



Amicus Altus HT

High temperature air source heat pump

Installation planning guide.



| | Document Control | | | |
|---------------------------------------------|-------------------------|----------------|-------------|--------------------|
| Article | Language | Version | Date | Modified by |
| Amicus Altus HT Installation planning guide | English | V1 | July 23 | S Addis |

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Introduction

This document includes all the basic information required for the Design team and whilst it provides detailed information it should be read in conjunction with the appliance installation manual available at www.lochinvar.ltd.uk.

Installers, this document is not intended to be an install manual before installing any Altius heat pump please read and understand the installation manual supplied with the unit.

The Lochinvar Amicus Altus High temperature air source heat pump range has been designed to provide heating and DHW at temperatures up to 70°C and can work in external air temperatures as low as -20°C. Altus uses R290 refrigerant which has a ODP of zero and a GWP of only 3 making it a future proof solution to heating and cooling projects. Altus is available as a cascade of up to ten units providing between 66.6kW and 666kW based on a 65°C flow and an outside air temperature of zero. Altus can provide heating and domestic hot water or cooling and domestic hot water, if simultaneous heating/cooling and domestic hot water is required a four-pipe version is available.



R290 (PROPANE) is flammable and as such special precautions should be made when handling and in the positioning of the unit(s). The unit(s) must be installed according to EN378 parts 3 and 4. The amount of gas used in each unit is extremely low at only 6.5kG which means any risk is very low.

Standard features

Each heat pump has the following standard features:

Leak detection system this constantly monitors the refrigerant circuit within the cabinet for leaks, should gas be detected the unit will shut down and the fans will be used to remove any gas away from the ground to dissipate harmlessly in the air. An alarm will also be activated.

Scroll compressors are specially designed to operate with R290, are Scroll type with orbiting spirals, optimized for heat pump operating mode and high compression ratios. They are installed in tandem configuration, mounted on rubber dampers, and equipped with direct-start engines cooled by the suctioned refrigerant gas. They are also fitted with built-in thermistor protection with manual reset, which safeguards them from overloads. The crankcase oil sump, PAG type, is equipped with a heating resistor. The compressors terminal block has an IP54 protection rating. Activation and deactivation of the compressors are controlled by the on-board microprocessor, which regulates the thermo-cooling power delivered.

Source heat exchanger made from micro finned copper with low air resistance to allow slower rotating fans and thus reduce noise.

EC Direct drive fans.

User heat exchanger made from 316 stainless steel with flow switch.

Cooling circuit includes a 4-way cycle reversing valve, liquid receiver, liquid/gas separator, and electronic thermostatic expansion valves operating in parallel (to allow the unit to work constantly along the entire working range). It also includes a liquid passage and humidity indicator, filter drier, safety valve, high-pressure switches with manual and automatic reset, service valve for the addition of the refrigerant and anti-freeze probe.

Water circuit on both user-side exchangers, the hydraulic circuit consists of a 2-pole centrifugal electric pump that allows water to circulate through the corresponding exchanger. On both hydraulic circuits, a check valve prevents recirculation of the processed fluid when the pump is off, and the unit is combined with others running on the same water circuit. The hydraulic circuit pipes inside the unit and the Victaulic joints are factory-insulated with thermal insulation material of high thickness.

Antifreeze kit which prevents internal pipework from freezing whilst the unit is non-operational.

Control panel is designed in accordance with EN 61439-1 and EN 60204-1 standards. It contains all the control system components, those required for starting the units, and the magneto thermal protection of the electric motors, which are connected and tested at the factory. The electrical board has a watertight structure, equipped with IP65/66 cable glands. Inside the electrical board, there are also installed all the power and control components. It includes the microprocessor electronic card with keyboard and display for the visualization of the various functions, main disconnecting switch with the door lock, insulation transformer for auxiliary circuit supply, magneto thermic protection for compressors and fans, fuses for auxiliary circuit devices, terminals for cumulative alarms and remote ON/OFF. It also comprises a terminal block for spring-type control circuits and the possibility of enabling communication with the BMS management systems. Additionally, there is also a phase monitor that controls the correct sequence and/or any failure of one of the three power phases, interrupting the unit's operation if necessary.

Standard ancillaries

Each Altus heat pump is supplied with the following standard ancillaries:

- Refrigerant leak detection
- Primary pump
- Double safety valves
- Pressure gauges
- Antifreeze kit
- RS485 BMS serial interface card
- Anti-vibration dampers
- Pipework header kit
- Crane lifting hooks
- Forklift truck lifting points
- Cascade control (from models LAHP-130HTR290 and above)

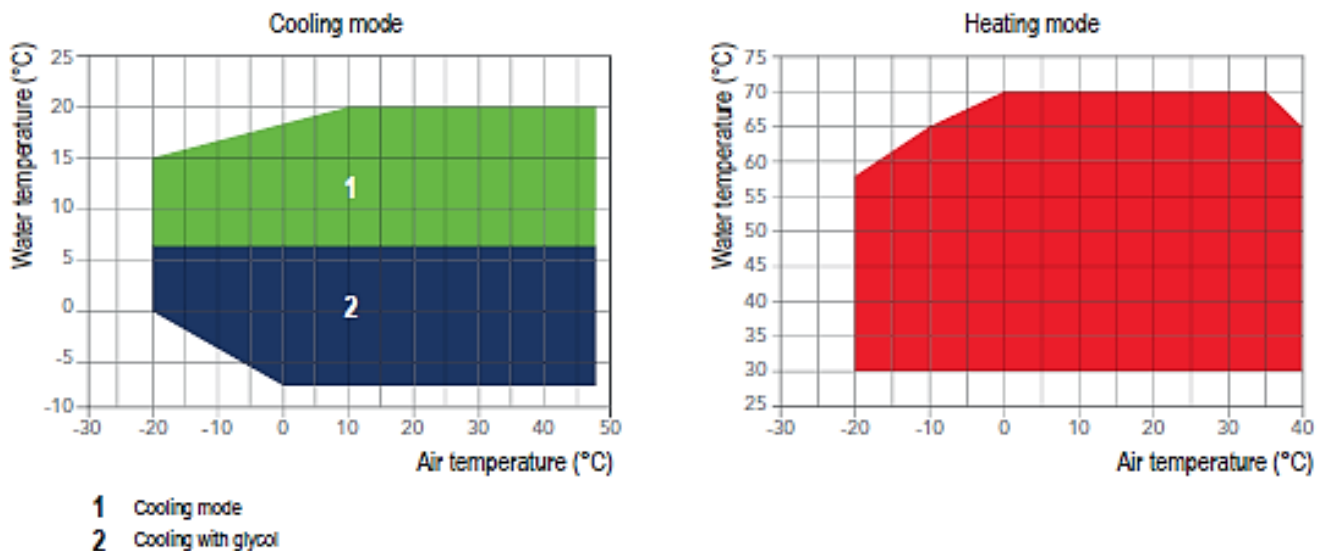
Optional Ancillaries

The following optional ancillaries are also available:

- Cascade control with remote connect
- Remote display
- Extra soundproofing on compressors
- Coastal protection
- Matched Thermal stores
- Matched domestic hot water plates
- Domestic hot water storage vessels

Operational limits

Amicus high temperature heat pumps can provide heating, cooling and/or domestic hot water at temperatures up to 70°C, and can operate in external temperatures down to as low as -20°C. The diagram below shows the general working limits for both heating and cooling mode.



Drawing 1 Operational limits

Table 1 Performance

| Water Delivery Temperature | | Heating OUT | | | | | | | | |
|----------------------------|------------------|------------------|------|------|------|------|------|------|------|------|
| | | 35C | 40C | 45C | 50C | 55C | 60C | 65C | 70C | |
| PERFORMANCE DATA | -10 | Heat Output (KW) | 51.4 | 50.6 | 49.6 | 48.7 | 48 | 47.2 | 46.5 | N/A |
| | | Efficiency COP | 2.3 | 2.2 | 2 | 1.9 | 1.8 | 1.7 | 1.5 | N/A |
| | -5 | Heat Output (KW) | 62.7 | 61.8 | 60.7 | 59.7 | 58.6 | 57.7 | 56.8 | N/A |
| | | Efficiency COP | 2.8 | 2.6 | 2.4 | 2.2 | 2.1 | 1.9 | 1.8 | N/A |
| | -4 | Heat Output (KW) | 64.7 | 63.9 | 62.9 | 61.7 | 60.6 | 59.6 | 58.7 | N/A |
| | | Efficiency COP | 2.9 | 2.7 | 2.5 | 2.3 | 2.1 | 2 | 1.9 | N/A |
| | -3 | Heat Output (KW) | 67 | 66.6 | 65 | 63.7 | 62.7 | 61.3 | 60.5 | N/A |
| | | Efficiency COP | 2.9 | 2.8 | 2.5 | 2.4 | 2.2 | 2 | 1.9 | N/A |
| | -2 | Heat Output (KW) | 69.4 | 68.3 | 67.3 | 65.9 | 64.8 | 63.5 | 62.5 | N/A |
| | | Efficiency COP | 3 | 2.8 | 2.6 | 2.4 | 2.3 | 2.1 | 1.9 | N/A |
| | -1 | Heat Output (KW) | 71.7 | 70.6 | 69.5 | 68.1 | 66.9 | 65.6 | 64.6 | N/A |
| | | Efficiency COP | 3.1 | 2.9 | 2.7 | 2.5 | 2.3 | 2.1 | 2 | N/A |
| | 0 | Heat Output (KW) | 74.5 | 73 | 71.8 | 70.3 | 69 | 67.8 | 66.6 | 65.5 |
| | | Efficiency COP | 3.2 | 3 | 2.7 | 2.6 | 2.4 | 2.2 | 2 | 1.89 |
| | 1 | Heat Output (KW) | 76.6 | 75.2 | 73.8 | 72.5 | 71 | 69.8 | 68.4 | 67.4 |
| | | Efficiency COP | 3.3 | 3.1 | 2.8 | 2.7 | 2.5 | 2.3 | 2.1 | 1.94 |
| | 2 | Heat Output (KW) | 78.9 | 77.4 | 76 | 74.6 | 73 | 71.6 | 70.1 | 68.9 |
| | | Efficiency COP | 3.4 | 3.2 | 3 | 2.7 | 2.5 | 2.4 | 2.2 | 1.99 |
| | 3 | Heat Output (KW) | 81.1 | 79.6 | 77.9 | 76.3 | 74.6 | 73 | 71.7 | 70.3 |
| | | Efficiency COP | 3.6 | 3.3 | 3 | 2.8 | 2.6 | 2.4 | 2.2 | 2.03 |
| | 4 | Heat Output (KW) | 82.8 | 81.3 | 79.8 | 77.9 | 76.3 | 74.7 | 73.2 | 71.9 |
| | | Efficiency COP | 3.7 | 3.4 | 3.1 | 2.9 | 2.7 | 2.5 | 2.3 | 2.08 |
| | 5 | Heat Output (KW) | 84.7 | 83.2 | 81.6 | 79.8 | 77.9 | 76.5 | 74.9 | 73.6 |
| | | Efficiency COP | 3.8 | 3.5 | 3.2 | 3 | 2.7 | 2.5 | 2.3 | 2.13 |
| | 6 | Heat Output (KW) | 86.6 | 85.4 | 83.7 | 81.9 | 79.9 | 78.2 | 76.5 | 75.1 |
| | | Efficiency COP | 3.9 | 3.6 | 3.3 | 3.1 | 2.8 | 2.6 | 2.4 | 2.17 |
| | 7 | Heat Output (KW) | 88.9 | 87.2 | 85.5 | 83.6 | 81.6 | 79.9 | 78.1 | 76.6 |
| | | Efficiency COP | 4 | 3.7 | 3.4 | 3.1 | 2.9 | 2.6 | 2.4 | 2.21 |
| | 20 | Heat Output (KW) | 115 | 112 | 110 | 107 | 104 | 101 | 98.6 | 96.2 |
| | | Efficiency COP | 5.1 | 4.6 | 4.3 | 3.9 | 3.5 | 3.2 | 2.9 | 2.63 |
| 21 | Heat Output (KW) | 117 | 114 | 111 | 108 | 105 | 103 | 99.9 | 97.3 | |
| | Efficiency COP | 5.2 | 4.7 | 4.3 | 3.9 | 3.5 | 3.2 | 2.9 | 2.65 | |
| 22 | Heat Output (KW) | 118 | 116 | 113 | 110 | 107 | 104 | 101 | 98.4 | |
| | Efficiency COP | 5.2 | 4.8 | 4.3 | 3.9 | 3.6 | 3.3 | 2.9 | 2.67 | |
| 23 | Heat Output (KW) | 120 | 117 | 114 | 111 | 108 | 105 | 102 | 99.6 | |
| | Efficiency COP | 5.3 | 4.8 | 4.4 | 4 | 3.6 | 3.3 | 3 | 2.69 | |
| 24 | Heat Output (KW) | 121 | 118 | 115 | 112 | 109 | 106 | 103 | 100 | |
| | Efficiency COP | 5.3 | 4.8 | 4.4 | 4 | 3.6 | 3.3 | 3 | 2.7 | |
| 25 | Heat Output (KW) | 123 | 120 | 117 | 113 | 110 | 107 | 104 | 101 | |
| | Efficiency COP | 5.4 | 4.9 | 4.5 | 4 | 3.7 | 3.3 | 3 | 2.71 | |

A full performance table showing performance from -20 to +30°C is available on request from Lochinvar.

Sizing

When sizing the air source heat pump careful consideration needs to be taken of design outside air temperatures as the output from the heat pump will be much lower at -5°C than shown in the standard rated conditions. Lochinvar can help with sizing your project, contact your local area sales manager <https://lochinvar.ltd.uk/contact/sales-team>

Table 1 gives performance figures at popular design parameters; a full version is available from -20°C to +30°C if required.

Sizing Example:

Example 1

Heat pumps will be serving a domestic hot water system sized at 230kW at zero external air. Flow/return temperatures required are 65°C/60°C.

Using table 1, the output of the Altus unit at zero external air and 65°C flow is 66.6kW. so, $230/66.6 = 3.5$ so four units will be required. Using table 2 we can find the appropriate model number.

Model LAHP-260HTR290.

Example 2

Heat pumps will be serving two heating circuits supplying low temperature radiators working at 55/50 each with a calculated design heat loss at -5° external air of 45kW each, they will also be supplying a domestic hot water circuit requiring 1000litres in a peak hour at 60°C. Heating and domestic hot water will share a single thermal store which must be kept at 65C to serve the domestic hot water load.

Calculated total heat load at -5° is 90kW at 55/50

Calculated domestic hot water load is $1000 * 4.186 * 50 / 3600 = 58\text{kW}$ at 65/60

Total required output at 65C and -5 outside air is 148kW, at these conditions a single Altus unit will supply 56.8kW so $148/56.8 = 2.55$ so three units will be required.

Model LAHP-195HTR290.

However, if the system was installed with domestic hot water priority this would reduce the number of units required to only two, it would also make the system more efficient as the thermal store serving the heating circuits could be kept at 55C.

Model LAHP-130HTR290.

Technical details

Table 2 Technical data table 2 pipe unit

| Heating Data | | LAHP-65HTR290 |
|-------------------------------------------|---------------|---------------|
| Heating Capacity (EN14511) ¹ | kW | 88.9 |
| Total Power input (EN14511) ¹ | kW | 22.2 |
| COP (EN14511) ¹ | W/W | 4 |
| EcoDesign data ² | | |
| Energy Label Rating Low temperature | | A++ |
| SCOP Low Temperature | | 3.95 |
| Seasonal Efficiency Low temperature | % | 155 |
| Energy Label Rating High temperature | | A+ |
| SCOP Medium Temperature | | 3.32 |
| Seasonal Efficiency Medium temperature | % | 130 |
| Cooling Data | | |
| Cooling Capacity (EN14511) ³ | kW | 66.3 |
| Total Power input (EN14511) ³ | kW | 26.4 |
| EER (EN14511) ³ | W/W | 2.51 |
| General data | | |
| Refrigerant type | | R290 |
| Refrigerant charge | Kg | 6.5 |
| Compressor Type | | Scroll |
| Number of Compressors | | 2 |
| Number of Circuits | | 1 |
| Sound power level | dB(A) | 87 |
| Sound pressure level (10m) | dB(A) | 55 |
| Minimum water content in the user circuit | litre | 900 |
| Shipping weight | Kg | 835 |
| Electrical Data | | |
| Power supply | V/Ph/Hz | 415/3/50 |
| Maximum input power | kW | 44 |
| Maximum input current standard unit | A (per phase) | 79.2 |
| Peak input current standard unit | A (per phase) | 231 |

¹=external air+7C 30/35 flow

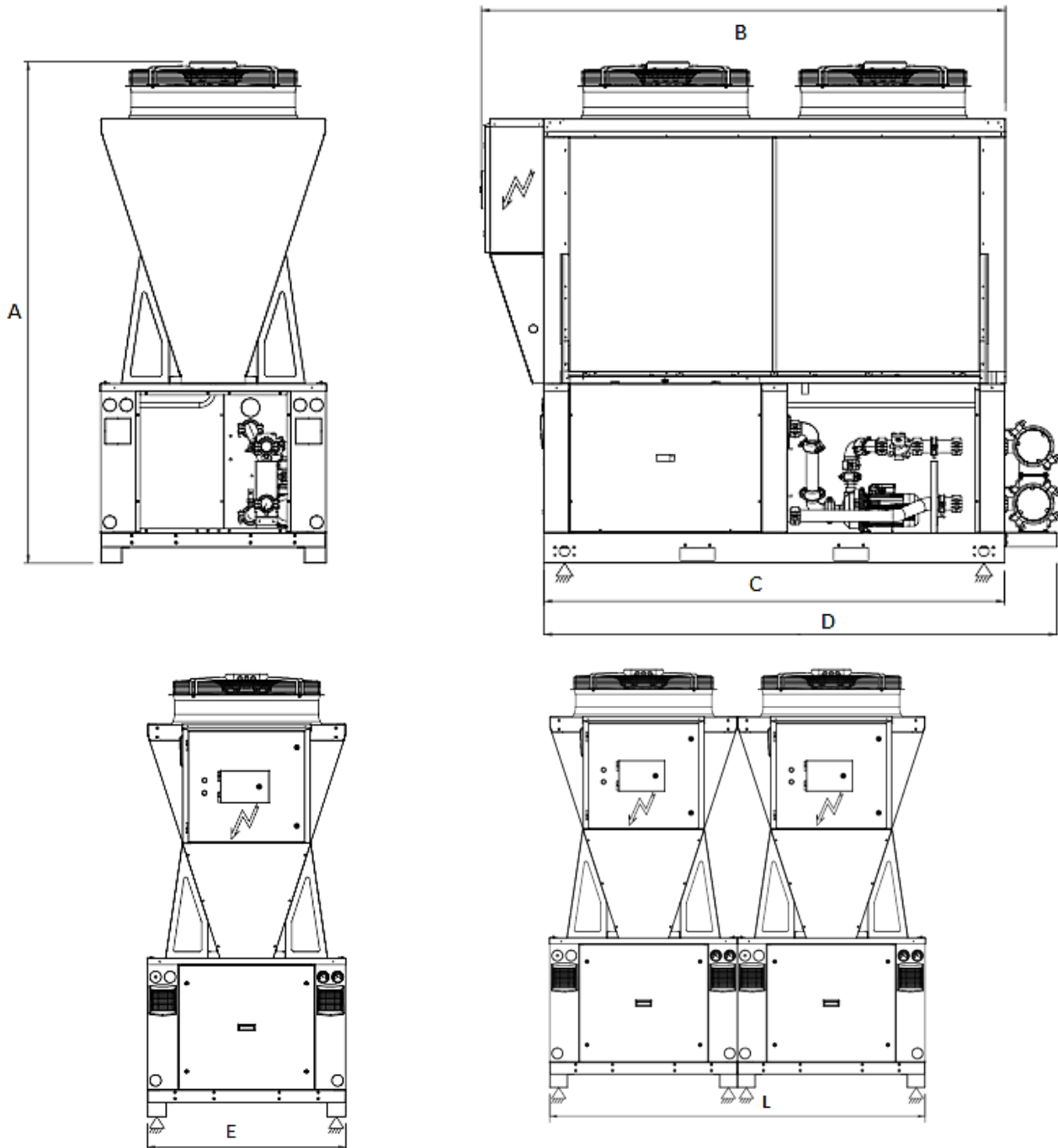
²=average conditions according to EU/811/2013

³=Cooling external air +35C 12/7 flow

Dimensions

Table 3 Dimensions 2 pipe unit

| Item | Description | Unit | 2 pipe unit |
|------|------------------------------------------|------|-------------------------------------|
| A | Height | mm | 2450 |
| B | Length including control box | mm | 2560 |
| C | Length of base | mm | 2250 |
| D | Length of base including pipework header | mm | 2515 |
| E | Width | mm | 1100 |
| L | Width of multiple units | mm | =E * number of units in the cascade |



Drawing 2 Dimensions

Model numbers

Amicus Altus will be supplied in a cascade of up to 10 heat pumps, cascade item numbers are shown in table 4 below.

Table 4 model range

| Model | Number in cascade |
|----------------|-------------------|
| LAHP-65HTR290 | 1 |
| LAHP-130HTR290 | 2 |
| LAHP-195HTR290 | 3 |
| LAHP-260HTR290 | 4 |
| LAHP-325HTR290 | 5 |
| LAHP-390HTR290 | 6 |
| LAHP-455HTR290 | 7 |
| LAHP-520HTR290 | 8 |
| LAHP-585HTR290 | 9 |
| LAHP-650HTR290 | 10 |

Each model includes:

- Amicus Altus very high temperature air source heat pump(S)
- Refrigerant gas R290
- Double safety valve
- Crane lifting hooks
- Forklift points
- Pressure gauges
- Anti-freeze kit
- RS458 interface card
- Anti-vibration dampers
- Pipework header kit
- Blanks for header kit
- And on models 130 and higher a cascade controller

Table 5 Technical data table 1-5 units in cascade

| Data | Unit | Model | | | | |
|-------------------------------------------|---------------|---------------|----------------|----------------|----------------|----------------|
| | | LAHP-65HTR290 | LAHP-130HTR290 | LAHP-195HTR290 | LAHP-260HTR290 | LAHP-325HTR290 |
| Cascade | | | | | | |
| Number of units in the cascade | | 1 | 2 | 3 | 4 | 5 |
| Minimum capacity step | % | 100 | 50 | 33 | 25 | 20 |
| Heating Data | | | | | | |
| Heating Capacity (EN14511) ¹ | kW | 88.9 | 177.8 | 266.7 | 355.6 | 444.5 |
| Total Power input (EN14511) ¹ | kW | 22.2 | 44.4 | 66.6 | 88.8 | 111 |
| COP (EN14511) ¹ | W/W | 4 | 4 | 4 | 4 | 4 |
| EcoDesign data ² | | | | | | |
| Energy Label Rating Low temperature | | A++ | A++ | A++ | A++ | A++ |
| SCOP Low Temperature | | 3.95 | 3.95 | 3.95 | 3.95 | 3.95 |
| Seasonal Efficiency Low temperature | % | 155 | 155 | 155 | 155 | 155 |
| Energy Label Rating High temperature | | A+ | A+ | A+ | A+ | A+ |
| SCOP High Temperature | | 3.32 | 3.32 | 3.32 | 3.32 | 3.32 |
| Seasonal Efficiency High temperature | % | 130 | 130 | 130 | 130 | 130 |
| Cooling Data | | | | | | |
| Cooling Capacity (EN14511) ³ | kW | 66.3 | 132.6 | 198.9 | 265.2 | 331.5 |
| Total Power input (EN14511) ³ | kW | 26.4 | 52.8 | 79.2 | 105.6 | 132 |
| EER (EN14511) ³ | W/W | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 |
| General data | | | | | | |
| Refrigerant type | | R290 | R290 | R290 | R290 | R290 |
| Refrigerant charge (per unit) | Kg | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Compressor Type | | Scroll | Scroll | Scroll | Scroll | Scroll |
| Number of Compressors | | 2 | 4 | 6 | 8 | 10 |
| Number of Circuits | | 1 | 2 | 3 | 4 | 5 |
| Sound power level (per unit) | dB(A) | 87 | 87 | 87 | 87 | 87 |
| Sound pressure level (10m) (per unit) | dB(A) | 55 | 55 | 55 | 55 | 55 |
| Minimum water content in the user circuit | litre | 900 | 900 | 900 | 900 | 900 |
| Shipping weight | Kg | 835 | 1670 | 2505 | 3340 | 4175 |
| Electrical Data (per unit) | | | | | | |
| Power supply | V/Ph/Hz | 415/3/50 | 415/3/50 | 415/3/50 | 415/3/50 | 415/3/50 |
| Maximum input power | kW | 44 | 44 | 44 | 44 | 44 |
| Maximum input current standard unit | A (per phase) | 79.2 | 79.2 | 79.2 | 79.2 | 79.2 |
| Peak input current standard unit | A (per phase) | 231 | 231 | 231 | 231 | 231 |

1. =external air+7C 30/35 flow
2. =average conditions according to EU/811/2013
3. =Cooling external air +35C 12/7 flow



Note: Sound data and power supply data in table 4 above is for a single unit, this will be higher when the cascade consists of more than one unit.

The calculation for sound power of more than one unit is shown below table 6, page 18:

Table 6 Technical data table 6-10 units in cascade

| Data | Unit | Model | | | | |
|-------------------------------------------|---------------|----------------|----------------|----------------|----------------|----------------|
| | | LAHP-390HTR290 | LAHP-455HTR290 | LAHP-520HTR290 | LAHP-585HTR290 | LAHP-650HTR290 |
| Cascade | | | | | | |
| Number of units in the cascade | | 6 | 7 | 8 | 9 | 10 |
| Minimum capacity step | % | 17 | 14 | 13 | 11 | 10 |
| Heating Data | | | | | | |
| Heating Capacity (EN14511) ¹ | kW | 533.4 | 622.3 | 711.2 | 800.1 | 889 |
| Total Power input (EN14511) ¹ | kW | 133.2 | 155.4 | 177.6 | 199.8 | 222 |
| COP (EN14511) ¹ | W/W | 4 | 4 | 4 | 4 | 4 |
| EcoDesign data ² | | | | | | |
| Energy Label Rating Low temperature | | A++ | A++ | A++ | A++ | A++ |
| SCOP Low Temperature | | 3.95 | 3.95 | 3.95 | 3.95 | 3.95 |
| Seasonal Efficiency Low temperature | % | 155 | 155 | 155 | 155 | 155 |
| Energy Label Rating High temperature | | A+ | A+ | A+ | A+ | A+ |
| SCOP High Temperature | | 3.32 | 3.32 | 3.32 | 3.32 | 3.32 |
| Seasonal Efficiency High temperature | % | 130 | 130 | 130 | 130 | 130 |
| Cooling Data | | | | | | |
| Cooling Capacity (EN14511) ³ | kW | 397.8 | 464.1 | 530.4 | 596.7 | 663 |
| Total Power input (EN14511) ³ | kW | 158.4 | 184.8 | 211.2 | 237.6 | 264 |
| EER (EN14511) ³ | W/W | 2.51 | 2.51 | 2.51 | 2.51 | 2.51 |
| General data | | | | | | |
| Refrigerant type | | R290 | R290 | R290 | R290 | R290 |
| Refrigerant charge (per unit) | Kg | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 |
| Compressor Type | | Scroll | Scroll | Scroll | Scroll | Scroll |
| Number of Compressors | | 12 | 14 | 16 | 18 | 20 |
| Number of Circuits | | 6 | 7 | 8 | 9 | 10 |
| Sound power level (per unit) | dB(A) | 87 | 87 | 87 | 87 | 87 |
| Sound pressure level (10m) (per unit) | dB(A) | 55 | 55 | 55 | 55 | 55 |
| Minimum water content in the user circuit | litre | 900 | 900 | 900 | 900 | 900 |
| Shipping weight | Kg | 5010 | 5845 | 6680 | 7515 | 8350 |
| Electrical Data (per unit) | | | | | | |
| Power supply | V/Ph/Hz | 415/3/50 | 415/3/50 | 415/3/50 | 415/3/50 | 415/3/50 |
| Maximum input power | kW | 44 | 44 | 44 | 44 | 44 |
| Maximum input current standard unit | A (per phase) | 79.2 | 79.2 | 79.2 | 79.2 | 79.2 |
| Peak input current standard unit | A (per phase) | 231 | 231 | 231 | 231 | 231 |

1. =external air+7C 30/35 flow
2. =average conditions according to EU/811/2013
3. =Cooling external air +35C 12/7 flow



Note: Sound data and power supply data in table 4 above is for a single unit, this will be higher when the cascade consists of more than one unit.

The calculation for sound power of more than one unit is shown below table 6 page 18:

Position on site

The Amicus Altus air source heat pump should be sited in an area which:

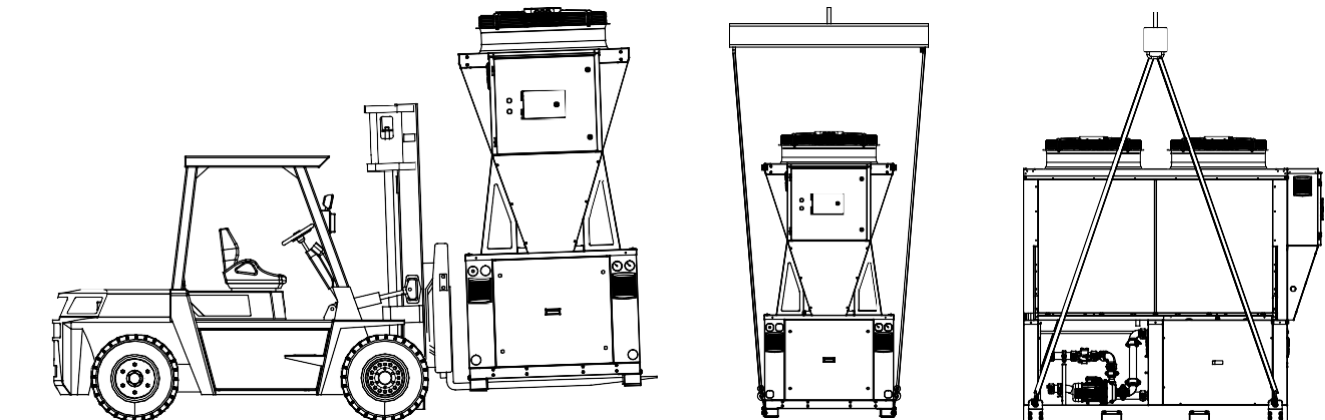
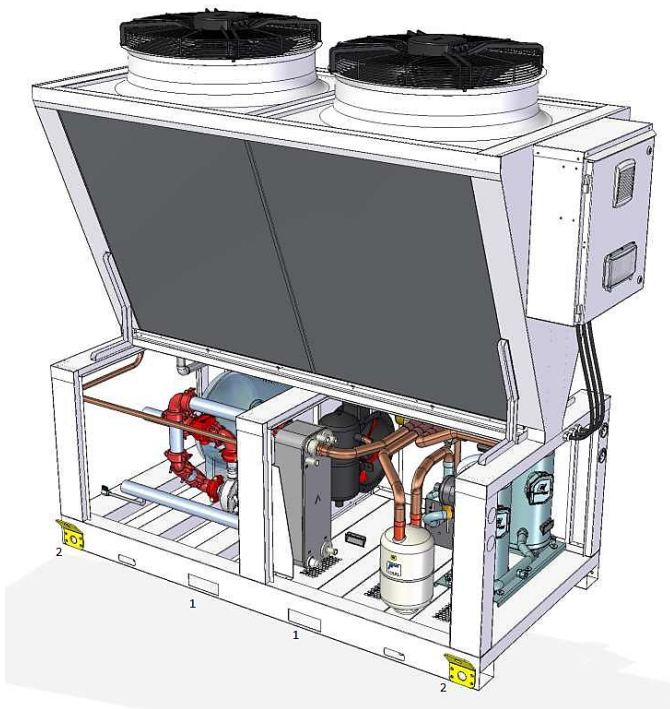
- Can bear the weight of the unit.
- Has enough space around the unit to allow the correct airflow across the source heat exchanger.
- Is not too windy.
- Does not present a noise nuisance to users of the building and neighbours.



The unit should be transported as close as possible to the location it is to be fitted with its packaging still on to prevent accidental damage to the frame or evaporators which are particularly vulnerable to impact damage.

Altus can be moved into position using either a suitable forklift truck or a crane, using the points provided in the unit.

1. Forklift lifting points.
2. Crane lifting points.



Drawing 3 lifting points

Tips for moving or lifting

Use a distributor beam if harness straps or ropes are used, making sure there is no pressure on the top edges of the unit or on the packaging.

When handling or lifting, the following must be performed:

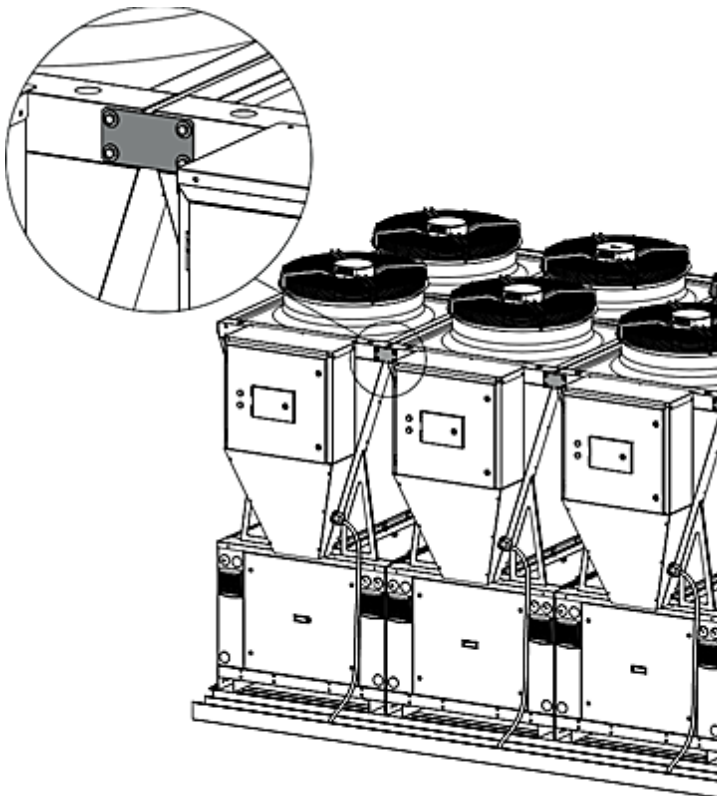
- Make sure that the vehicle being used has sufficient load capacity.
- Make sure that the forks cross the entire width of the unit.
- Provide any protection to avoid damaging the unit.
- Avoid abrupt or violent manoeuvres.
- Make sure all the panels are closed.
- Use a distributor beam in case of lifting by means of belts to avoid pressures on the carpentry of the unit.
- Use means and/or devices in accordance with the law.
- Keep the unit horizontal; the maximum inclination must not exceed 5°.
- Comply with the current regulations and standards.



Before any lifting or moving of the unit a thorough risk assessment must be carried out by a suitable qualified person.

The unit should be bolted down to the floor to prevent movement due to high winds for example and fitted with suitable antivibration feet which are supplied with every unit. This is especially important when installing the units on the roof of the building.

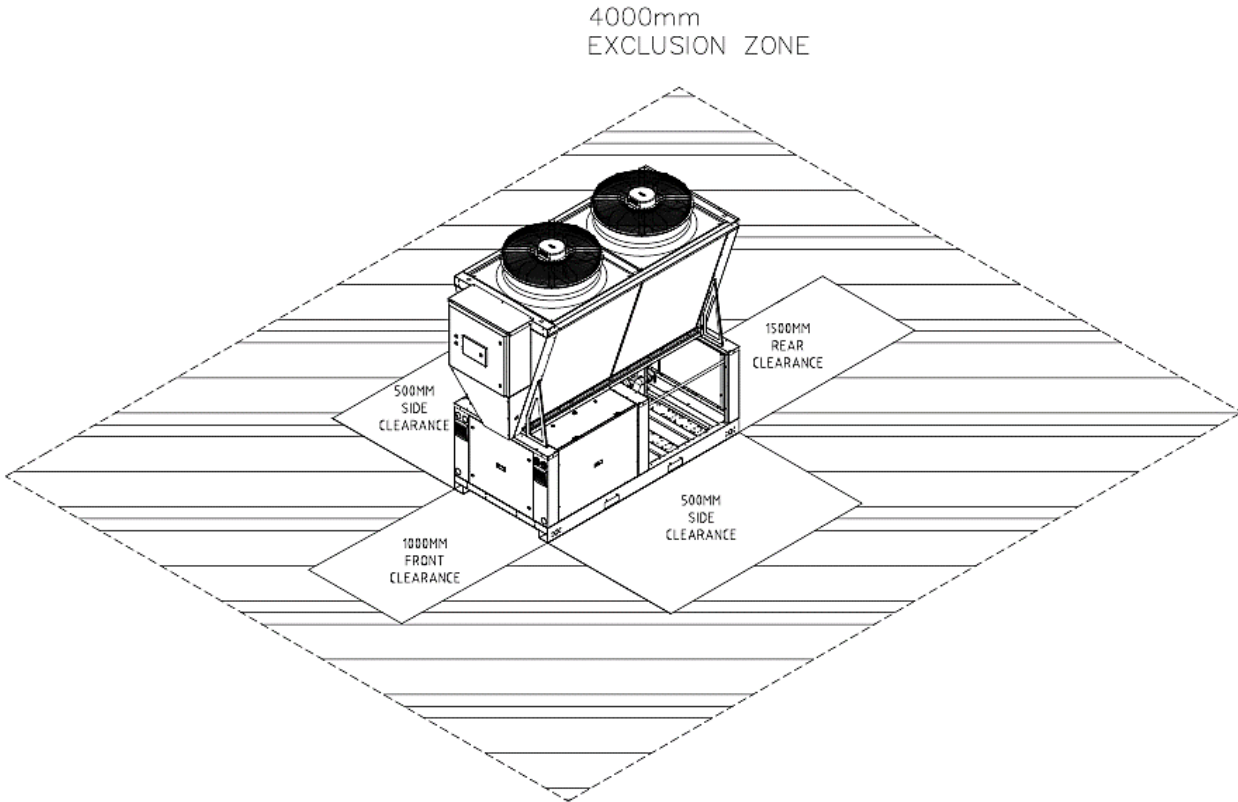
Each unit is supplied with a bracket to fasten more than one unit together, this should be fitted near the top of the as shown in drawing 4 below.



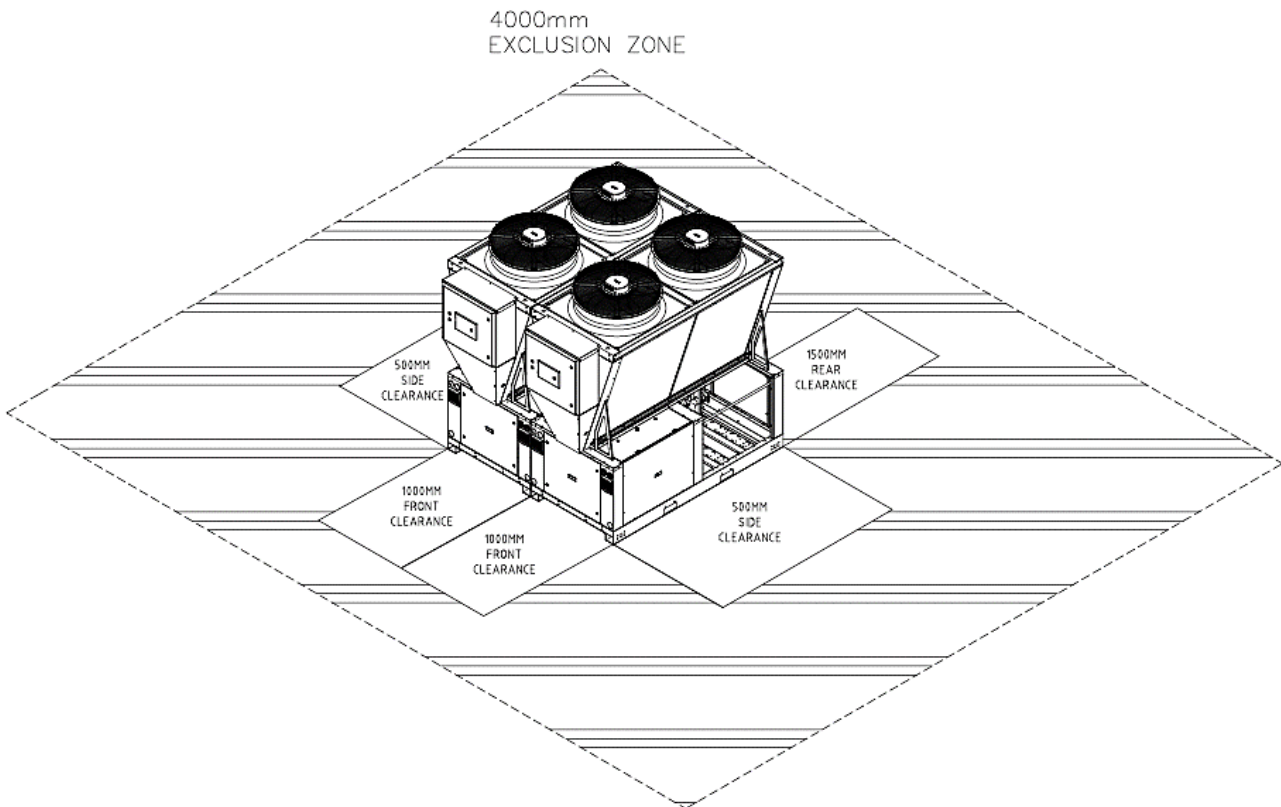
Drawing 4 top bracket position

Clearances

Amicus Altus air source heat pumps require minimum clearances around them to enable the fan which is fitted on top of the unit to draw sufficient air through the source heat exchanger (evaporator) which is fitted to both sides of the unit. Clearances also prevent exhaust air recirculation which can create operational problems for the units.



Drawing 5 clearances for a single unit



Drawing 6 clearances for multiple units

Security

If the units are to be installed in an area with open access a suitable hit and miss security fence should be erected around the units to prevent unauthorised access.

When using fencing or an acoustic shield sufficient clearances must be maintained to allow access to all the panels for service and maintenance work on all sides (these do not override the airflow clearances shown in drawings 3 and 4).

Exclusion zone

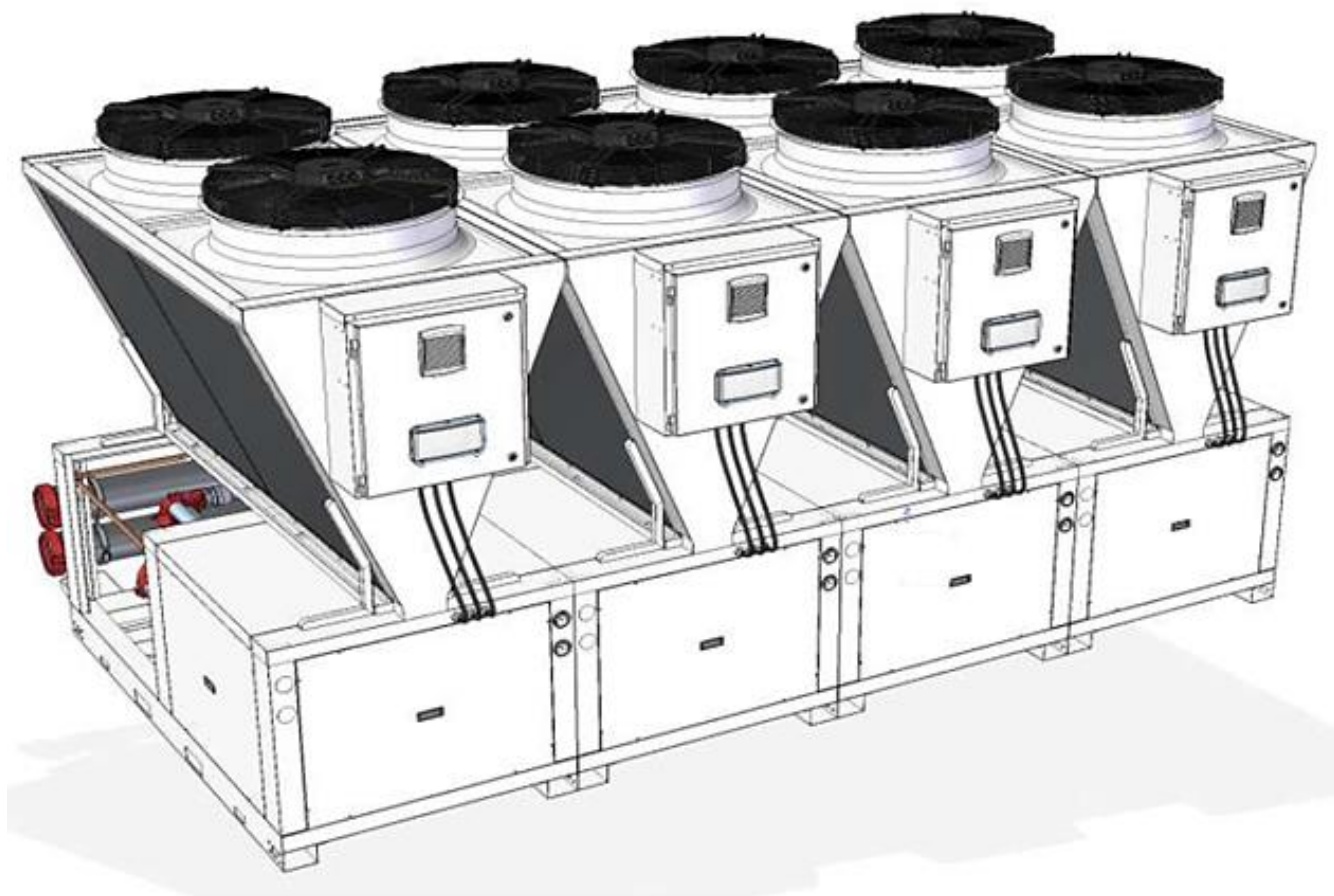
As shown in drawings 3 and 4 there should be a 4000mm exclusion zone around the heat pump(s), within this exclusion zone there should be no drains or wells where (in the unlikely event there is a refrigeration leak) it can enter the building or build up to a potentially hazardous level. Also, there should be no electrical switchgear other than that required for the heat pump operation.

Locations near the coast

If the heat pumps are to be located within one mile of the coast or tidal water, then the unit should be ordered with the source heat exchanger treated to ensure premature saltwater corrosion does not occur. Item number LH700597A.

Positioning multiple units

Amicus Altus can be installed in a cascade of up to ten modules, each module sits side by side with no additional clearances required between each unit. See drawing 6 and 7 for details.



Drawing 7 Units sited side by side

Sound power data

Table 6 Sound power levels for standard single unit

| octave bands (hz) | | | | | | | | Lw | Lp1 | Lp10 |
|-------------------|-----|-----|-----|----|----|----|----|------|------|------|
| 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | | | |
| db | db | db | db | db | db | db | db | db | db | db |
| 43 | 51 | 69 | 76 | 79 | 84 | 76 | 63 | 85.5 | 68.3 | 54.6 |

Lw: Sound power level according to ISO 9614

Table 6a Sound power levels for multiple units

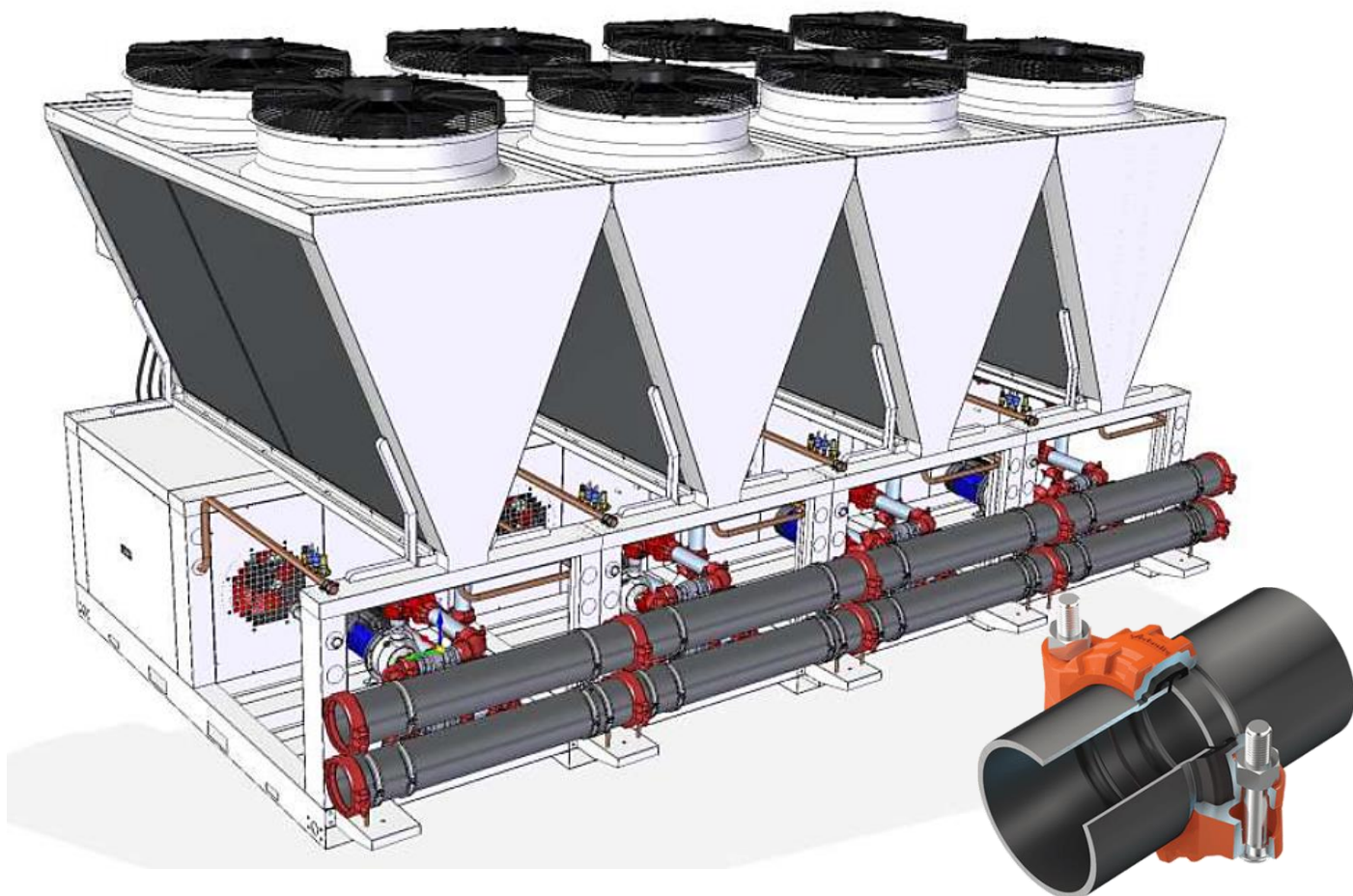
| Number of modules | Lw | Lp10 | Number of modules | Lw | Lp10 |
|-------------------|------|------|-------------------|------|------|
| | db | db | | db | db |
| 1 | 68.3 | 54.6 | 6 | 91.7 | 59.1 |
| 2 | 87.6 | 55.6 | 7 | 92.3 | 59.6 |
| 3 | 89.1 | 56.8 | 8 | 92.8 | 60 |
| 4 | 90.1 | 57.8 | 9 | 93.3 | 60.3 |
| 5 | 91 | 58.5 | 10 | 93.7 | 60.7 |

Pipework sizing and flow rates

Pipework should always be sized to match the flow rates below and maintaining a 5k delta T, this will result in larger pipework compared to a traditional 20k system design.

Altus is supplied with a built in single primary pump designed to supply the correct flow across the source heat exchanger, pipework within the unit also includes a non-return valve to prevent cross circulation in a non-working heat pump when part of a cascade.

Altus is also supplied with a primary pipework header to allow for easy installation, this can be taken either left or right as required. This pipework is 2" Victaulic.



Drawing 8 Pipework header kit to rear of cascade

Design flow rates should be calculated depending on the function of the system:

Table 7 Design flow rates

| System type | Unit | Design flow rate | Pump head | Heat pump Pd | System head available |
|--------------------------------|------------|------------------|-----------|--------------|-----------------------|
| Heating only | Litres/sec | 3 | 95kPa | 27.4 kPa | 67.6 kPa |
| Domestic hot water only | Litres/sec | 4.6 | 95kPa | 45.4 kPa | 40 kPa |
| Heating and Domestic hot water | Litres/sec | 4.6 | 95kPa | 45.4 kPa | 40 kPa |
| Cooling | Litres/sec | 3.2 | 95kPa | 21.8 kPa | 73.2 kPa |

Buffer vessel sizing

Amicus air source heat pumps require a certain amount of system volume to ensure problem free running and to reduce the number of starts and hence wear and tear on the compressor. In practise in most installations a buffer vessel will be required. The minimum system volume will:

1. Prevent the unit cycling during low demand.
2. Allow the unit to defrost without affecting the heat available to the system.

Minimum water content required.

The buffer vessel should be sized as follows:

$\text{kW output of the cascade} \times 20 \text{ litres} / \text{number of compressors in the cascade}$

Lochinvar will offer a suitably buffer vessel depending upon what the Amicus units are supplying but are generally sized according to the output of the unit at 2°C ambient. Multiple units supplied with cascade control will not require a substantially larger buffer due to the number of compressors in the cascade. However, the above is the minimum the unit requires to operate satisfactorily in practise a larger buffer may be required to iron out peaks in demand of the system. Each project should have the buffer sized according to site demands.

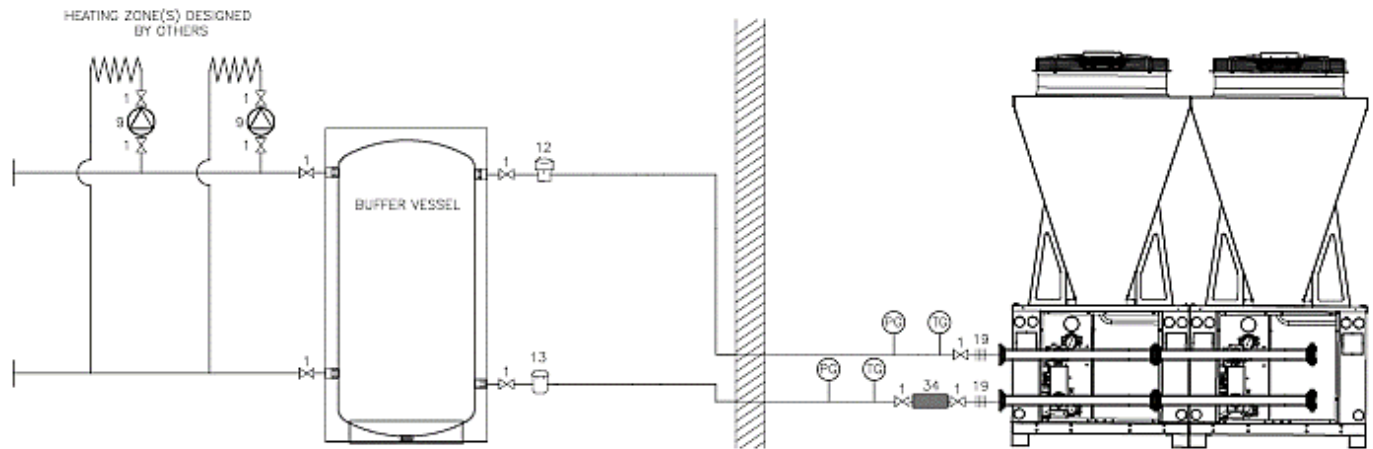
DHW Supply

Amicus Altus can supply low temperature hot water at up to 70°C for use in providing domestic hot water (DHW). Generally, DHW is provided by a specially designed Lochinvar plate and buffer arrangement which has been sized according to the required flow rate, delta T and only a 2k temperature drop between the primary and secondary side of the plate. (See drawing 10 and 11) The plate must be sized according to the kW rating during summer months to take advantage of the extra power available. For system requiring DHW to be stored above these temperatures or those requiring a higher temperature pasteurisation this will need the assistance of a boost immersion heater fitted to the DHW vessel.

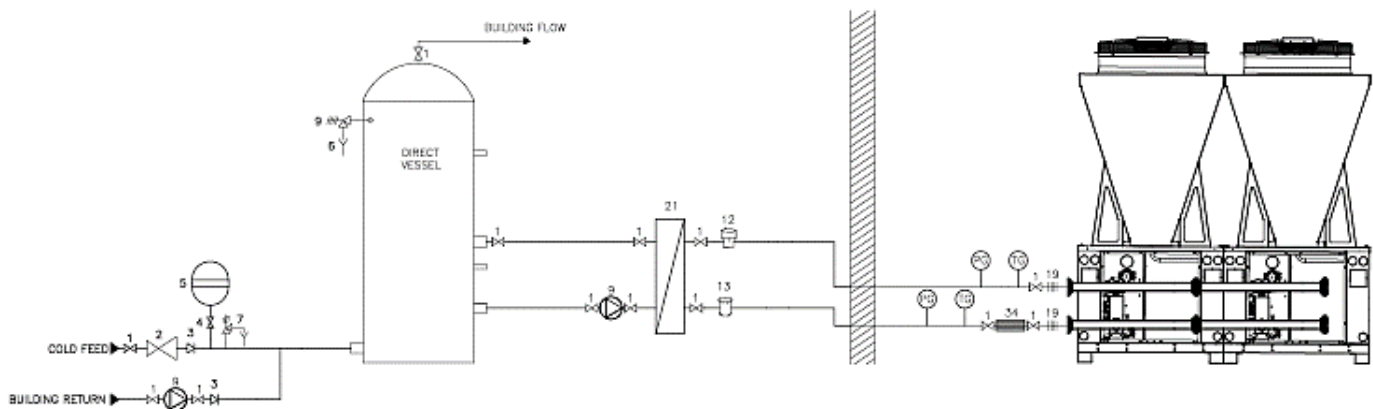
If the Amicus is supplying DHW only then the DHW storage vessel will also act as the buffer vessel. See drawing 10

Standard installation schematics

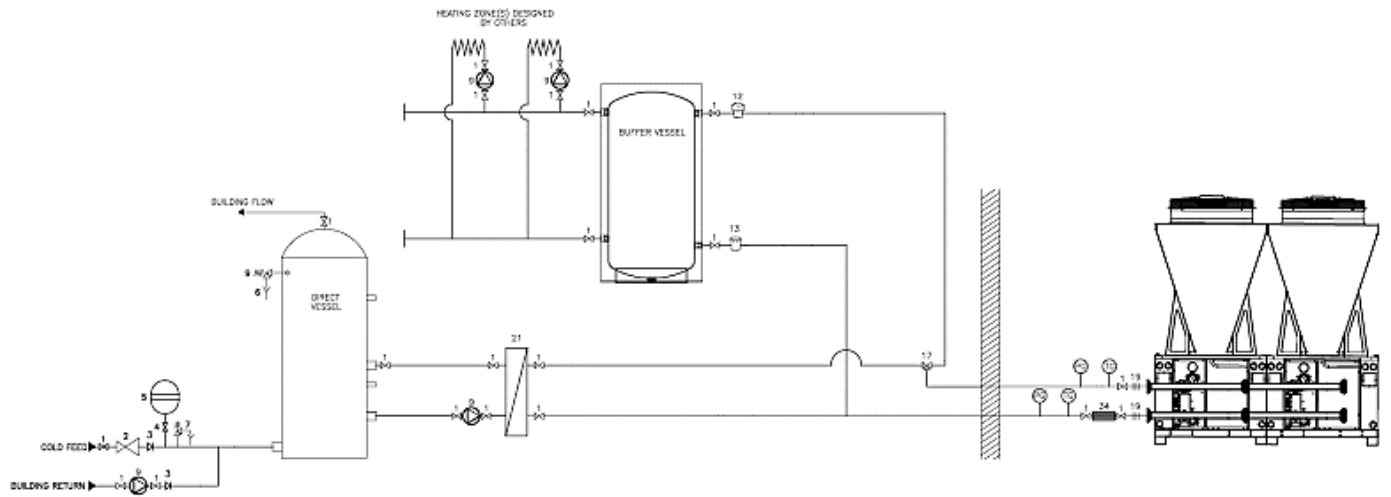
This section contains various standard schematics showing the concept installation options for the Amicus range. These drawings must not be used for detailed design but can be built upon by the design team to produce their own installations drawings.



Drawing 9 Altus supplying heating only

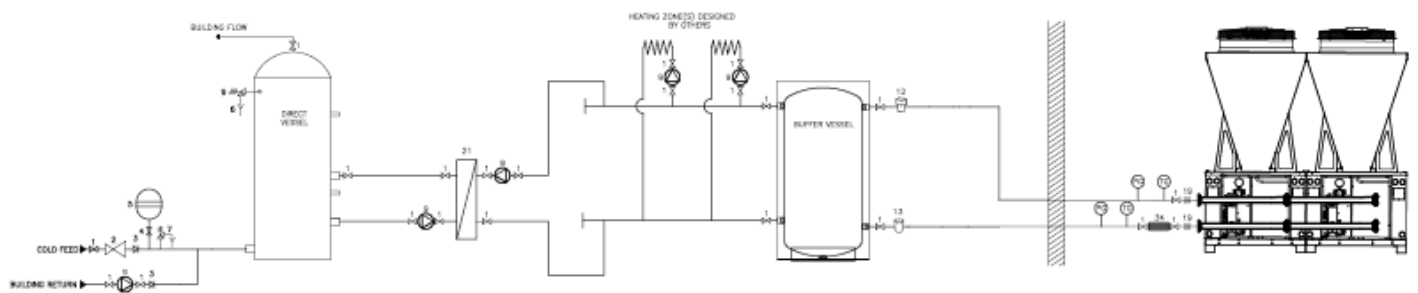


Drawing 10 Altus supplying domestic hot water only



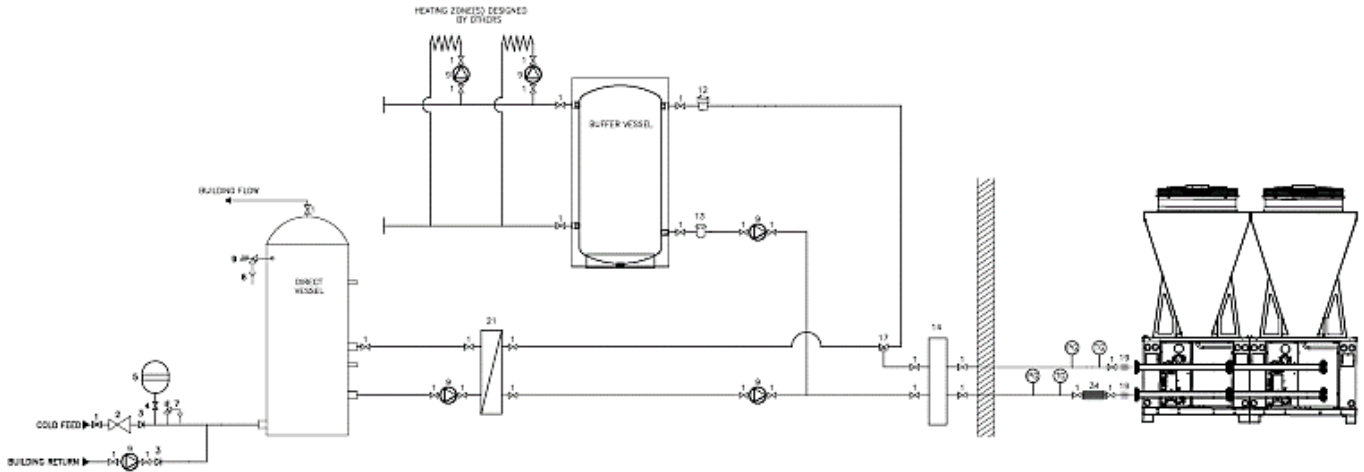
Drawing 11a Altus supplying heating and domestic hot water with hot water priority

This scheme should only be used with a maximum of two Altus heat pumps and where the heating circuit will not suffer from long periods where the domestic hot water has priority such as on underfloor heating or where a large heating buffer has been used.



Drawing 11b Altus supplying heating and domestic hot water

This scheme assumes both domestic hot water and heating will work simultaneously.



Drawing 12 Altus providing heating and domestic hot water with additional header

The built-in shunt pump has a large head available to supply heat direct to the buffer as shown in drawing 10, however if the pipework between the Altus cascade and buffer vessel is very long an additional header and pumps may be required as shown in drawing 12. See table 7 for details of pump head available.

Installation assistance

Included in the cost of every Amicus unit is the use of the Lochinvar Project Engineer and commissioning. This helps ensure the units are installed correctly and the end user has the assurance the unit has been commissioned by the manufacturer. After orders are placed a Project Engineer will contact the installer and offer:

1. Initial pre-start visit to ensure the installer has all the required information to install the units and has the Project Engineer contact details for telephone and email support during the construction phase.
 - a. This visit covers flow rates, Location of equipment, wiring/controls, integration with other equipment and any other questions the installers may have.
2. A second visit during installation to make sure everything is OK.
 - a. This visit will review the progress and check everything is going ok, answer any further questions relating to the install – at this stage it is also good to meet the controls/BMS team.
3. A pre-commissioning visit to ensure all installation work is complete prior to the Lochinvar commissioning engineer visit.
 - a. On this visit we will complete the pre-com sheet ensure all works are complete and plan in a commissioning date.
4. Commissioning visit

On completion of the commissioning the installer will receive a detailed report.

Electrical Connections

All models require a 3-phase supply with standard electrical requirements as per table 7

Table 8 electrical requirements.

| ELECTRICAL DATA | | |
|------------------------------|----------------|------------|
| Nominal voltage supply | P h / V / H z | 3/400/50.0 |
| Maximum voltage supply | V | 440 |
| Minimum voltage supply | V | 360 |
| Maximum input power | kW | 44.1 |
| Maximum input current | Amps per phase | 79.3 |
| Maximum peak current | Amps per phase | 231 |
| Input power in stand-by mode | kW | 0.100 |

| Number of units in the cascade | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------------------------|----|----|----|-----|-----|-------|-------|--------|--------|--------|--------|
| Line section | mm | 25 | 70 | 120 | 150 | 2x120 | 2x150 | 2x 150 | 2x 185 | 3x 150 | 3x 185 |
| PE section | mm | 16 | 50 | 70 | 95 | 2x 70 | 2x 95 | 2x 95 | 2x 120 | 2x 120 | 2x 150 |



Cable sizes are shown for general planning only, a qualified electrical engineer must check and size the cable required before work commences on site.

Each unit within the cascade must have its own dedicated power source and safety features.

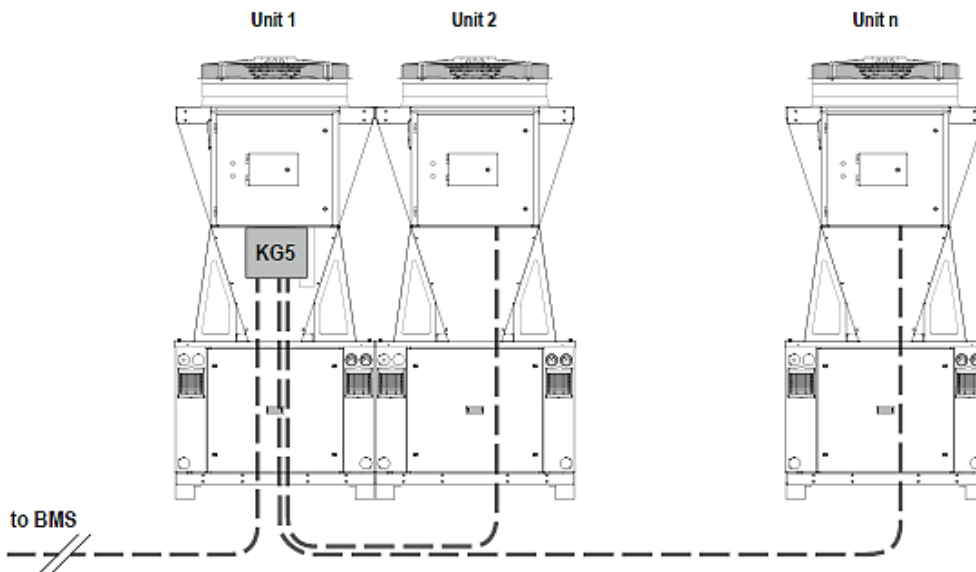
Provision should be made for local isolation with a lockable isolator fitted on or very close to the heat pump. If the heat pump is to be sited some way from the plantroom a single weatherproof 230v plug socket should also be fitted to aid commissioning and future maintenance of the unit.

Standard electrical connections available

Electrical ancillaries available

1. Cascade control, this will be supplied as standard on projects with more than one heat pump.

The cascade control wiring between each unit must be of good quality BELDON 8772 and not be run in the same trunking as the power supply wiring.



Drawing 9 Cascade wiring

It is advisable to install the Cascade controller kit on one of the two units outside the modular system. In this case, the removal of one of them from the system does not involve the rebuilding of the network cables of the other units present.

All power supply cables, and data cables must be physically divided from each other using separate cable trays to prevent disruption of the data between units and the cascade control.

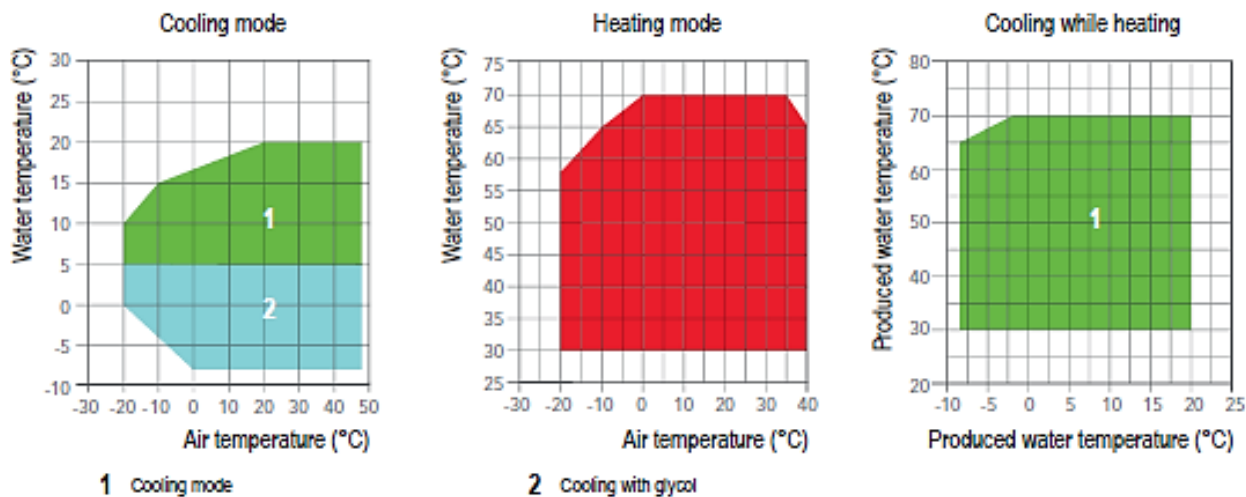
Cooling

Amicus Altus can be used for cooling also, the standard 2 pipe units can supply heating or cooling without any further adaptations.

Cooling data is available in technical data in table 2 for the 2-pipe unit and table 9 for the 4-pipe unit.

Four pipe units

Four pipe units are available which can produce heating and cooling simultaneously or cooling and domestic hot water using heat reclaim at a very high COP. Physical dimensions do not change.



Drawing 13 Operational limits four pipe units

Table 9 Technical data table 4 pipe unit

| Heating Data | | LAHP-65HTR2904P |
|-------------------------------------------|---------------|-----------------|
| Heating Capacity (EN14511) ¹ | kW | 86.8 |
| Total Power input (EN14511) ¹ | kW | 22.1 |
| COP (EN14511) ¹ | W/W | 3.93 |
| EcoDesign data ² | | |
| Energy Label Rating Low temperature | | A++ |
| SCOP Low Temperature | | 3.69 |
| Seasonal Efficiency Low temperature | % | 145 |
| Energy Label Rating High temperature | | A |
| SCOP Medium Temperature | | 3.15 |
| Seasonal Efficiency Medium temperature | % | 123 |
| Cooling Data | | |
| Cooling Capacity (EN14511) ³ | kW | 71.9 |
| Total Power input (EN14511) ³ | kW | 26.7 |
| EER (EN14511) ³ | W/W | 2.69 |
| Cooling with Heating | | |
| Cooling Capacity (EN14511) ³ | kW | 79.5 |
| Heating Capacity (EN14511) ¹ | kW | 101 |
| Total Power input (EN14511) | kW | 21.4 |
| TER | W/W | 8.4 |
| General data | | |
| Refrigerant type | | R290 |
| Refrigerant charge | Kg | 6.5 |
| Compressor Type | | Scroll |
| Number of Compressors | | 2 |
| Number of Circuits | | 1 |
| Sound power level | dB(A) | 87 |
| Sound pressure level (10m) | dB(A) | 55 |
| Minimum water content in the user circuit | litre | 900 |
| Shipping weight | Kg | 835 |
| Electrical Data | | |
| Power supply | V/Ph/Hz | 415/3/50 |
| Maximum input power | kW | 44 |
| Maximum input current standard unit | A (per phase) | 79.2 |
| Peak input current standard unit | A (per phase) | 231 |

¹=external air+7C 30/35 flow

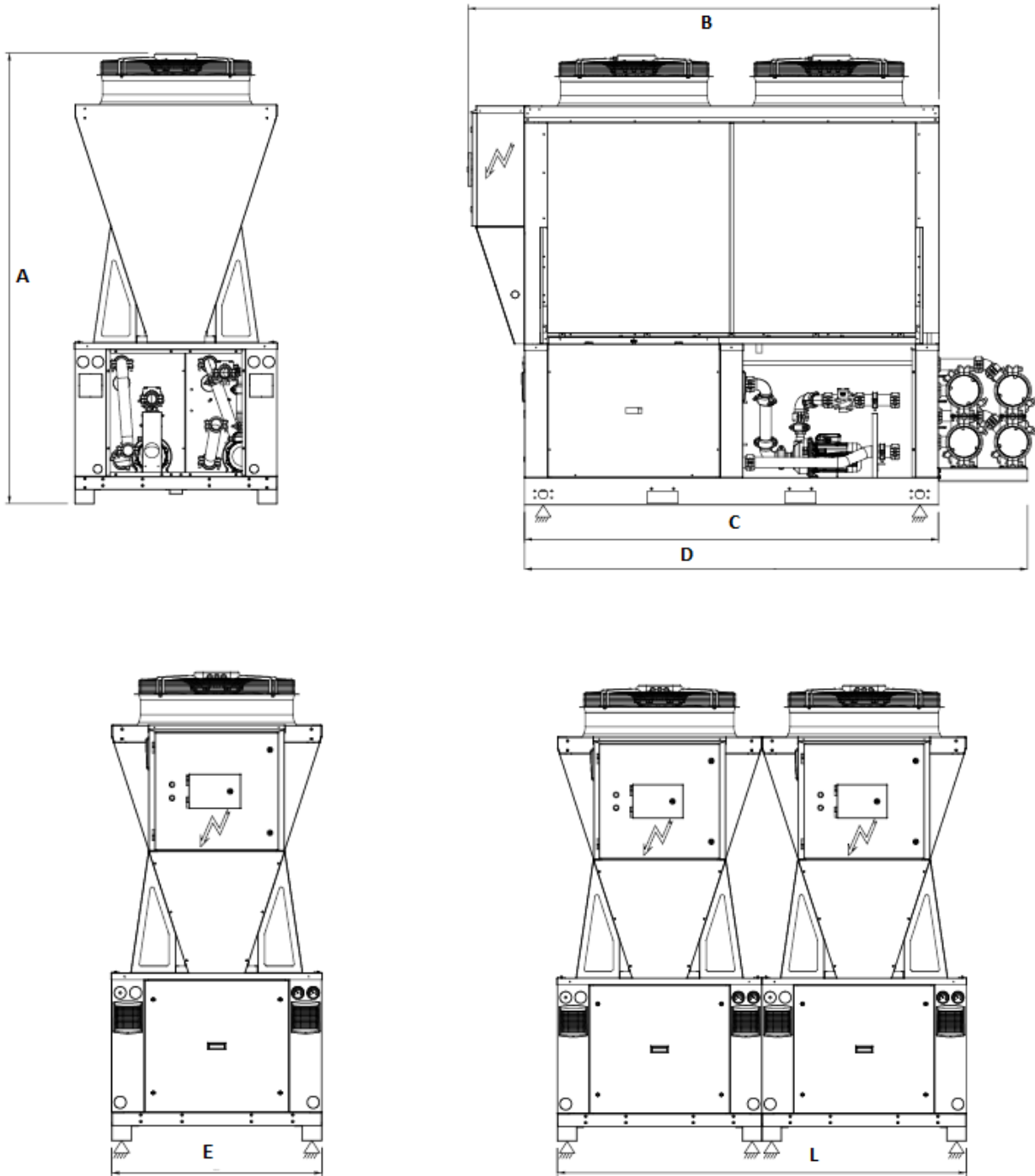
²=average conditions according to EU/811/2013

³=Cooling external air +35C 12/7 flow

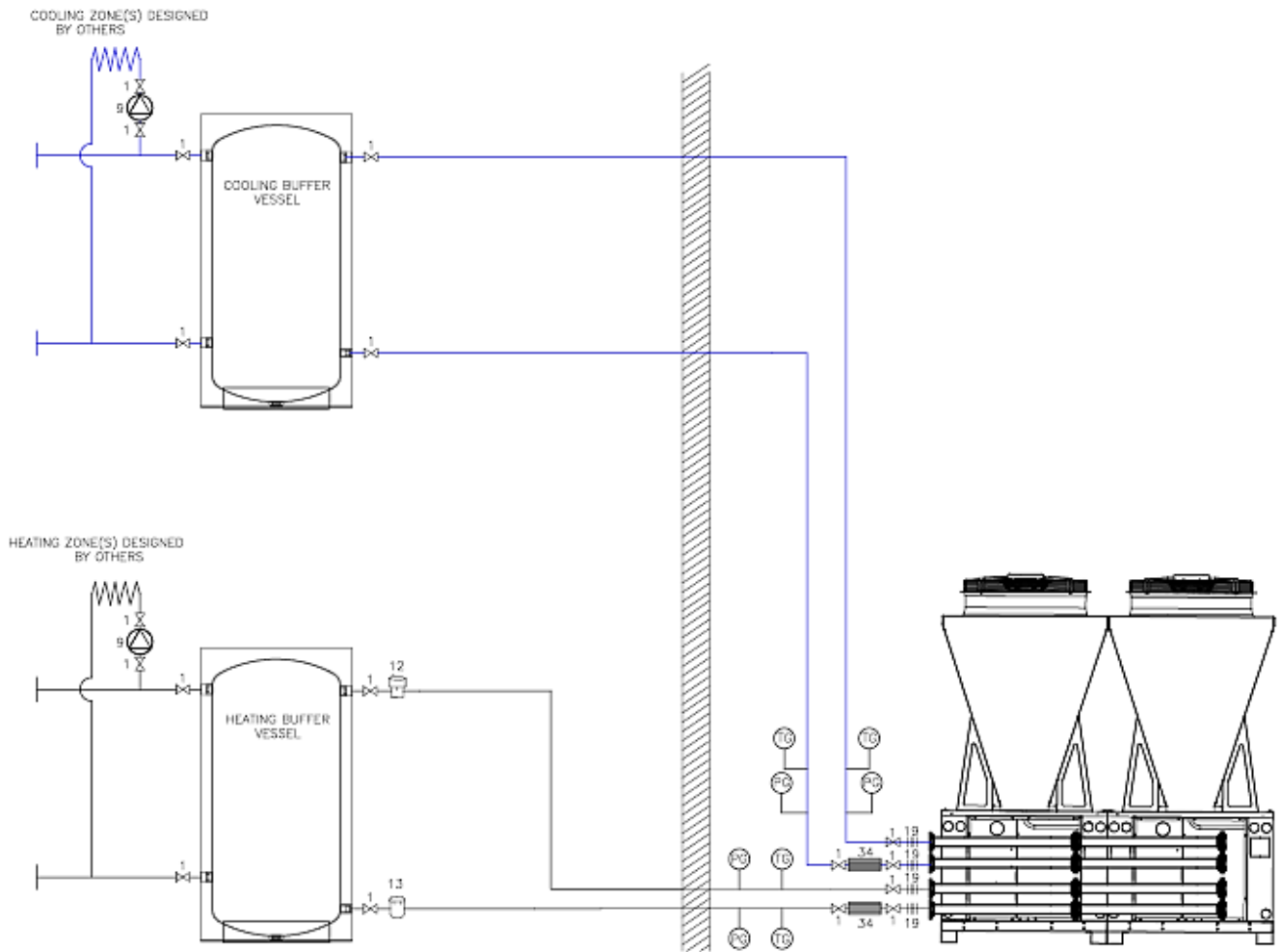
Dimensions 4 pipe units

Table 10 dimensions 4 pipe units

| Item | Description | Unit | 4 pipe unit |
|------|------------------------------------------|------|------------------------------------|
| A | Height | mm | 2450 |
| B | Length including control box | mm | 2560 |
| C | Length of base | mm | 2250 |
| D | Length of base including pipework header | mm | 2775 |
| E | Width | mm | 1100 |
| L | Width of multiple units | mm | =E* number of units in the cascade |



Standard install scheme 4 pipe units





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