.1
	70/30	2.6	168.3	77.1	2.2	189.6	80.6	2.4	189.6	75.2	2.5	189.6	70.0	2.7	189.6	68.0	2.8	189.6	65.2	2.9	189.6	60.5	3.1
	65/30	2.6	168.3	77.1	2.2	189.6	80.6	2.4	189.6	75.2	2.5	189.6	70.0	2.7	189.6	68.0	2.8	189.6	65.2	2.9	189.6	60.5	3.1
	60/30	2.6	168.3	77.1	2.2	189.6	80.6	2.4	189.6	75.2	2.5	189.6	70.0	2.7	189.6	68.0	2.8	189.6	65.2	2.9	189.6	60.5	3.1
	55/35	2.5	158.2	78.7	2.0	178.2	82.2	2.2	178.2	72.3	2.5	178.2	67.3	2.6	178.2	65.4	2.7	178.2	62.6	2.8	178.2	58.0	3.1
	55/30	2.6	168.3	77.1	2.2	189.6	80.6	2.4	189.6	75.2	2.5	189.6	70.0	2.7	189.6	68.0	2.8	189.6	65.2	2.9	189.6	60.5	3.1
	70/40	2.4	148.1	82.7	1.8	166.9	86.3	1.9	166.9	71.2	2.3	166.9	66.3	2.5	166.9	64.3	2.6	166.9	61.6	2.7	166.9	57.0	2.9
	65/40	2.4	148.1	82.7	1.8	166.9	86.3	1.9	166.9	71.2	2.3	166.9	66.3	2.5	166.9	64.3	2.6	166.9	61.6	2.7	166.9	57.0	2.9
	60/40	2.4	148.1	82.7	1.8	166.9	86.3	1.9	166.9	71.2	2.3	166.9	66.3	2.5	166.9	64.3	2.6	166.9	61.6	2.7	166.9	57.0	2.9

3.10.2 Maple Range 300/390 kW

POWER MODE (+7°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-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
	70/35	**2.4**	237.3	118.1	2.0	267.3	123.3	2.2	299.4	128.2	2.3	332.8	132.5	2.5	346.6	134.0	2.6	346.6	121.2	2.9	346.6	112.8	3.1
	65/35	**2.4**	237.3	118.1	2.0	267.3	123.3	2.2	299.4	128.2	2.3	332.8	132.5	2.5	346.6	134.0	2.6	346.6	121.2	2.9	346.6	112.8	3.1
	60/35	**2.4**	237.3	118.1	2.0	267.3	123.3	2.2	299.4	128.2	2.3	332.8	132.5	2.5	346.6	134.0	2.6	346.6	121.2	2.9	346.6	112.8	3.1
	70/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	318.5	125.6	2.5	354.1	129.8	2.7	368.8	131.4	2.8	368.8	126.1	2.9	368.8	117.5	3.1
	65/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	318.5	125.6	2.5	354.1	129.8	2.7	368.8	131.4	2.8	368.8	126.1	2.9	368.8	117.5	3.1
MAPLE 390/300	**60/30**	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	318.5	125.6	2.5	354.1	129.8	2.7	368.8	131.4	2.8	368.8	126.1	2.9	368.8	117.5	3.1
	55/35	**2.4**	237.3	118.1	2.0	267.3	123.3	2.2	299.4	128.2	2.3	332.8	132.5	2.5	346.6	134.0	2.6	346.6	121.2	2.9	346.6	112.8	3.1
	55/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	318.5	125.6	2.5	354.1	129.8	2.7	368.8	131.4	2.8	368.8	126.1	2.9	368.8	117.5	3.1
	70/40	**2.2**	222.1	124.0	1.8	250.3	129.5	1.9	280.3	134.6	2.1	311.6	139.1	2.2	324.5	140.7	2.3	324.5	119.3	2.7	324.5	110.9	2.9
	65/40	**2.2**	222.1	124.0	1.8	250.3	129.5	1.9	280.3	134.6	2.1	311.6	139.1	2.2	324.5	140.7	2.3	324.5	119.3	2.7	324.5	110.9	2.9
	60/40	**2.2**	222.1	124.0	1.8	250.3	129.5	1.9	280.3	134.6	2.1	311.6	139.1	2.2	324.5	140.7	2.3	324.5	119.3	2.7	324.5	110.9	2.9

EFFICIENCY MODE (-5°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-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
MAPLE 390/300	**70/35**	**2.5**	237.3	118.1	2.0	267.3	123.3	2.2	267.3	108.4	2.5	267.3	101.0	2.6	267.3	98.0	2.7	267.3	93.9	2.8	267.3	87.0	3.1
	65/35	**2.5**	237.3	118.1	2.0	267.3	123.3	2.2	267.3	108.4	2.5	267.3	101.0	2.6	267.3	98.0	2.7	267.3	93.9	2.8	267.3	87.0	3.1
	60/35	**2.5**	237.3	118.1	2.0	267.3	123.3	2.2	267.3	108.4	2.5	267.3	101.0	2.6	267.3	98.0	2.7	267.3	93.9	2.8	267.3	87.0	3.1
	70/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	284.4	112.8	2.5	284.4	105.1	2.7	284.4	102.1	2.8	284.4	97.8	2.9	284.4	90.7	3.1
	65/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	284.4	112.8	2.5	284.4	105.1	2.7	284.4	102.1	2.8	284.4	97.8	2.9	284.4	90.7	3.1
	60/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	284.4	112.8	2.5	284.4	105.1	2.7	284.4	102.1	2.8	284.4	97.8	2.9	284.4	90.7	3.1
	55/35	**2.5**	237.3	118.1	2.0	267.3	123.3	2.2	267.3	108.4	2.5	267.3	101.0	2.6	267.3	98.0	2.7	267.3	93.9	2.8	267.3	87.0	3.1
	55/30	**2.6**	252.4	115.7	2.2	284.4	120.9	2.4	284.4	112.8	2.5	284.4	105.1	2.7	284.4	102.1	2.8	284.4	97.8	2.9	284.4	90.7	3.1
	70/40	**2.4**	222.1	124.0	1.8	250.3	129.5	1.9	250.3	106.9	2.3	250.3	99.4	2.5	250.3	96.5	2.6	250.3	92.4	2.7	250.3	85.5	2.9
	65/40	**2.4**	222.1	124.0	1.8	250.3	129.5	1.9	250.3	106.9	2.3	250.3	99.4	2.5	250.3	96.5	2.6	250.3	92.4	2.7	250.3	85.5	2.9
	60/40	**2.4**	222.1	124.0	1.8	250.3	129.5	1.9	250.3	106.9	2.3	250.3	99.4	2.5	250.3	96.5	2.6	250.3	92.4	2.7	250.3	85.5	2.9

3.10.3 Maple Range 520/400 kW

POWER MODE (+7°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-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
MAPLE 520/400	**70/35**	**2.4**	316.4	157.4	2.0	356.5	164.5	2.2	399.2	170.9	2.3	443.8	176.7	2.5	462.2	178.7	2.6	462.2	161.6	2.9	462.2	150.3	3.1
	65/35	**2.4**	316.4	157.4	2.0	356.5	164.5	2.2	399.2	170.9	2.3	443.8	176.7	2.5	462.2	178.7	2.6	462.2	161.6	2.9	462.2	150.3	3.1
	60/35	**2.4**	316.4	157.4	2.0	356.5	164.5	2.2	399.2	170.9	2.3	443.8	176.7	2.5	462.2	178.7	2.6	462.2	161.6	2.9	462.2	150.3	3.1
	70/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	424.6	167.5	2.5	472.1	173.1	2.7	491.7	175.1	2.8	491.7	168.2	2.9	491.7	156.7	3.1
	65/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	424.6	167.5	2.5	472.1	173.1	2.7	491.7	175.1	2.8	491.7	168.2	2.9	491.7	156.7	3.1
	60/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	424.6	167.5	2.5	472.1	173.1	2.7	491.7	175.1	2.8	491.7	168.2	2.9	491.7	156.7	3.1
	55/35	**2.4**	316.4	157.4	2.0	356.5	164.5	2.2	399.2	170.9	2.3	443.8	176.7	2.5	462.2	178.7	2.6	462.2	161.6	2.9	462.2	150.3	3.1
	55/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	424.6	167.5	2.5	472.1	173.1	2.7	491.7	175.1	2.8	491.7	168.2	2.9	491.7	156.7	3.1
	70/40	**2.2**	296.2	165.3	1.8	333.7	172.7	1.9	373.7	179.5	2.1	415.5	185.5	2.2	432.7	187.7	2.3	432.7	159.0	2.7	432.7	147.8	2.9
	65/40	**2.2**	296.2	165.3	1.8	333.7	172.7	1.9	373.7	179.5	2.1	415.5	185.5	2.2	432.7	187.7	2.3	432.7	159.0	2.7	432.7	147.8	2.9
	60/40	**2.2**	296.2	165.3	1.8	333.7	172.7	1.9	373.7	179.5	2.1	415.5	185.5	2.2	432.7	187.7	2.3	432.7	159.0	2.7	432.7	147.8	2.9

EFFICIENCY MODE (-5°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-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
MAPLE 520/400	**70/35**	**2.5**	316.4	157.4	2.0	356.5	164.5	2.2	356.5	144.6	2.5	356.5	134.6	2.6	356.5	130.7	2.7	356.5	125.2	2.8	356.5	116.0	3.1
	65/35	**2.5**	316.4	157.4	2.0	356.5	164.5	2.2	356.5	144.6	2.5	356.5	134.6	2.6	356.5	130.7	2.7	356.5	125.2	2.8	356.5	116.0	3.1
	60/35	**2.5**	316.4	157.4	2.0	356.5	164.5	2.2	356.5	144.6	2.5	356.5	134.6	2.6	356.5	130.7	2.7	356.5	125.2	2.8	356.5	116.0	3.1
	70/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	379.2	150.4	2.5	379.2	140.1	2.7	379.2	136.1	2.8	379.2	130.4	2.9	379.2	120.9	3.1
	65/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	379.2	150.4	2.5	379.2	140.1	2.7	379.2	136.1	2.8	379.2	130.4	2.9	379.2	120.9	3.1
	60/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	379.2	150.4	2.5	379.2	140.1	2.7	379.2	136.1	2.8	379.2	130.4	2.9	379.2	120.9	3.1
	55/35	**2.5**	316.4	157.4	2.0	356.5	164.5	2.2	356.5	144.6	2.5	356.5	134.6	2.6	356.5	130.7	2.7	356.5	125.2	2.8	356.5	116.0	3.1
	55/30	**2.6**	336.6	154.3	2.2	379.2	161.2	2.4	379.2	150.4	2.5	379.2	140.1	2.7	379.2	136.1	2.8	379.2	130.4	2.9	379.2	120.9	3.1
	70/40	**2.4**	296.2	165.3	1.8	333.7	172.7	1.9	333.7	142.5	2.3	333.7	132.5	2.5	333.7	128.7	2.6	333.7	123.1	2.7	333.7	114.0	2.9
	65/40	**2.4**	296.2	165.3	1.8	333.7	172.7	1.9	333.7	142.5	2.3	333.7	132.5	2.5	333.7	128.7	2.6	333.7	123.1	2.7	333.7	114.0	2.9
	60/40	**2.4**	296.2	165.3	1.8	333.7	172.7	1.9	333.7	142.5	2.3	333.7	132.5	2.5	333.7	128.7	2.6	333.7	123.1	2.7	333.7	114.0	2.9

3.10.4 Maple Range 650/500 kW

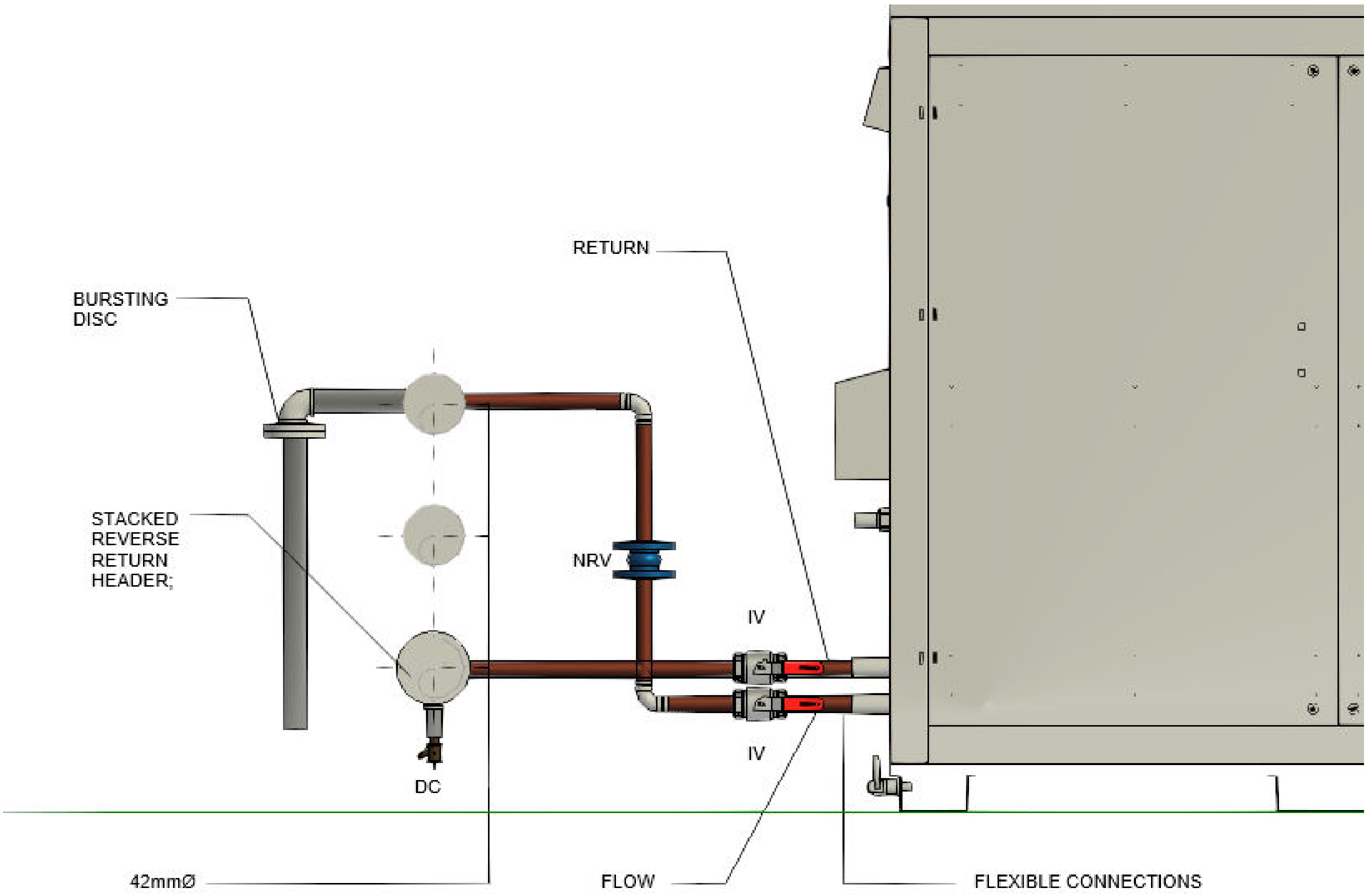
POWER MODE (+7°C CAPACITY CONTROL)																							
Model name	Water Temp (°C)	SCOP	-10°C External			-5°C External			0°C External			5°C External			7°C External			10°C External			15°C External		
			QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP	QH (kW)	PI (kW)	COP
MAPLE 650/500	70/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	65/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	60/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	70/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	65/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	60/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	55/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	55/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	70/40	2.2	370.3	206.6	1.8	375	214	1.9	415	220.8	2.1	456.8	226.8	2.2	474	229	2.3	474	200.3	2.7	474	189.1	2.9
	65/40	2.2	370.3	206.6	1.8	333.7	172.7	1.9	373.7	179.5	2.1	415.5	185.5	2.2	432.7	187.7	2.3	432.7	159	2.7	432.7	147.8	2.9
	60/40	2.2	370.3	206.6	1.8	333.7	172.7	1.9	373.7	179.5	2.1	415.5	185.5	2.2	432.7	187.7	2.3	432.7	159	2.7	432.7	147.8	2.9

EFFICIENCY MODE (-5°C CAPACITY CONTROL)

Model name	Water Temp (°C)	SCOP	-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
MAPLE 650/500	70/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	65/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	60/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	70/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	65/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	60/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	55/35	2.4	395.5	196.8	2.0	445.6	205.6	2.2	499.0	213.7	2.3	554.7	220.8	2.5	577.7	223.4	2.6	577.7	201.9	2.9	577.7	187.9	3.1
	55/30	2.6	420.7	192.9	2.2	474.0	201.5	2.4	530.8	209.4	2.5	590.2	216.4	2.7	614.6	218.9	2.8	614.6	210.2	2.9	614.6	195.9	3.1
	70/40	2.2	370.3	206.6	1.8	375	214	1.9	375	214	2.3	375	214	2.5	375	214	2.6	375	214	2.7	375	214	2.9
	65/40	2.2	370.3	206.6	1.8	333.7	172.7	1.9	333.7	172.7	2.3	333.7	172.7	2.5	333.7	172.7	2.6	333.7	172.7	2.7	333.7	172.7	2.9
	60/40	2.2	370.3	206.6	1.8	333.7	172.7	1.9	333.7	172.7	2.3	333.7	172.7	2.5	333.7	172.7	2.6	333.7	172.7	2.7	333.7	172.7	2.9

4 Hydraulics

4.1 Piping Connections (per module)



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

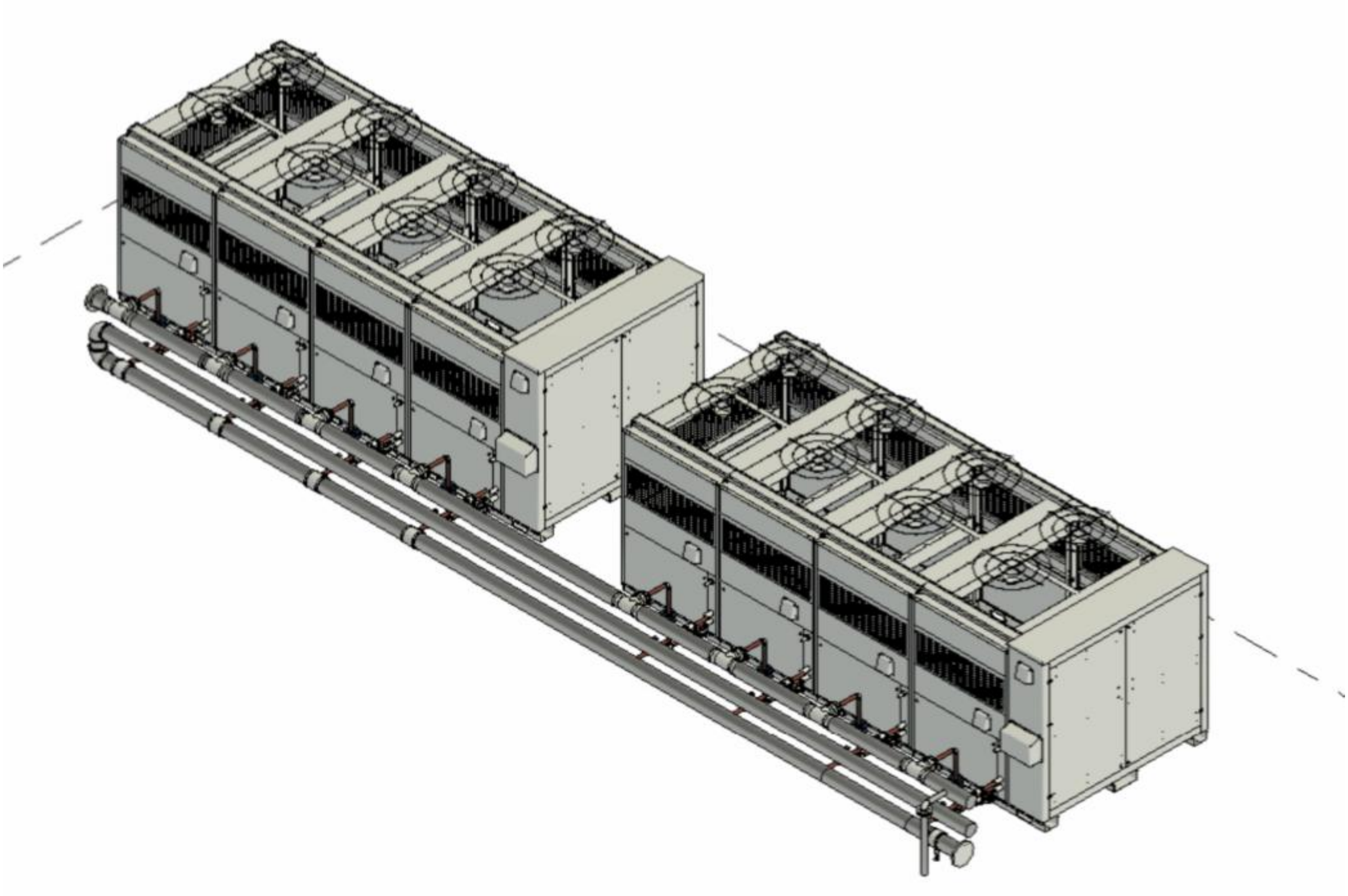
IV	Isolation Valve	Allow for isolation for maintenance
NRV	Non return Valve	Prevents reverse flow of fluid ensuring unidirectional flow.
DC	Drain valve	Allows for drainage during servicing of components

Each of these items should be located on the modules inlet and outlet pipework, as illustrated, before connecting to the common reverse-return header. Further installation details and header-pipe arrangement are provided on the following page.

4.1.1 Pipe Connection Sizes

Connection Type	Maple (each module)
Heating Flow	42mm Copper – plain end
Heating Return	42mm Copper – plain end
Condensate	32mm solvent weld waste pipe – plain end

4.1.2 Header Details



For Maple units, a stacked reverse-return header is the recommended configuration to achieve optimal hydraulic performance with minimal manual balancing. This arrangement consists of two parallel headers, one for flow and one for return—mounted in a compact “stacked” format, typically one directly above the other. Implementing this stacked reverse-return header setup on Maple units delivers consistent flow distribution, reduces commissioning time, and simplifies ongoing maintenance by inherently balancing all circuits.

4.2 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. To mitigate the loss of output while in defrost, the system buffer vessel must be sized accordingly.

4.2.1 Minimum Buffer Size

Clade's minimum buffer recommendations are given in the table. These represent the minimum storage requirements necessary to protect the heat pump and allow for a maximum of six starts per hour.

Minimum buffer volume required for start up (liters)	200/260kW	300/390kW	400/250kW	500/650kW
	1213	1819	2426	3032

4.2.2 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 30 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.

4.2.3 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 0.2 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.

- **Perforated Baffle Plate**: Positioned inside the vessel, the baffle plate ensures an even spread of stratification and helps maintain the cold section at the bottom of the buffer critical for return temperatures.

- **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.

4.3 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.

4.3.1 Safety Valves

Safety valves on the low-temperature hot-water side are compulsory on all Maple 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.

4.3.2 Bursting Disc

In addition to the required safety valves and pressurization equipment of the LTHW system it is strongly recommended that a bursting disc is installed to the system to protect the system from increase in pressure from the high- pressure CO_2 system should the plate heat exchanger fail.

CO_2 refrigerant within the heat pump operates at 120 bar, protection for plant and equipment on the LTHW side of the system is advised to mitigate any sudden variations in pressure.

Burst Discs consist of a thin membrane which is designed to break and open when the specific level of differential pressure rises above the resistance limit that the disc was originally calibrated for, so as to allow for the excess pressure to vent out safely.

System configuration, plant locations and servicing routes will need to be considered when locating the burst disc on the system. It is therefore the responsibility of the designer/installer to specify the type and location. On multiple Maple installations one burst disc on the common primary pipework maybe deemed sufficient.

Burst discs are designed to be installed between two flanges. Please refer to manufactures instructions for installation information.

⚠ **WARNING**

A BURSTING DISC IS NOT A SUBSTITUTE FOR A SAFETY VALVE.

⚠ **WARNING**

The designer/installer must consider adequate protection for sudden various in pressure.

4.4 Frost Protection

Each Maple unit relies on an externally supplied water-side circulation pump to prevent internal freezing under low-ambient conditions. When temperatures drop, the heat pump’s built-in controller issues an “enable” signal to start the pump, which circulates warmer secondary fluid through the internal heat exchanger. Note that the pump must be powered and installed by the customer or installer; the unit provides only the control signal.

5 Unit Installation

5.1 General notes

5.1.1 Installation criteria:

Accessibility & Space

- Select a location that is safely and easily accessible for maintenance.
- Allow sufficient technical clearance around the unit for its overall dimensions, airflow paths (intake and exhaust), and service access (as specified in this manual).
- Ensure unobstructed airflow by avoiding siting near tall walls, in corners, beneath overhangs, or below ground level where air can stagnate or recirculate.

Structural Support

- Verify that all support points can bear the unit’s weight.
- Mount the unit above ground level to facilitate condensate drainage and reduce moisture ingress.
- Align and level all bearing points accurately to prevent vibration and uneven loading.

Environmental Considerations

- Avoid flood-prone areas and account for maximum potential snow levels—ensure snow drift won’t block airflow or drainage.
- Protect against debris accumulation (leaves, litter, etc.) on the air coil.
- Avoid siting near strong wind corridors that could impede or exaggerate airflow, and steer clear of nearby heat or pollution sources (e.g. chimneys, flues, vehicle exhausts).
- Prevent cold-air stratification by ensuring intake air remains free-flowing and that expelled air cannot be drawn back in.
- Consult the unit’s declared sound power level (dB A) in the technical specifications. Use this to model expected sound pressure levels at neighbouring facades and property boundaries.

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.

Final Verification

- After positioning and securing the unit, verify that all space requirements (clearances for airflow, service access, and noise dissipation) outlined in this manual are met.

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

5.1.2 Structural

- Concrete bases are preferred.
- Raise the base at least 300 mm above ground level to fit hydraulic and electrical connections.
- Check that all supports are level.
- Provide adequate condensate drainage when the unit is in heating mode, ensuring water drains safely away from traffic areas where ice may form.
- Separate the foundation from the building structure to limit noise and vibration transmission.
- Use the factory-provided holes to secure the unit to its foundation.

5.1.3 Positioning

The unit is intended for outdoor use in a permanent, flat orientation, either at ground level or on a roof. In roof installations, verify that the structure supports both the unit's weight and potential maintenance loads.

Minimising vibration:

- Install anti-vibration mounts or neoprene pads under the heat pump support.
- Use flexible joints in the water circuit to reduce transmitted vibration.
- Keep the unit perfectly level.

Key considerations:

- Required service clearances.
- Electrical connection routes.
- Water/hydraulic connection access.
- Potential increases in overall height if optional vibration dampers are used.

5.1.4 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.

5.1.5 Pressure Relief Valve Refrigerant Side

PRVs are included on the refrigerant loop within the unit.

5.1.6 Condensate

Heat pumps produce significant condensate from defrost cycles. Route condensate away from areas where frozen water could pose hazards. Use a downward-sloping drainpipe to prevent ice buildup. In colder climates, consider trace heating cables to prevent freezing.

5.1.7 Freezing Prevention

In regions where ambient temperatures can fall below freezing, it is essential to protect all external pipework and equipment from ice formation. Install self-regulating trace heating cables beneath the insulation on external water lines to maintain fluid temperatures above 0 °C, even when the air temperature drops to -25 °C. After commissioning, verify under worst-case conditions that inlet and outlet pipe temperatures remain above freezing. Where trace heaters alone may not suffice, use one or more of the following measures—particularly if outdoor temperatures hover around 0 °C—to avoid permanent damage (which voids warranty):

- Mix the system water with an appropriate concentration of antifreeze glycol.
- Install electric heating cables directly under the insulation on all exposed piping.
- Drain down and isolate the system during extended shutdown periods.

Select self-regulating heaters to prevent local hot spots or overheating, and always ensure adequate control and monitoring of pipe temperatures.

5.2 Water quality

5.2.1 New Systems

Before commissioning any new installation, remove the circulator and thoroughly flush the entire system to clear out welding residue, waste, sealants, mineral oils, and other preservatives. Only then should you fill the system with clean, high-quality tap water.

5.2.2 Existing Systems

When replacing or adding a heat pump to an existing system, first drain and flush all pipework before installing the new unit. Flush each section separately, paying special attention to areas prone to debris build-up due to reduced flow, then refill with clean, high-quality tap water. If the water is still unsuitable, install an appropriate filter, such as a coarse (mesh) filter for larger debris or a finer tissue filter for smaller particles.

5.2.3 Water Filter

- Use a filter of ≥30 mesh at the water inlet, positioned for easy cleaning.
- Never remove the filter, as doing so invalidates the warranty.

5.2.4 Exclusions

Warranty coverage does not extend to damage caused by limescale, deposits, or impurities from the water supply, nor to issues stemming from improper system cleaning.

5.2.5 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 mixture (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

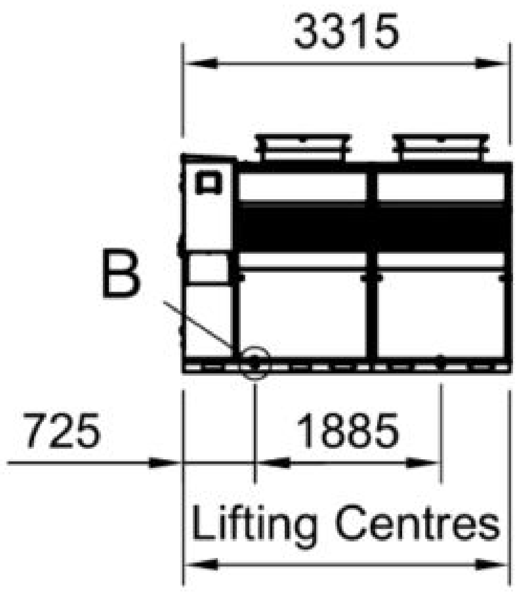
5.2.6 Minimum Water Quality Requirements for Maple Units

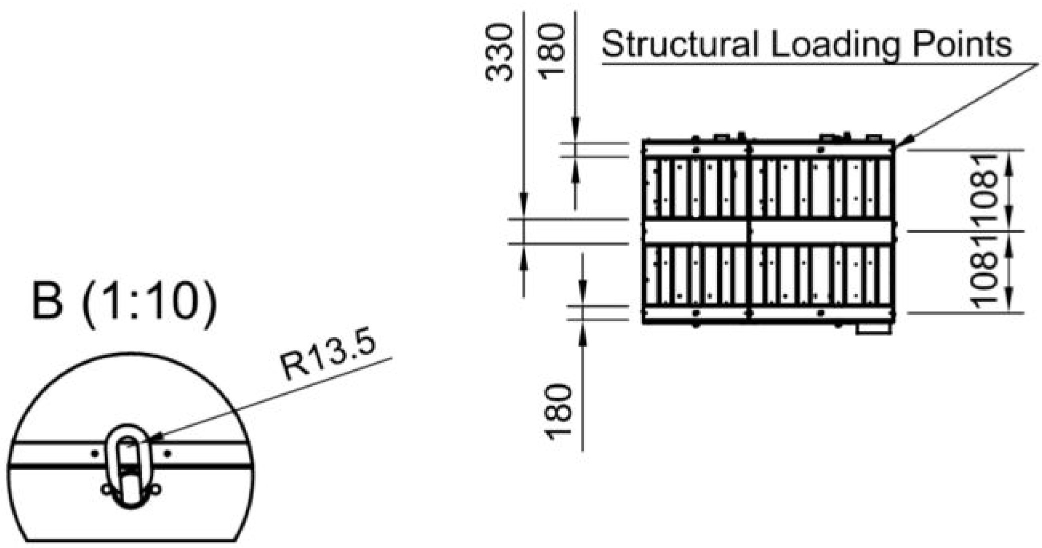
The water system should be maintained to BS 8552. Below is an extract of the figures the water sampling should achieve on a quarterly basis.

Parameter	Source Water	System Water	ALS LoR
Suspended solids	One off	Quarterly	1.0 mg/l
Conductivity	One off	Quarterly	30 µS/cm
pH	One off	Quarterly	1 pH units Dilution number
Visual appearance	One off	Quarterly	-
Odour	One off	Quarterly	-
Total Alkalinity	One off	Quarterly	2.8 mg/l
Total Hardness	One off	Quarterly	0.38 mg/l
Nitrite	-	Quarterly	0.08 mg/l
Sulphate	One off	Quarterly	4.4 mg/l
Chloride	One off	Quarterly	3.7 mg/l
Total Iron	-	Quarterly	230 µg/l
Dissolved Iron	-	Quarterly	230 µg/l
Total Copper	-	Quarterly	9 µg/l
Molybdate	-	Quarterly	0.006 mg/l
Phosphate	One off	Quarterly	0.6 mg/l
Glycol	-	Quarterly	2 mg/l
TVC 22-37°	-	Quarterly	0 cfu/ml
Pseudomonas	-	Quarterly	0 cfu/100ml
SRB	-	Quarterly	DET/ND
NRB	-	Quarterly	0 cfu/ml

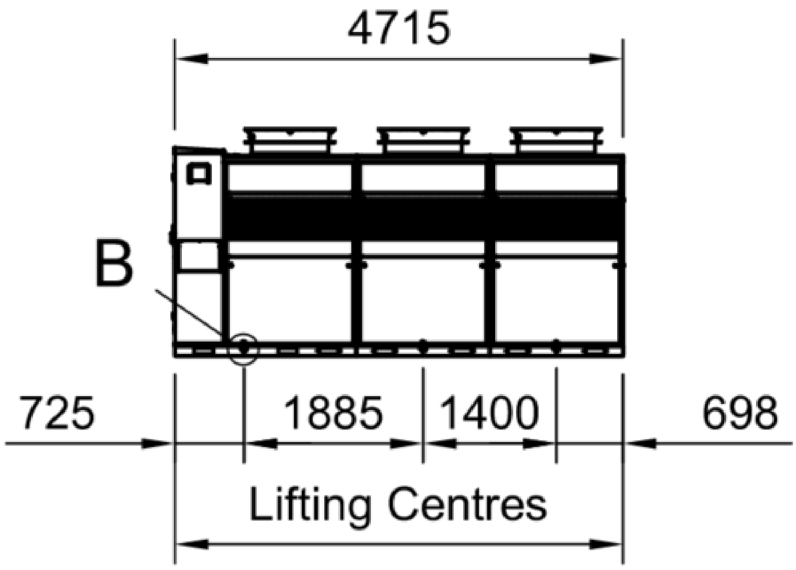
5.3 Lifting Centers and Structural Loading Points

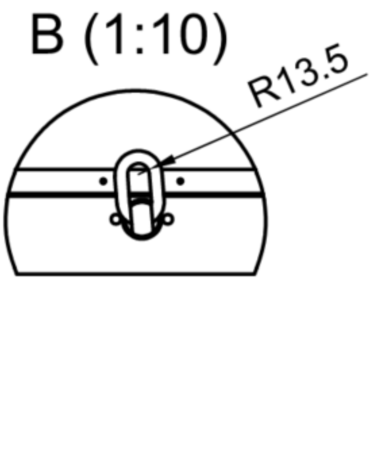
5.3.1 Maple 200/260 kW

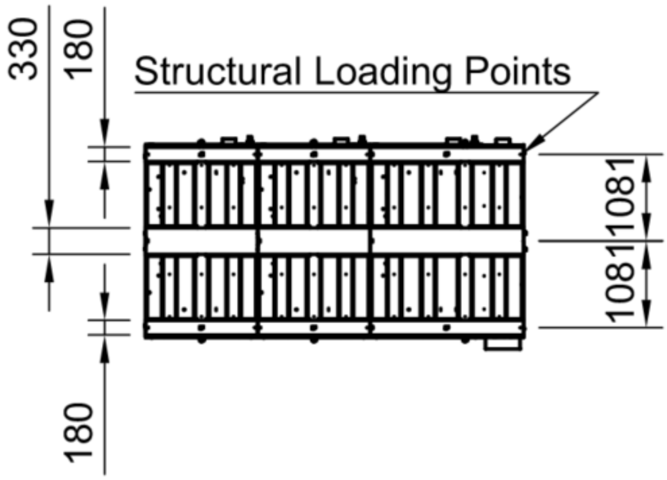




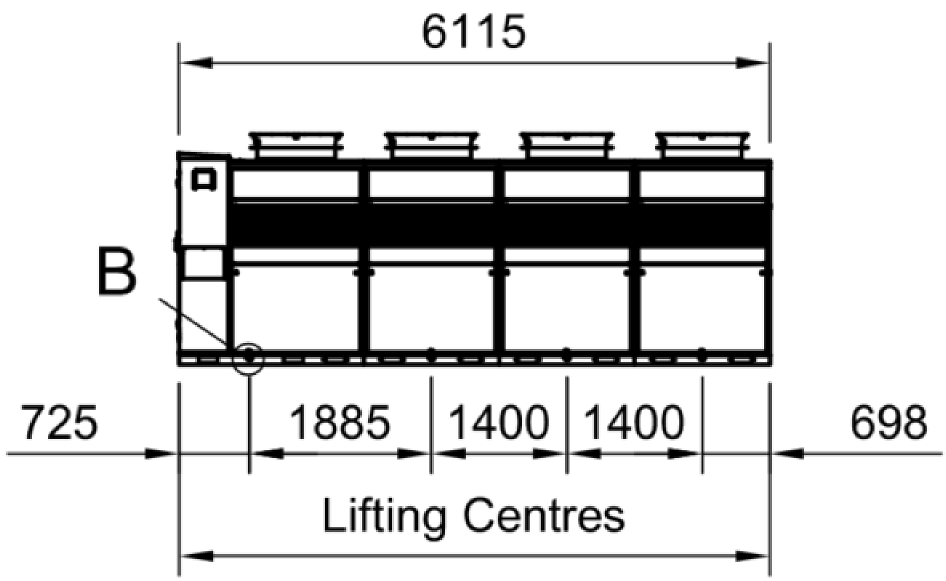
5.3.2 Maple 300/390 kW

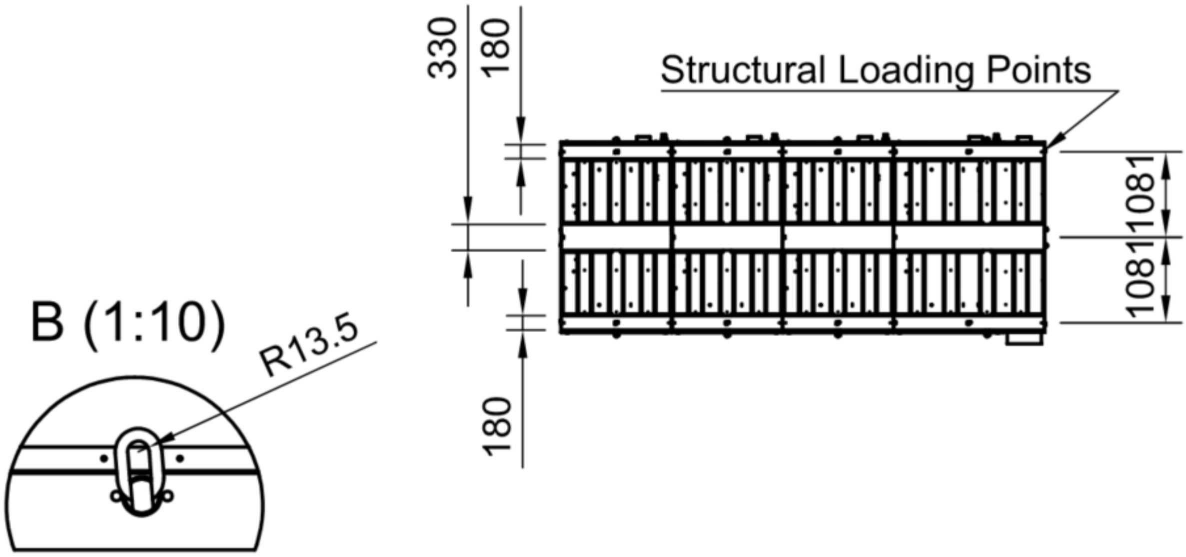




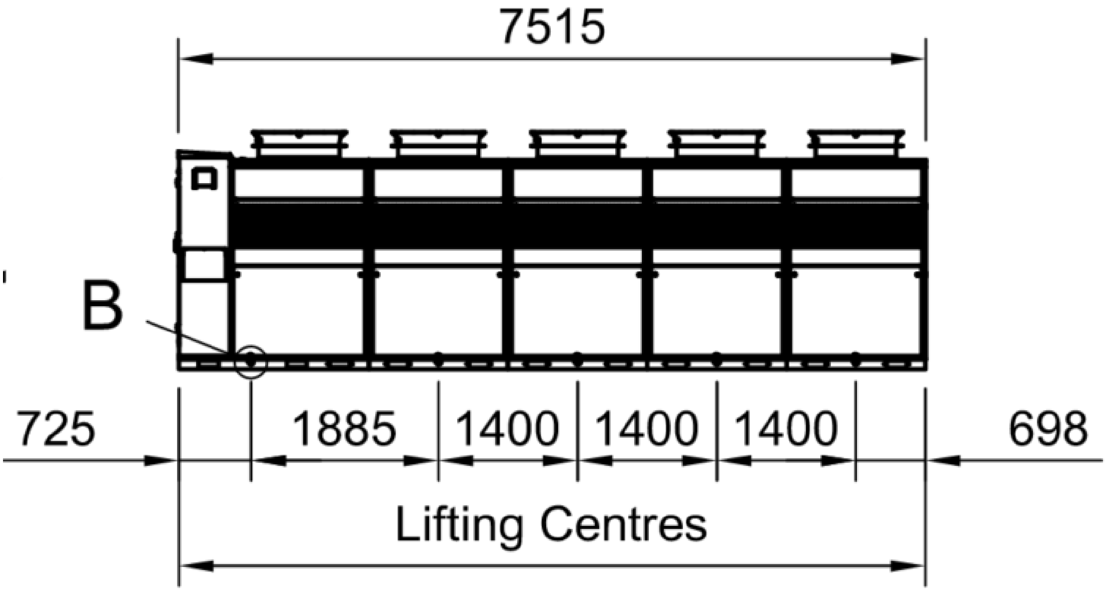


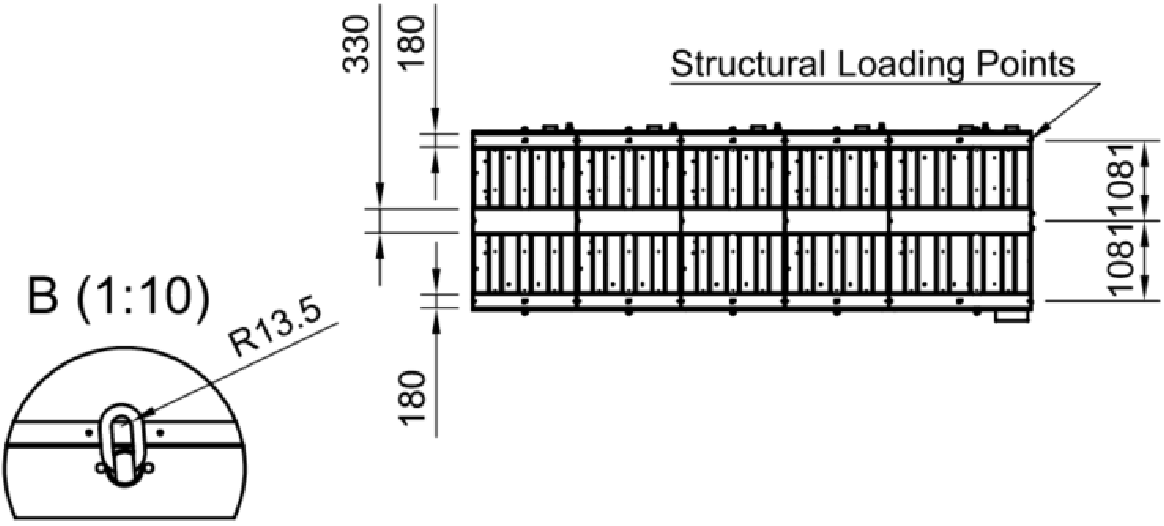
5.3.3 Maple 400/520 kW





5.3.4 Maple 500/650 kW





6 System Configuration

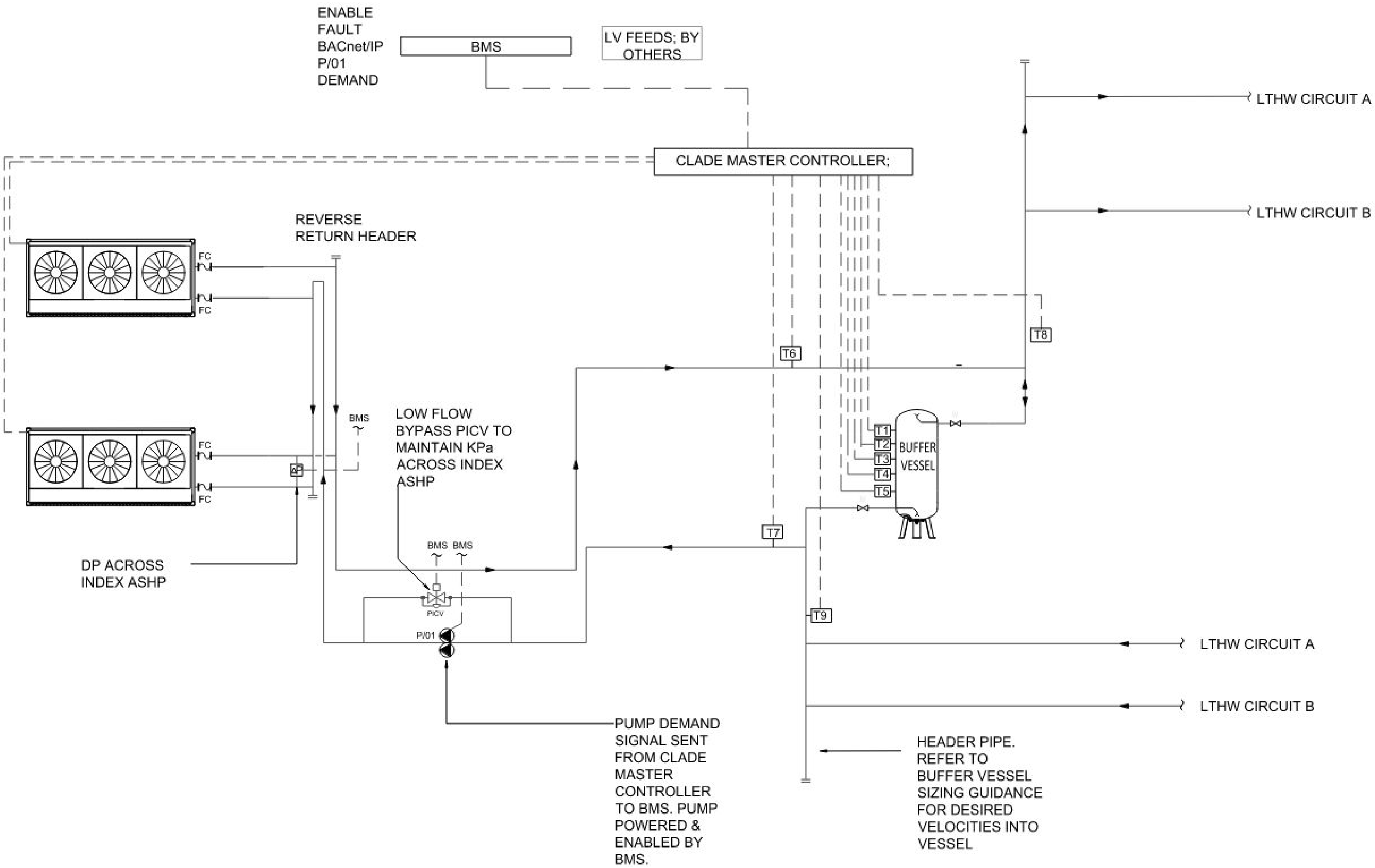
6.1 System Schematics

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 Maple 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.

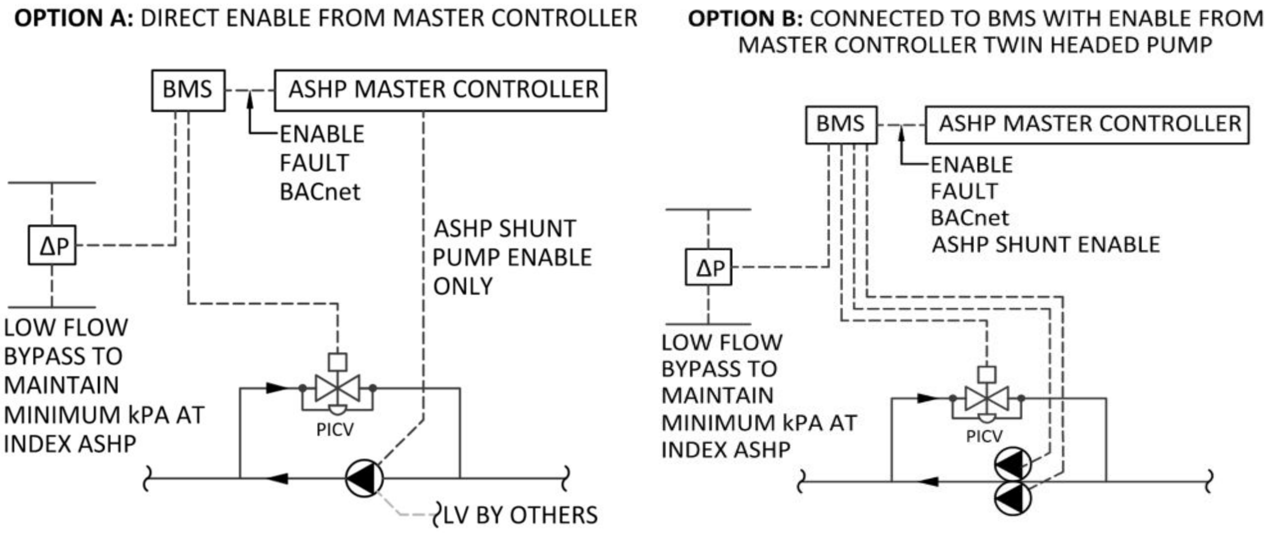
Multiple ASHP units are to be connected in a reverse return configuration to ensure equal flow distribution across all units. Even flow distribution across ASHPs enhances system efficiency and prolongs equipment lifespan.

6.1.1 General Arrangement



6.1.2 ASHP Shunt Pump and Low flow Bypass

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



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

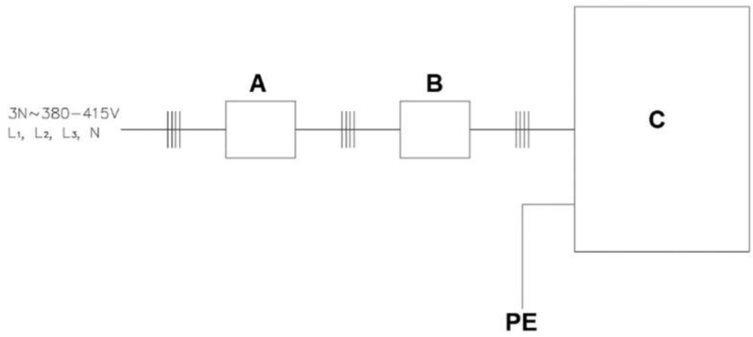
The primary circulation pump shall be fitted with a dedicated low-flow bypass loop incorporating a pressure-independent control valve (PICV) sized based on the system's minimum bypass flow requirement. This configuration ensures that, under minimum pump speed and flow conditions, the hydraulically most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

7 Wiring

7.1 Mains Supply Installation

Schematic Drawing

A: Protection Device
B: Local Isolation
C: Heat Pump unit



Main power supply cable size and switch capacities:

Model	Cable size (mm^2)			Local Isolation (A)	Protection (A)
	L1,L2,L3	Neutral	Earth	AC22/AC23	
Maple 200/260 kW	70	70	70	200A	200A
Maple 300/390 kW	95	95	95	250A	250A
Maple 400/520 kW	185	185	185	400A	400A
Maple 500/650 kW	240	240	240	500A	500A

A dedicated power supply is required for each unit with its own protection device and local isolation.

Local climate conditions and cable service routes should be taken into account as part of the cable selection and installation of the electrical supply.

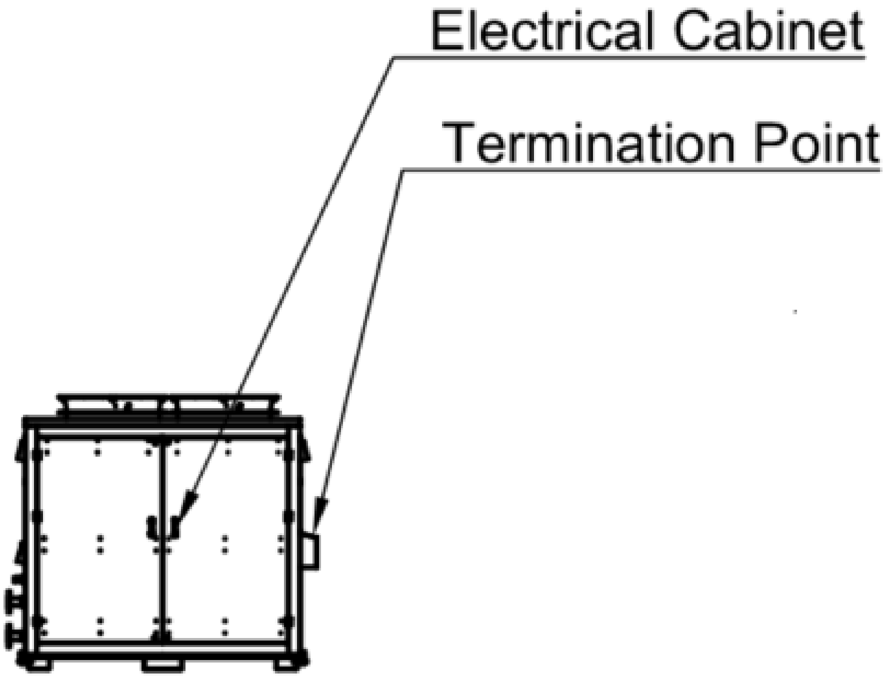
The cable size in the above table is selected using Table 4E4A as part of BS7671 2018 IET wiring regulations. The cable selection should only be used between the local isolation and outdoor unit.

The electrical installation should be designed and installed to meet BS7671 2018 IET wiring regulations or adhere to the wiring regulations of the region of install.

7.1.1 Terminal Block Arrangement

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

- Route supply conductors through the factory-installed gland plate.
- Size cables to suit the full-load current.
- Tighten all terminals to the torque values specified on the terminal-strip label.



⚠ **CAUTION**

Earth tabs must be reconnected prior to refitting access panels

7.1.2 Maximum Cable Sizes

The maximum cable sizes into the isolators of the unit can be seen below.

Model	Maximum Cu cable cross-section (mm^2)
Maple 200/260 kW	95
Maple 300/390 kW	150
Maple 400/520 kW	240
Maple 500/650 kW	240

⚠ **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.

7.2 Control Connections

Control cable specifications:

Remote controller cable size	0.3 - 1mm^2
Cable between units	Cat 6

8 Controls

8.1 Individual Heat Pump Controls

Each heat pump has its own integrated and independent controls on board the heat pump designed to maintain a fixed flow temperature. This is an adjustable parameter and, in this instance, has been set to maintain the target temperature (55-70°C)

8.1.1 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

There are three options for the method of control on the heat pump:

- Multiplex
- BMS
- Local control

These will be described in the following sections.

8.3 Multiplex Controls

8.3.1 Multiplex Control

Multiplex control should be used when the heat pump is to be controlled by a Master Controller. This enables the control of the heat pump by the Master Controller which can operate multiple heat pumps.

NOTE: Should the return water temperature go above 40°C, this will initiate a high return water fault and cause the heat pump to eventually shut off.

The controller has two modes of control based on the temperatures of the flow and return on both the primary and secondary side of the system. This manages the heat pump(s) and buffer vessel to maintain efficient heating, switching between two modes depending on how much the heat the building is calling for.

Mode 1 – Buffer Filling

If the flow to the building (Secondary Flow) is significantly cooler (≥3 °C difference) than the heat pump's outlet (Primary Flow), the system gradually heats the buffer in multiple stages based on the setpoints of temperature sensors T4, T3, T2, and T1. Each consecutive heating stage activates only once the lower region is mostly heated. This ensures a reserve of hot water in the vessel without sending overly hot water back to the heat pump.

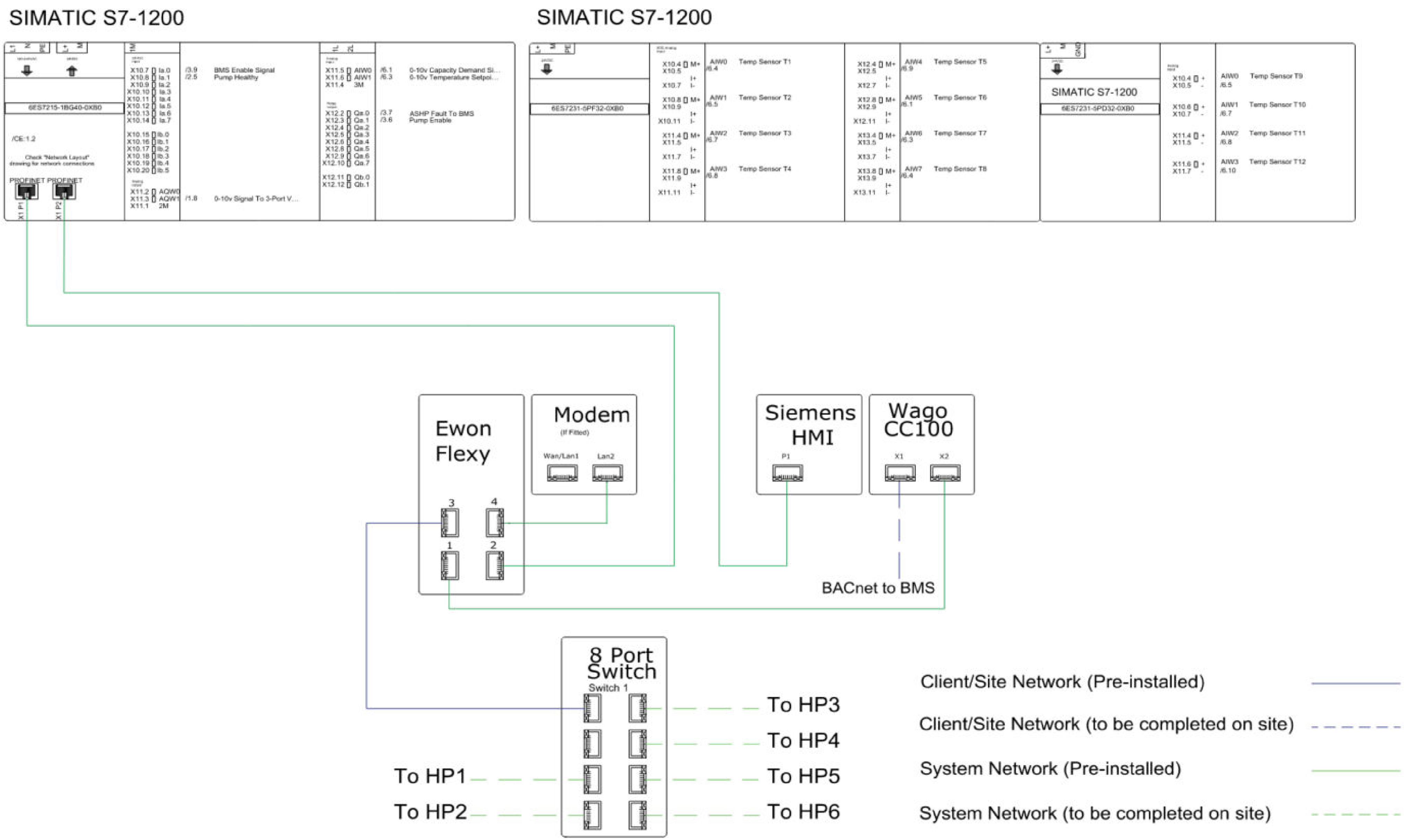
Mode 2 – Site-Load matching

If the Secondary Flow rises closer (within ~2 °C of that 3 °C gap) to the Primary Flow, this means the building is drawing most of the heat directly. The system then uses a faster-acting PI control to match the building's demand in real time. It focuses on keeping the buffer topped up near its target while preventing excessive return temperatures. This maximizes direct supply to the site under higher loads, adjusting capacity so the return from the buffer stays within safe limits.

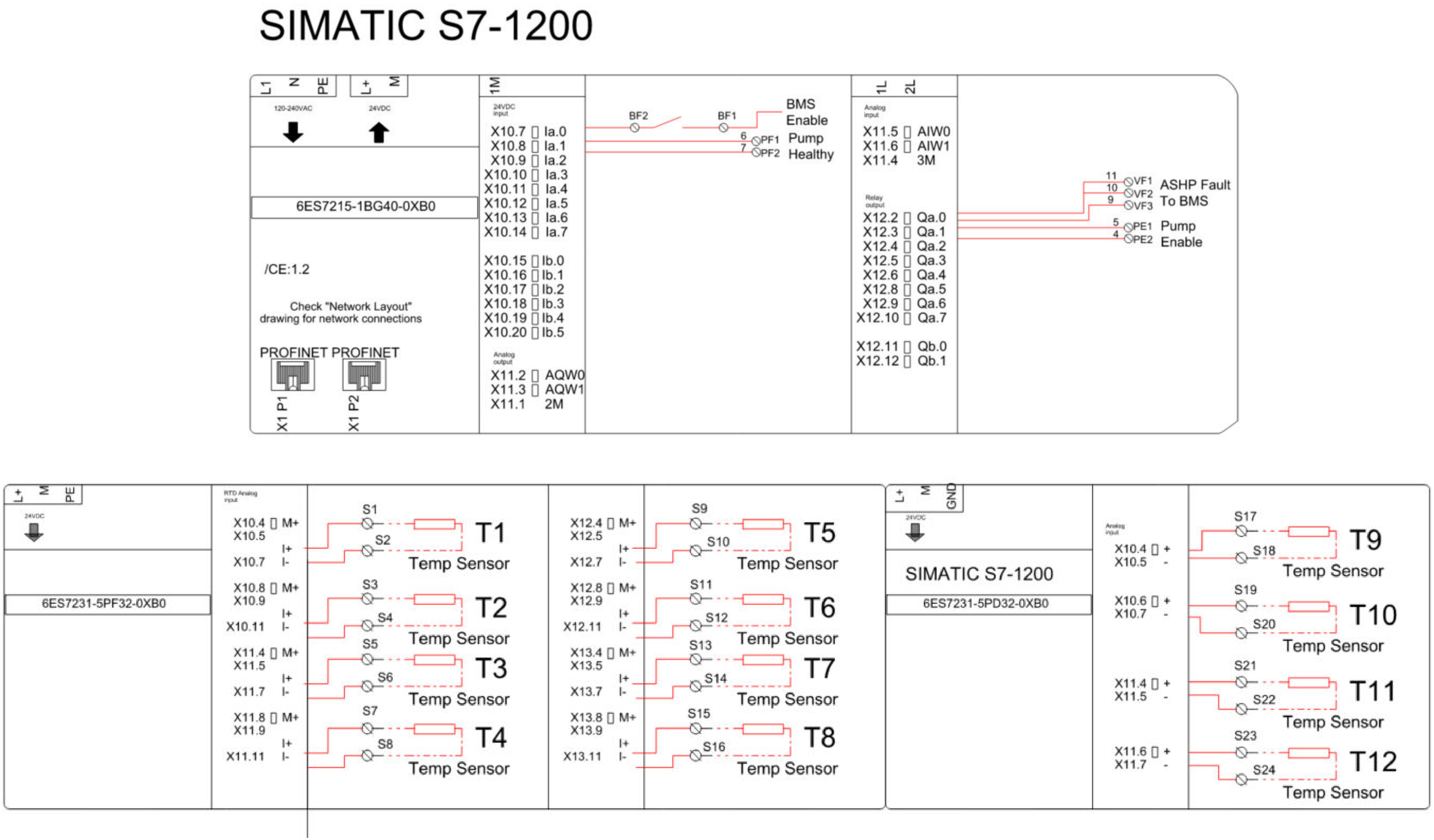
Master controller will be installed as a standalone unit. The heat pumps will connect to the master controller by CAT5 cable between the two units, installed by the contractor as below.

8.3.2 Multiplex System Network Diagram

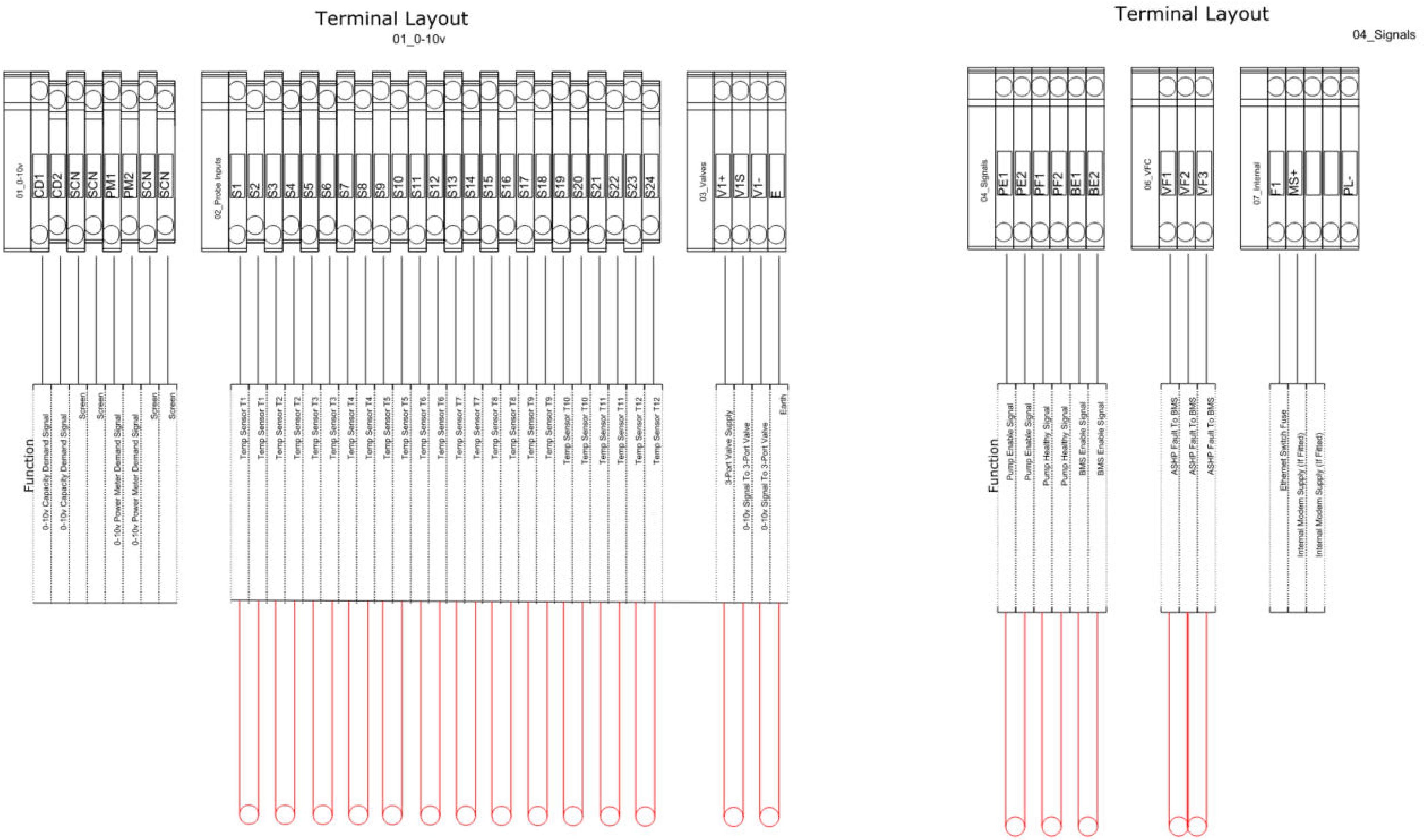
Master Control Panel



Siemens Controller



Terminal Layout



8.3.3 Heat Pump Data

A single connection to the master 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 master controller can be integrated through its BACnet interface. The table below details the data points available via the BACnet connection from the master controller:

Master Controller (large)				
Device Name		**BACnet**		
Inst.-No.		**280028**		
Obj. Type	**Object Name**	**Description**	**Unit**	**Read/Write**
BO	obj_1	System Healthy	On=Healthy / Off=Fault	Read
AO	obj_2	Ambient Temp	ºC	Read
AO	obj_3	ASHP Target Temp	ºC	Read
AO	obj_4	Heating Demand	%	Read
AO	obj_5	T1 Temp	ºC	Read
AO	obj_6	T2 Temp	ºC	Read
AO	obj_7	T3 Temp	ºC	Read
AO	obj_8	T4 Temp	ºC	Read
AO	obj_9	T5 Temp	ºC	Read
AO	obj_10	T6 Temp	ºC	Read
AO	obj_11	T7 Temp	ºC	Read
AO	obj_12	T8 Temp	ºC	Read
AO	obj_13	T9 Temp	ºC	Read
AO	obj_14	T10 Temp	ºC	Read
AO	obj_15	T11 Temp	ºC	Read
AO	obj_16	T12 Temp	ºC	Read
AO	obj_17	HP1 Status	*See Status Table	Read
AO	obj_18	HP1 P11 Flow Temp	ºC	Read
AO	obj_19	HP1 P12 Return Temp	ºC	Read
AO	obj_20	HP2 Status	*See Status Table	Read
AO	obj_21	HP2 P11 Flow Temp	ºC	Read
AO	obj_22	HP2 P12 Return Temp	ºC	Read
AO	obj_23	HP3 Status	*See Status Table	Read
AO	obj_24	HP3 P11 Flow Temp	ºC	Read
AO	obj_25	HP3 P12 Return Temp	ºC	Read
AO	obj_26	HP4 Status	*See Status Table	Read
AO	obj_27	HP4 P11 Flow Temp	ºC	Read
AO	obj_28	HP4 P12 Return Temp	ºC	Read
AO	obj_29	HP5 Status	*See Status Table	Read
AO	obj_30	HP5 P11 Flow Temp	ºC	Read
AO	obj_31	HP5 P12 Return Temp	ºC	Read
AO	obj_32	HP6 Status	*See Status Table	Read
AO	obj_33	HP6 P11 Flow Temp	ºC	Read
AO	obj_34	HP6 P12 Return Temp	ºC	Read
AO	obj_35	HP7 Status	*See Status Table	Read
AO	obj_36	HP7 P11 Flow Temp	ºC	Read
AO	obj_37	HP7 P12 Return Temp	ºC	Read
AO	obj_38	HP8 Status	*See Status Table	Read
AO	obj_39	HP8 P11 Flow Temp	ºC	Read
AO	obj_40	HP8 P12 Return Temp	ºC	Read
***Status Table**				
0=Off				
1=Heating				
2=Defrost				
3=Satisfied				
4=Initialising				
5=Fault				
6=Not Present				
7=Offline				

8.4 BMS Control

This control type must be selected when it is intended to control the heat pump from an independent BMS.

Selecting BMS will allow the heat pump to operate on a 0-10V input signal from the BMS, overriding the local return temperature control.

NOTE: Should the return water temperature go above 40°C, this will initiate a high return water fault and cause the heat pump to eventually shut off.

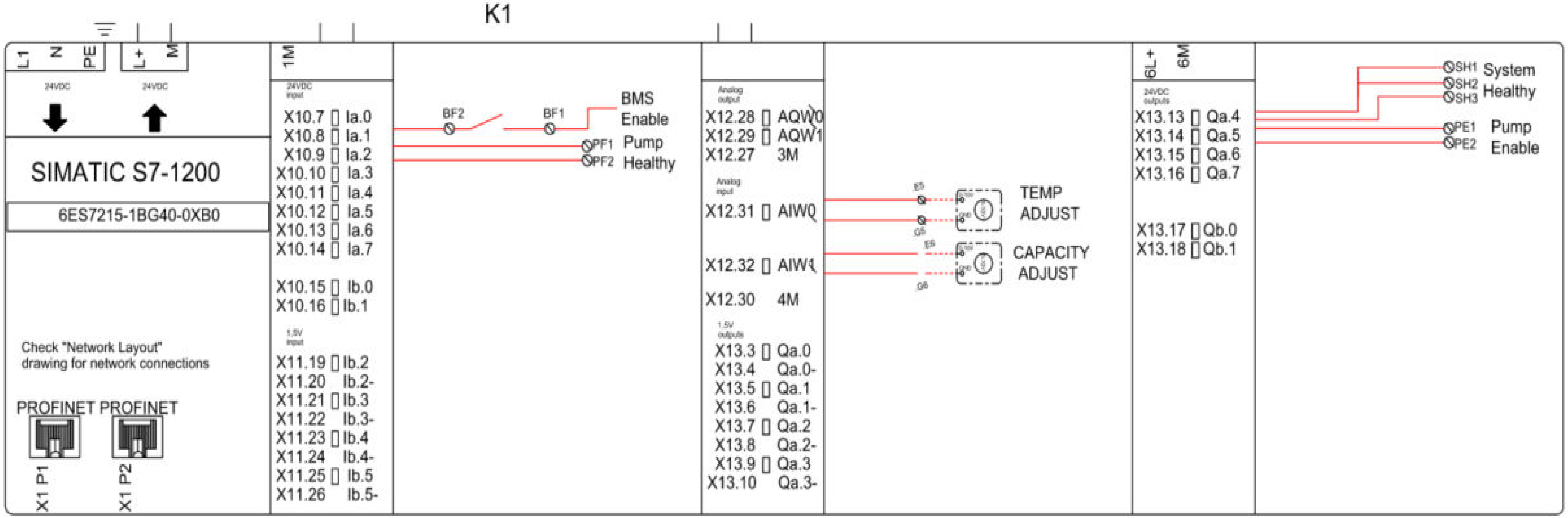
A 0-10V signal allows the heat pump to be controlled to a desired capacity (QH) based on a percentage of maximum capacity.

NOTE: Maximum capacity will alter dependent on ambient temperatures. Therefore, the minimum QH at 2V (50%) at -5ºC will be less than the minimum capacity during times of warmer ambient conditions. When sizing and selecting buffer vessels the low demands of the building need to be considered in conjunction with minimum turn capacity of the heat pump. Published capacities at 7ºC ambient temperatures are deemed as maximum capacities.

The table below denotes the controls associated with a 0-10V signal:

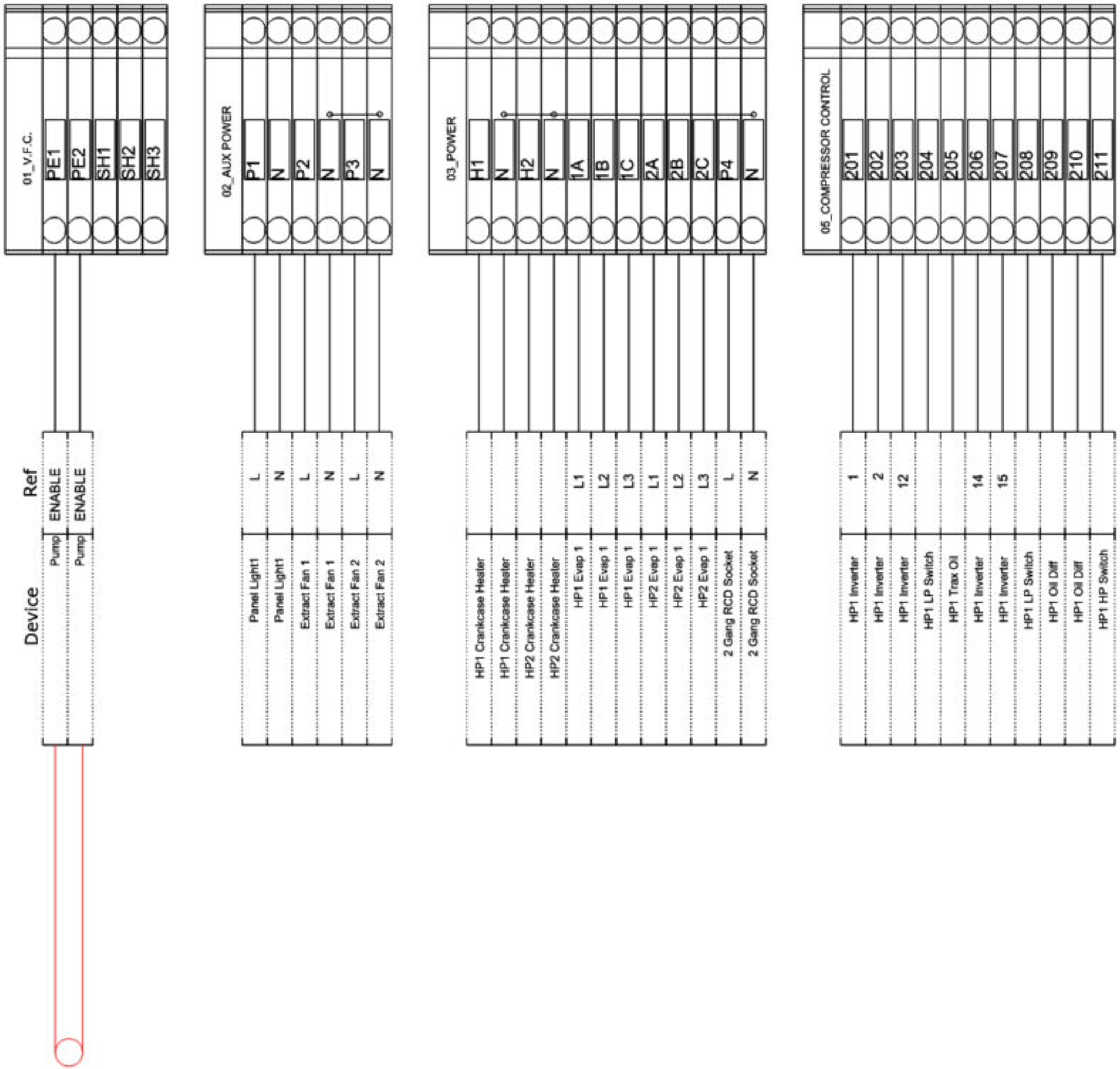
Voltage Signal	Status
0-0.9	Fault
1-1.9	Off
2	Capacity Control (50-100%)
3	
4	
5	
6	
7	
8	
9	
10	

NOTE: The function will not be available when operating as a multiplex installation using the master controller


K1
L1
N
PE
L+
M
24VDC
24VDC
SIMATIC S7-1200
6ES7215-1BG40-0XB0
Check "Network Layout" drawing for network connections
PROFINET PROFINET
X1 P1
X1 P2
1M
X10.7 Ia.0
X10.8 Ia.1
X10.9 Ia.2
X10.10 Ia.3
X10.11 Ia.4
X10.12 Ia.5
X10.13 Ia.6
X10.14 Ia.7
X10.15 Ib.0
X10.16 Ib.1
X11.19 Ib.2
X11.20 Ib.2-
X11.21 Ib.3
X11.22 Ib.3-
X11.23 Ib.4
X11.24 Ib.4-
X11.25 Ib.5
X11.26 Ib.5-
BF2
BF1
BMS Enable
PF1
PF2
Pump Healthy
X12.28 AQW0
X12.29 AQW1
X12.27 3M
X12.31 AIW0
X12.32 AIW1
X12.30 4M
X13.3 Qa.0
X13.4 Qa.0-
X13.5 Qa.1
X13.6 Qa.1-
X13.7 Qa.2
X13.8 Qa.2-
X13.9 Qa.3
X13.10 Qa.3-
TEMP ADJUST
CAPACITY ADJUST
6L+
6M
X13.13 Qa.4
X13.14 Qa.5
X13.15 Qa.6
X13.16 Qa.7
X13.17 Qb.0
X13.18 Qb.1
SH1
SH2
SH3
System Healthy
PE1
PE2
Pump Enable

Terminal Layout

01_V.F.C.



Terminal Layout

05_COMPRESSOR CONTROL

05_COMPRESSOR CONTROL

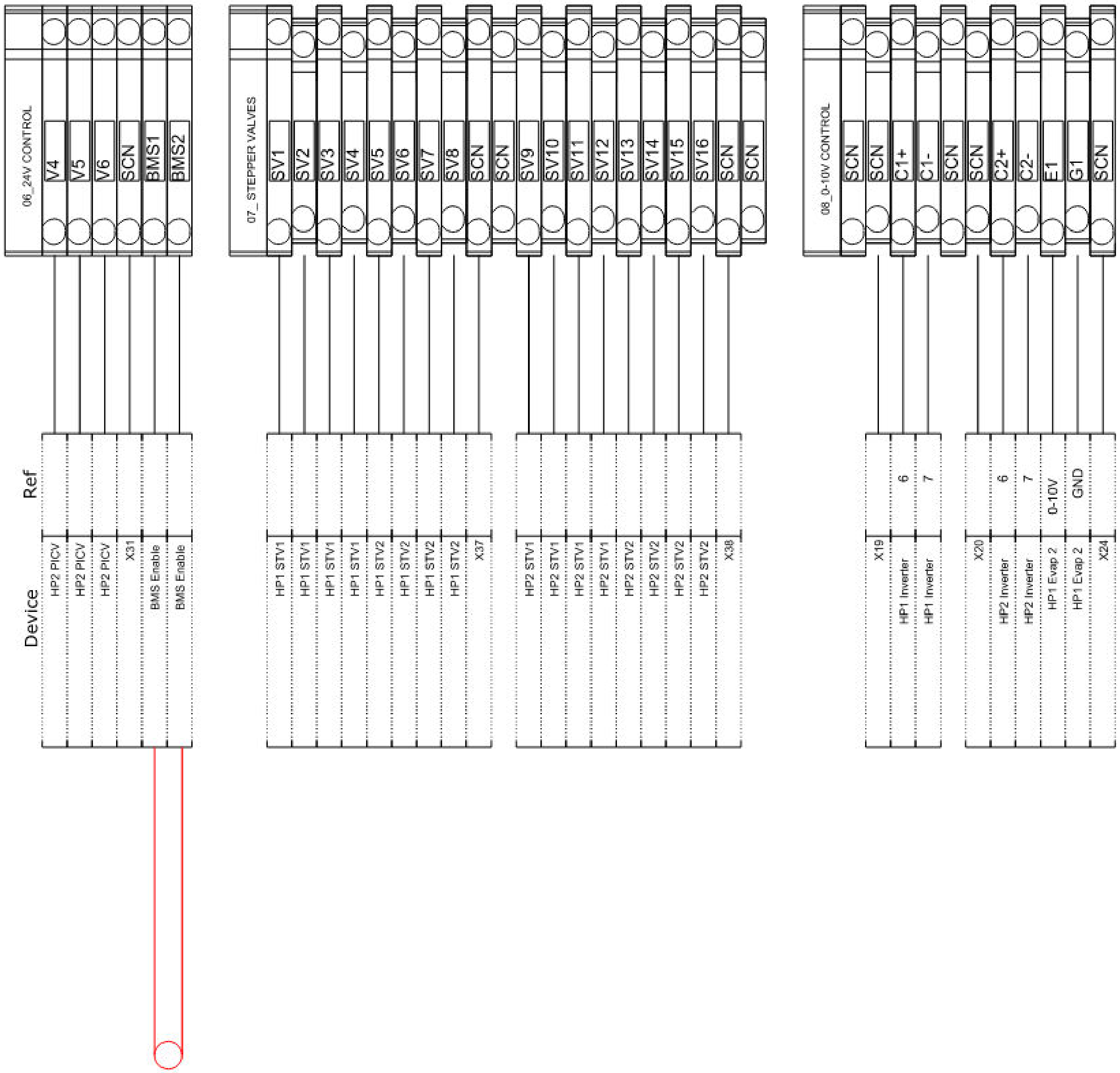
	Ref	Device
212		HP1
213		HP1
214		HP1 Oil Diff
221	1	HP2 Inverter
222	2	HP2 Inverter
223	12	HP2 Inverter
224		HP2 LP Switch
225		HP2 Trax Oil
226	14	HP2 Inverter
227	15	HP2 Inverter
228		HP2 LP Switch
229		HP2 Oil Diff
230		HP2 Oil Diff
231		HP2 HP Switch
232		HP2
233		HP2
234		HP2 Oil Diff

06_24V CONTROL

	Ref	Device
LD1		Leak Detector
LD2		Leak Detector
LD3		Leak Detector
LD4	2	LDR2
LD5		Remote Beacon Sounder
FF1	COM	HP1 Evap 1
FF2	NO	HP1 Evap 2
FF3	COM	HP2 Evap 1
FF4	NO	HP2 Evap 2
FR1		HP1 Evap 1
FR2		HP1 Evap 1
FR3		HP1 Evap 2
FR4		HP1 Evap 2
FR5		HP2 Evap 1
FR6		HP2 Evap 1
FR7		HP2 Evap 2
FR8		HP2 Evap 2
PF1	COM	Pump
PF2	NO	Pump
V1		HP1 PICV
V2		HP1 PICV
V3		HP1 PICV
SCN		X30

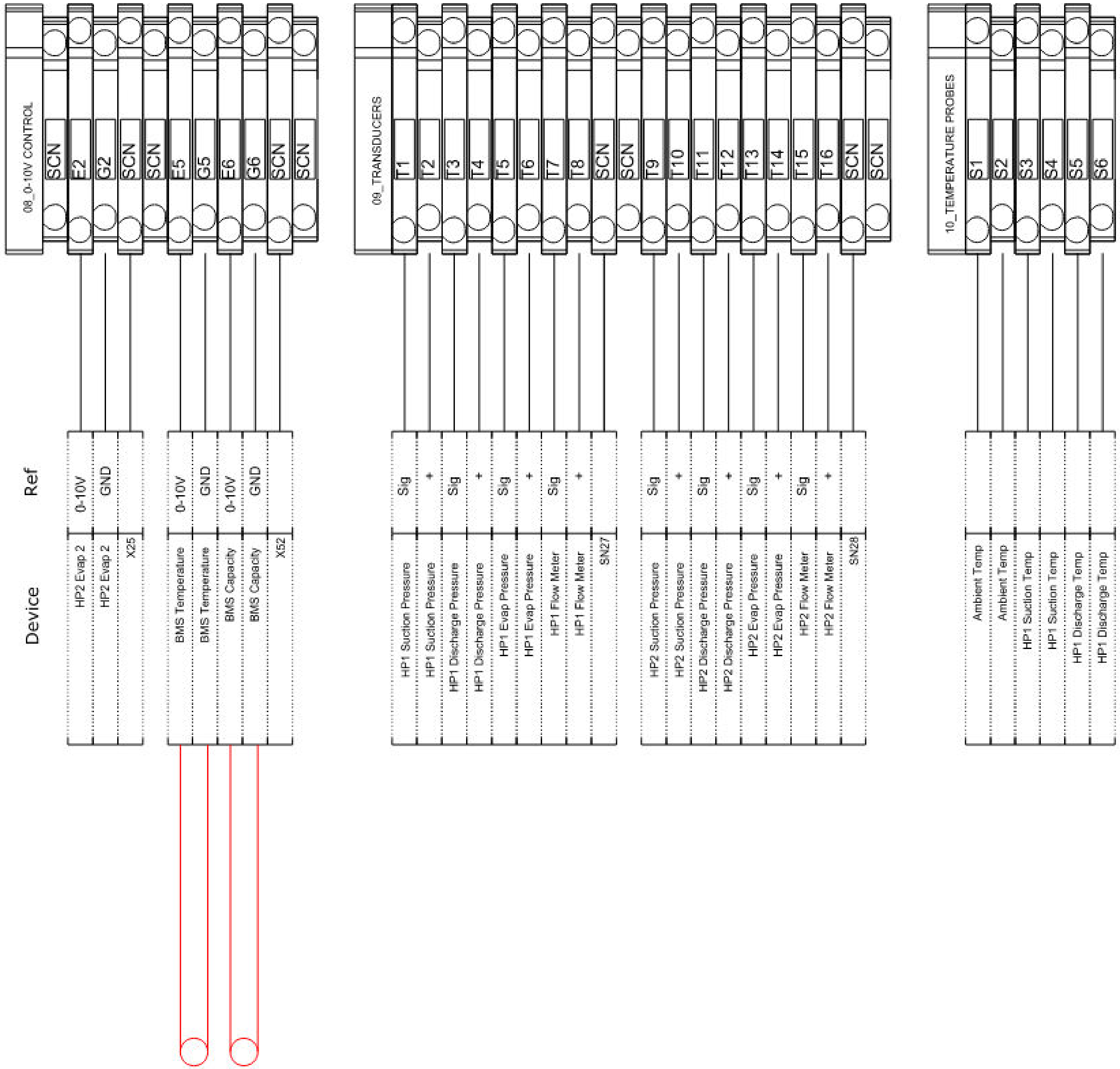
Terminal Layout

06_24V CONTROL



Terminal Layout

08_0-10V CONTROL



8.5 Local control

Selecting LOCAL control means the heat pump will control without any external control signals. This should be selected when there is no BMS 0-10V capacity control input or Master Controller input. Selecting this control type means the unit will operate on return temperature control.

The delivered heating capacity is adjusted by the return temperature which is set to 30°C for optimum efficiency. Should the return temperature rise above this, the heat pump will reduce its heat output and in turn reduce the flow rate of the pump whilst maintaining flow temperature. A reduction in return water temperature will see increase the heating capacity of the heat pump and thus increase flow to maintain a constant flow temperature.

NOTE: Should the return water temperature go above 40°C, this will initiate a high return water fault and cause the heat pump to eventually shut off.

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