



Amicus Altus HT

High temperature air source heat pump

Installation planning guide.



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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)

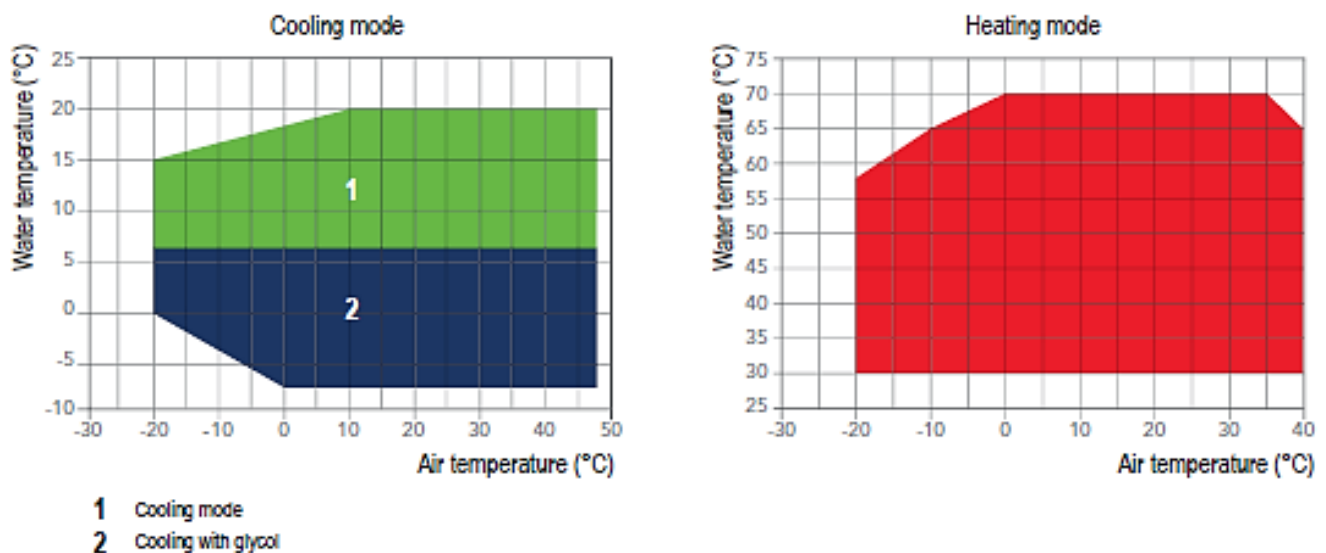
Optional Ancillaries

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.

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 35°C		A++
SCOP Low Temperature 35°C		3.95
Seasonal Efficiency Low temperature 35°C	%	155
Energy Label Rating Medium temperature 55°C		A+
SCOP Medium Temperature 55°C		3.32
Seasonal Efficiency Medium temperature 55°C	%	130
Energy Label Rating High temperature 65°C		A+
SCOP High Temperature 65°C		2.76
Seasonal Efficiency High temperature 65°C	%	106
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	79.2
Peak input current standard unit	A	231

¹=external air+7C 30/35 flow

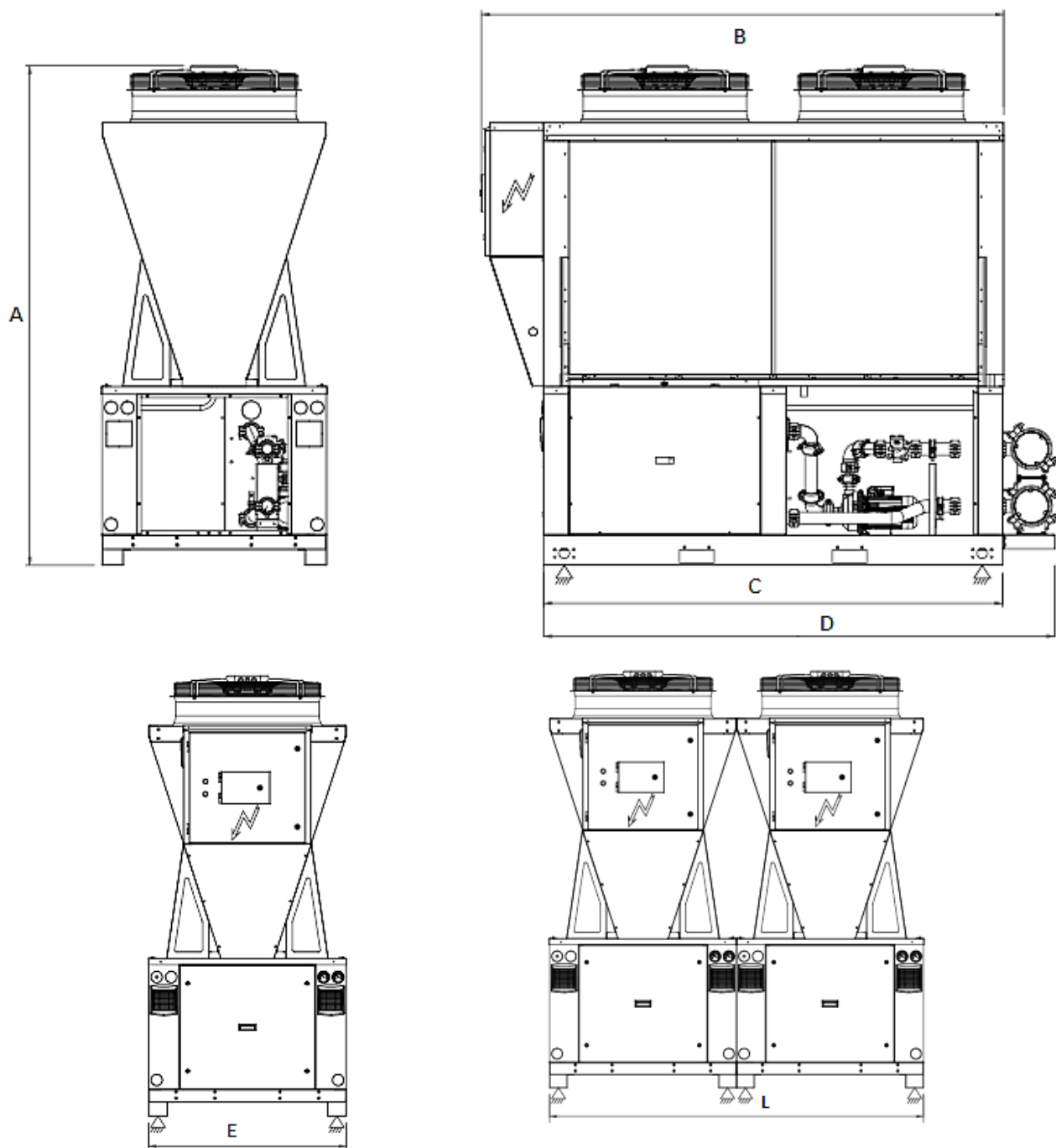
²=average conditions according to EU/811/2013

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 35°C		A++	A++	A++	A++	A++
SCOP Low Temperature 35°C		3.95	3.95	3.95	3.95	3.95
Seasonal Efficiency Low temperature 35°C	%	155	155	155	155	155
Energy Label Rating Medium temperature 55°C		A+	A+	A+	A+	A+
SCOP Medium Temperature 55°C		3.32	3.32	3.32	3.32	3.32
Seasonal Efficiency Medium temperature 55°C	%	130	130	130	130	130
Energy Label Rating High temperature 65°C		A+	A+	A+	A+	A+
SCOP High Temperature 65°C		2.76	2.76	2.76	2.76	2.76
Seasonal Efficiency High temperature 65°C	%	106	106	106	106	106
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	79.2	79.2	79.2	79.2	79.2
Peak input current standard unit	A	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 on tables 8 and 10, page 14:

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 35°C		A++	A++	A++	A++	A++
SCOP Low Temperature 35°C		3.95	3.95	3.95	3.95	3.95
Seasonal Efficiency Low temperature 35°C	%	155	155	155	155	155
Energy Label Rating Medium temperature 55°C		A+	A+	A+	A+	A+
SCOP Medium Temperature 55°C		3.32	3.32	3.32	3.32	3.32
Seasonal Efficiency Medium temperature 55°C	%	130	130	130	130	130
Energy Label Rating High temperature 65°C		A+	A+	A+	A+	A+
SCOP High Temperature 65°C		2.76	2.76	2.76	2.76	2.76
Seasonal Efficiency High temperature 65°C	%	106	106	106	106	106
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	79.2	79.2	79.2	79.2	79.2
Peak input current standard unit	A	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 on tables 8 and 10 on page 14:

Sound power data.

Table 7 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

Table 8 Sound power levels for multiple units in cascade

Number of modules	Lw	Lp10	Number of modules	Lw	Lp10
	db	db		db	db
1	85.5	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

Lw: Sound power level according to ISO 3744

Lp: Sound pressure level measured at 10 meters from the unit in free field conditions according to ISO 3744

Low noise fans are available which reduce the sound power, if fitted with the compressor casings the sound power levels are as below.

Table 9 Sound power levels with low noise fans fitted

octave bands (hz)								Lw	Lp10
63	125	250	500	1k	2k	4k	8k		
db	db	db	db	db	db	db	db	db	db
71.8	72.2	70.7	75.6	76.1	71.8	66.3	56.4	81.5	50.3

Table 10 Sound power levels for multiple units in cascade with low noise fans fitted

Number of modules	Lw	Lp10	Number of modules	Lw	Lp10
	db	db		db	db
1	81.5	49.5	6	87.1	54.5
2	82.3	50.2	7	87.8	55
3	84.1	51.9	8	88.3	55.5
4	85.3	53	9	88.9	55.9
5	86.3	53.8	10	89.3	56.2

Lw: Sound power level according to ISO 9613-2

Lp: Sound pressure level measured at 10 meters from the unit in free field conditions according to ISO 9613-2

Position on site

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

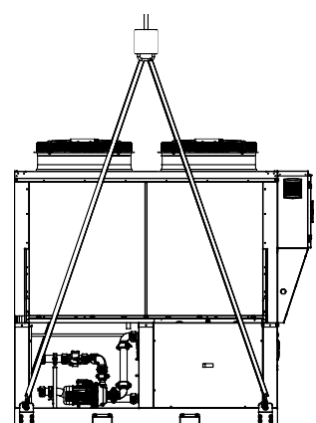
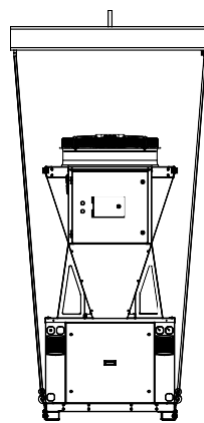
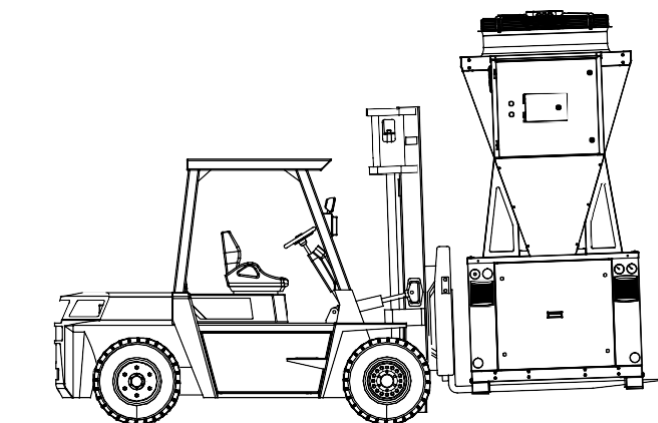
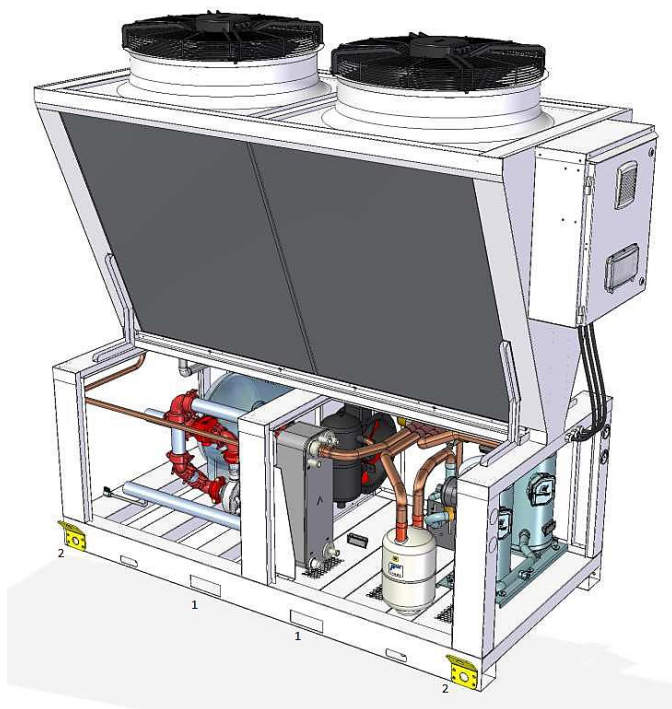
- Can bear the weight of the unit.
- Has enough space around the unit to allow the correct airflow across the source heat exchanger.
- Is not too windy.
- Does not present a noise nuisance to users of the building and neighbours



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:

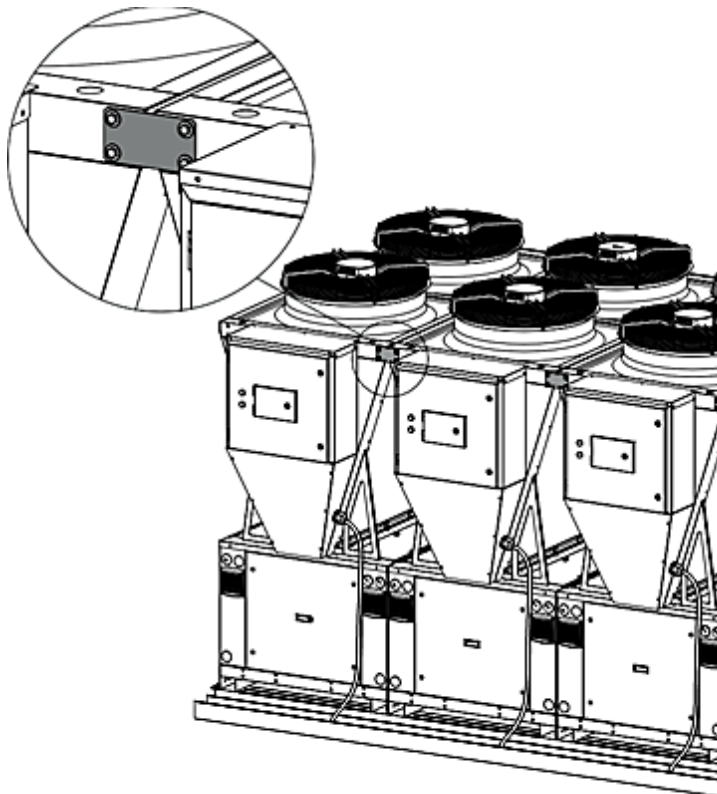
- Make sure that the vehicle being used has sufficient load capacity.
- Make sure that the forks cross the entire width of the unit.
- Provide any protection to avoid damaging the unit.
- Avoid abrupt or violent manoeuvres.
- Make sure all the panels are closed.
- Use a distributor beam in case of lifting 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.

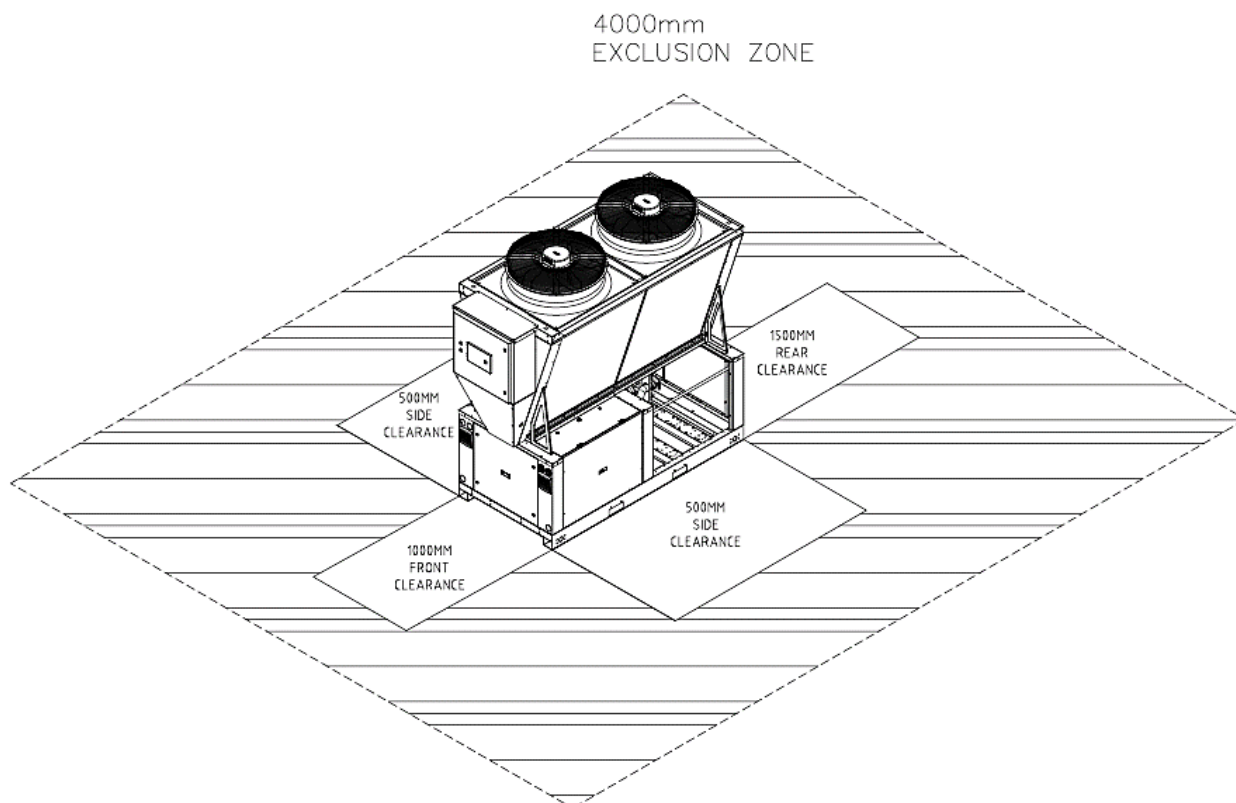
Each unit is supplied with a bracket to fasten more than one unit together, this should be fitted near the top of the as shown in drawing 4 below.



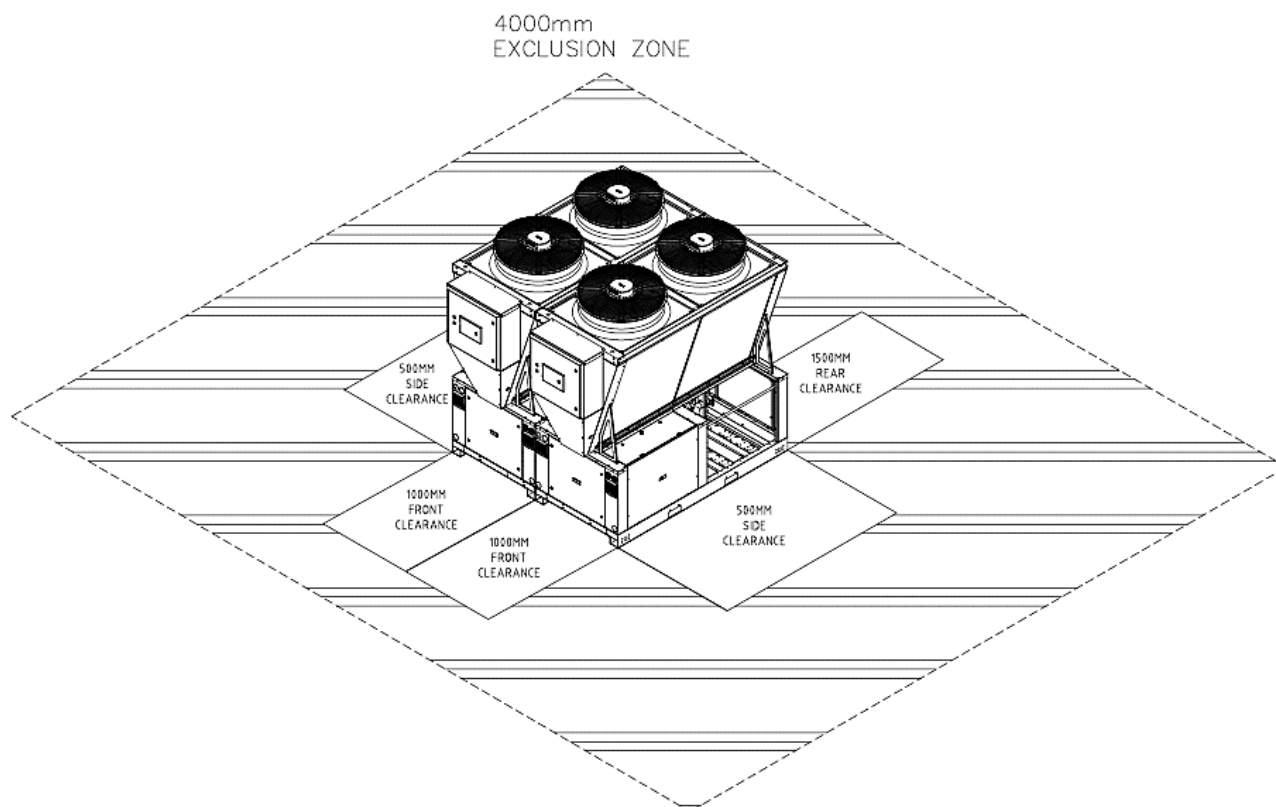
Drawing 4 top bracket position

Clearances

Amicus Altus air source heat pumps require minimum technical 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



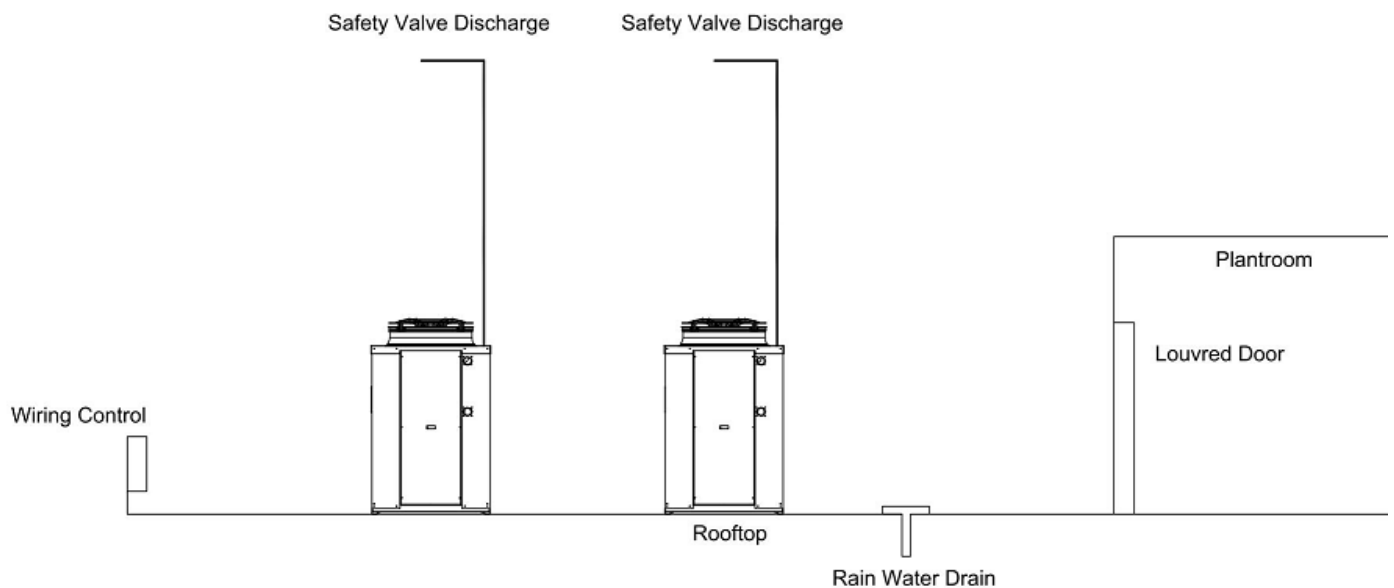
Drawing 6 clearances for multiple units

Exclusion zone

Any heat pump using R290 refrigerant must be installed in accordance with EN378-3, this will ensure the installation is safe and that in the unlikely event of a refrigerant leak no hazardous situation can occur. There must be nothing within the 4-meter exclusion zone that could create a hazardous situation should a leak occur, drawing 7 below gives some examples of what cannot be within the exclusion zone:

1. Wiring box- there must be nothing within the exclusion zone that could create a spark, contactors or switches are some examples. Only the wiring within the heat pumps is allowed.
2. Rainwater drain- this could allow a refrigerant leak which is heavier than air to sink into the building.
3. Access points into the building- louvred doors or openable windows are some examples which are not allowed, however the building itself could be closer than 4 meters if there are no access points into the building.

The above list is not exhaustive but should give an indication of what is allowed, for further advice contact Lochinvar technical support.



Drawing 7 Exclusion zone

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.

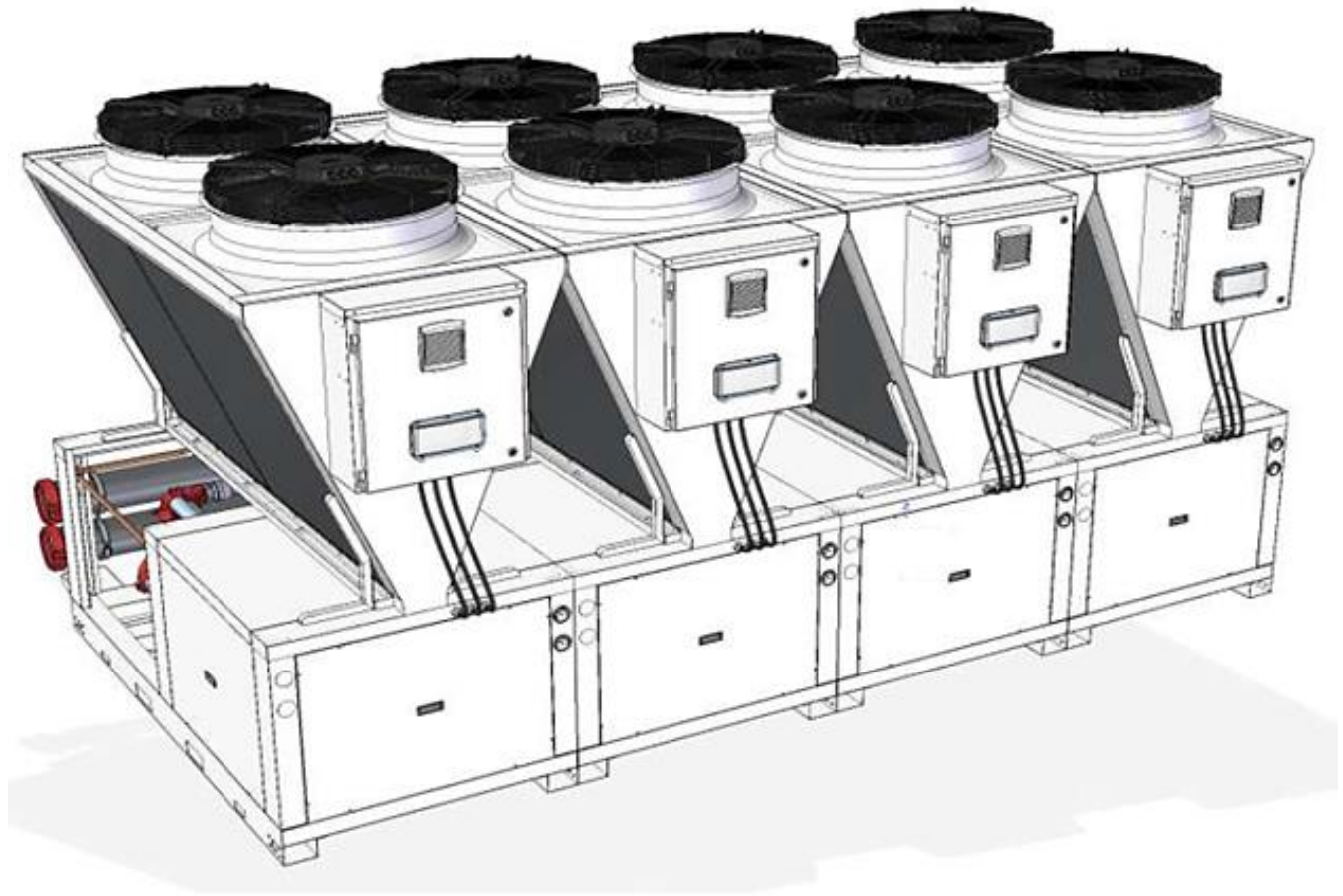
When using fencing or an acoustic shield sufficient clearances must be maintained to allow access to all the panels for service and maintenance work on all sides (these do not override the airflow clearances shown in drawings 3 and 4).

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 5 and 6 for details.



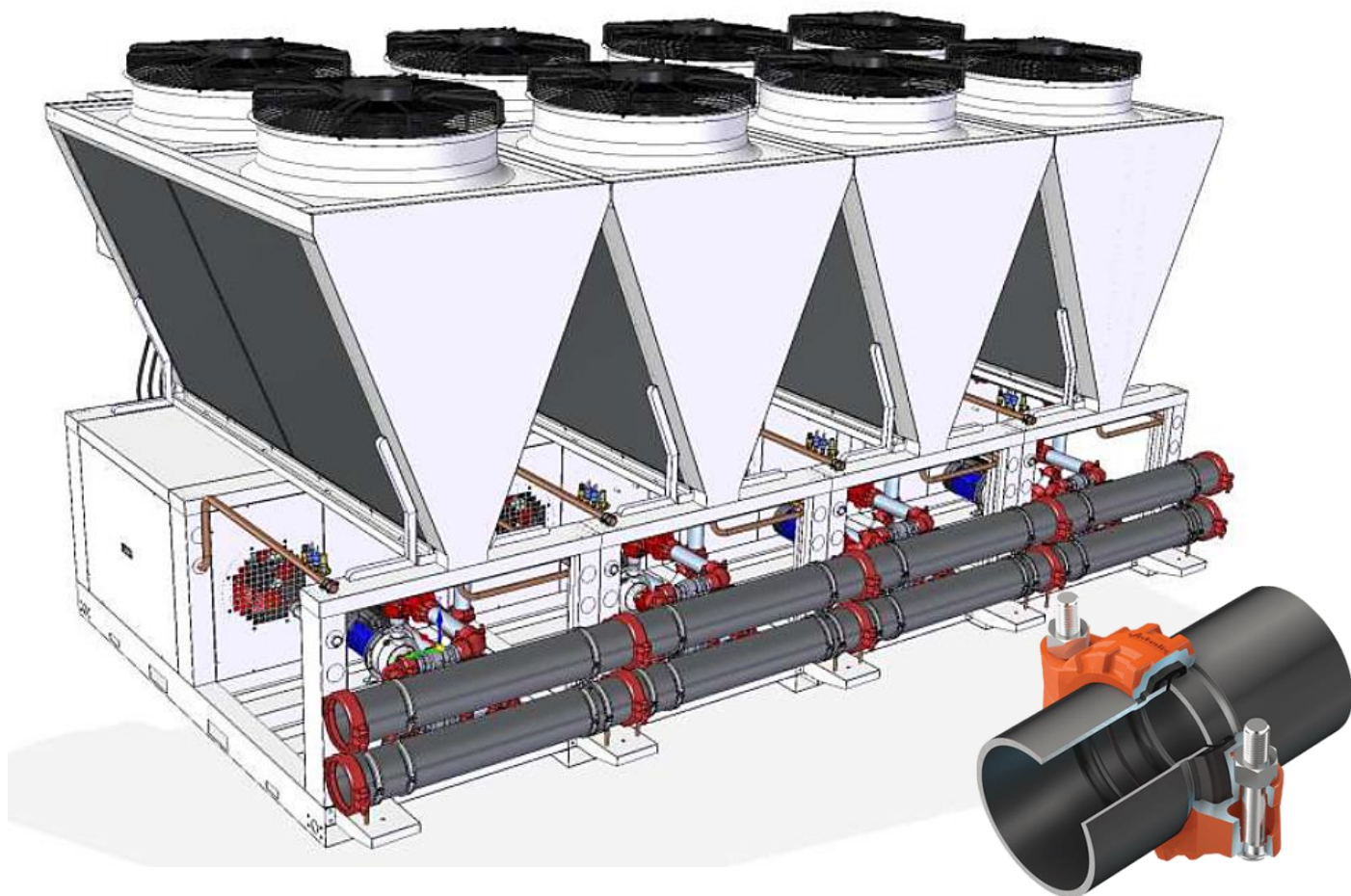
Drawing 8 Units sited side by side

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 header is 6" Victaulic regardless of the number of units in the cascade.



Drawing 9 Pipework header kit to rear of cascade.

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

Table 11 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 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 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:

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

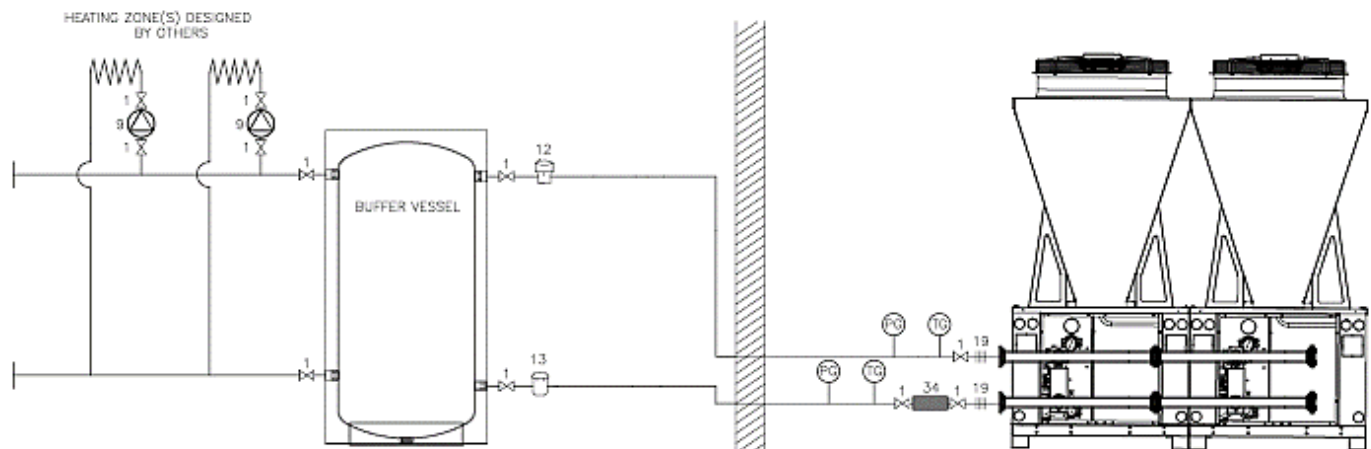
Lochinvar will offer a suitably buffer vessel depending upon what the Amicus units are supplying but are generally sized according to the output of the unit at 2°C ambient. Multiple units supplied with cascade control will not require a substantially larger buffer due to the number of compressors in 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

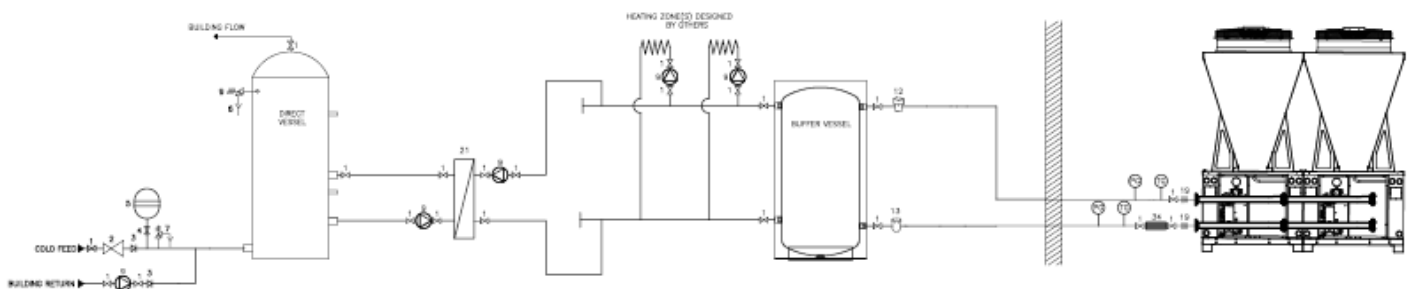
Amicus Altus can supply low temperature hot water at up to 70°C for use in providing domestic hot water (DHW). Generally, DHW is provided by a specially designed Lochinvar plate and buffer arrangement which has been sized according to the required flow rate, delta T and only a 2k temperature drop between the primary and secondary side of the plate. (See drawing 11 and 12) 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.

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.

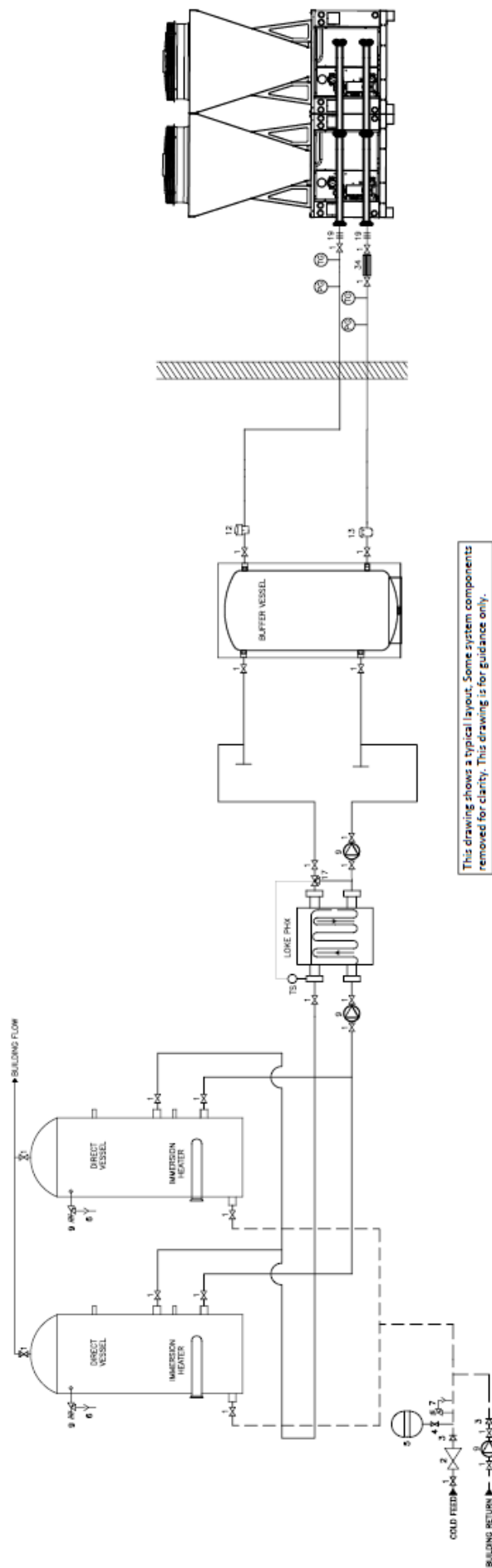


Drawing 10 Altus supplying heating only



Drawing 11 Altus supplying heating and domestic hot water

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



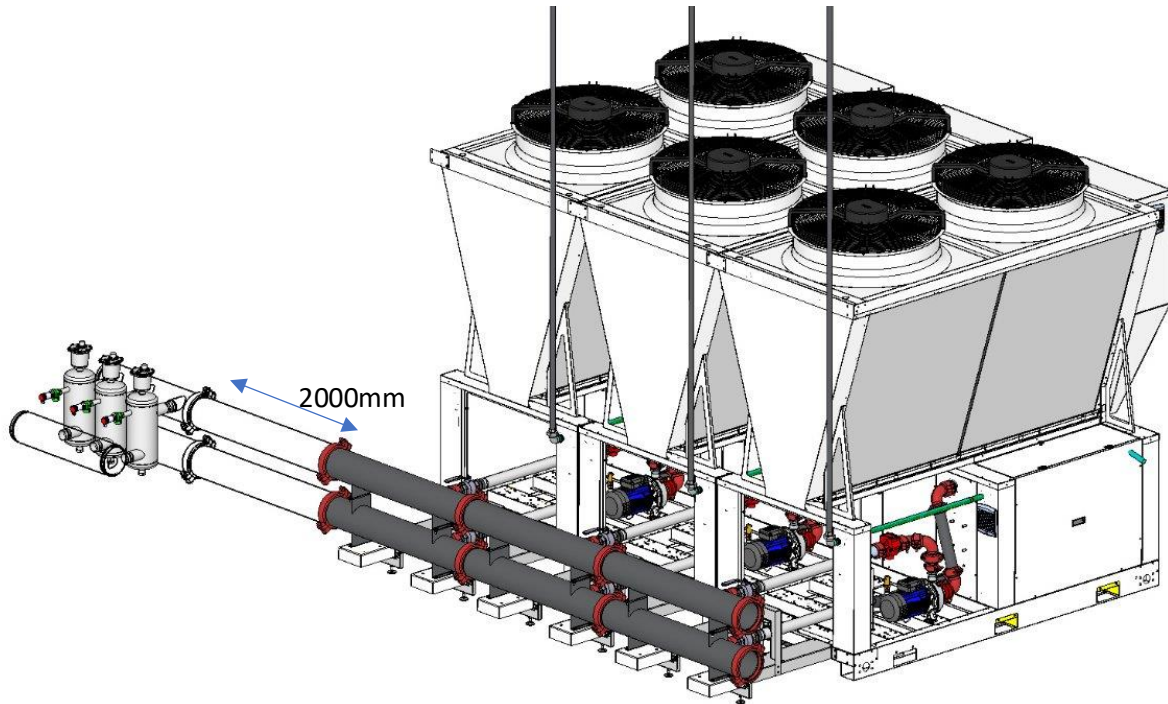
Drawing 12 Altus providing domestic hot water only

De gasser

To comply with EN378-3 a de-gasser must be fitted in the pipework between the heat pumps and the thermal store, this de-gasser will ensure no refrigerant leak through the plate heat exchanger can end up within the main building. This could pose a hazard during removal of air through a radiator for example.

The de-gasser must be designed for the specific purpose and must clear over 90% of any gas on a single pass. Lochinvar can supply a suitable de-gasser with every unit, this will need to be fitted on the pipework header close to the heat pump.

Contact Lochinvar technical support for further details.



Drawing 13 De-gasser piping option

The degasser safety valve and air vent outlets must be piped away from the heat pump and must be at least 2000mm away as shown above.

If the installation of the degasser is difficult another safety measure must be employed, one option could be the installation of a plate heat exchanger on the primary pipework just outside the plantroom.

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 12 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	A	79.3
Maximum peak current	A	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.

Soft starter

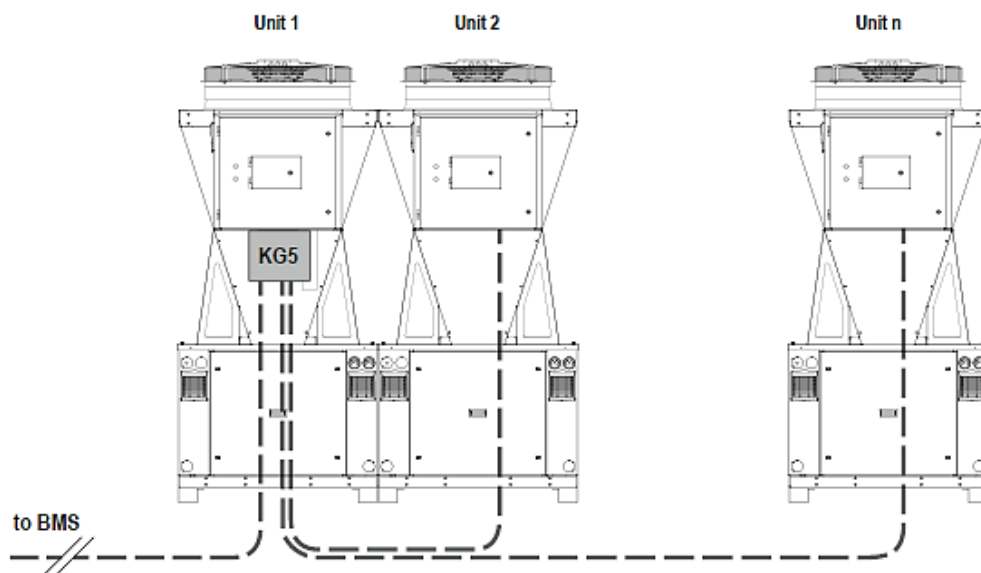
A soft starter is available as a factory fitted option; this reduces start up current draw by around 40%.

Standard electrical connections available

Electrical ancillaries available

1. Cascade control is fitted as standard on all models, in order to wire the cascade together the cascade wiring centre is required, 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 ethernet cables and not be run in the same trunking as the power supply wiring.



Drawing 14 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.



Cascade wiring centre showing ethernet connections

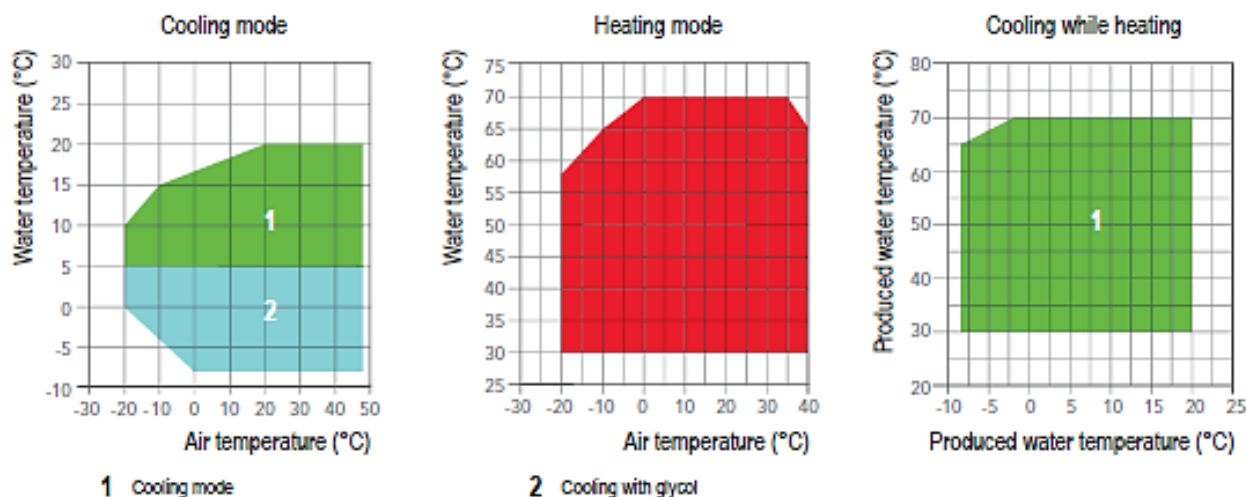
Cooling

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 15 Operational limits four pipe units

Table 13 Technical data table 4 pipe unit

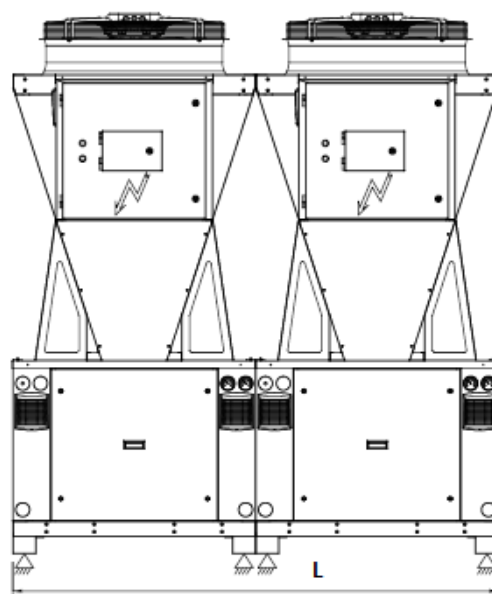
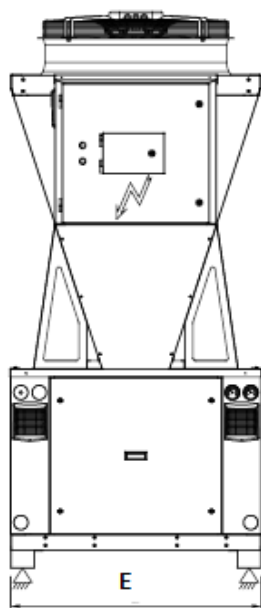
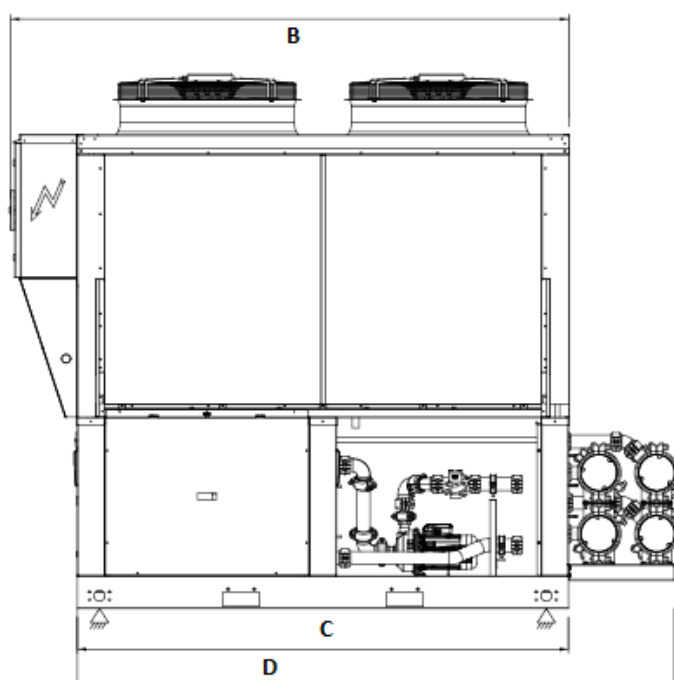
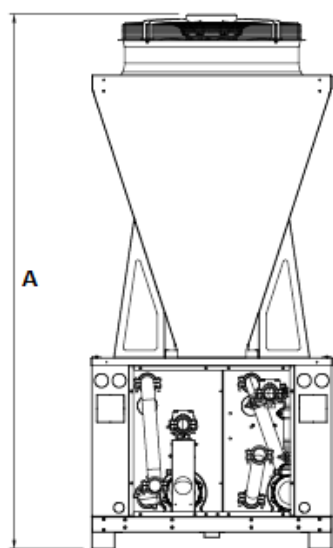
Heating Data		LAHP-65HTR2904P
Heating Capacity (EN14511) ¹	kW	86.8
Total Power input (EN14511) ¹	kW	22.1
COP (EN14511) ¹	W/W	3.93
EcoDesign data ²		
Energy Label Rating Low temperature 35°C		A++
SCOP Low Temperature 35°C		3.95
Seasonal Efficiency Low temperature 35°C	%	155
Energy Label Rating Medium temperature 55°C		A+
SCOP Medium Temperature 55°C		3.32
Seasonal Efficiency Medium temperature 55°C	%	130
Energy Label Rating High temperature 65°C		A+
SCOP High Temperature 65°C		2.76
Seasonal Efficiency High temperature 65°C	%	106
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	79.2
Peak input current standard unit	A	231

¹=external air+7C 30/35 flow²=average conditions according to EU/811/2013³=Cooling external air +35C 12/7 flow

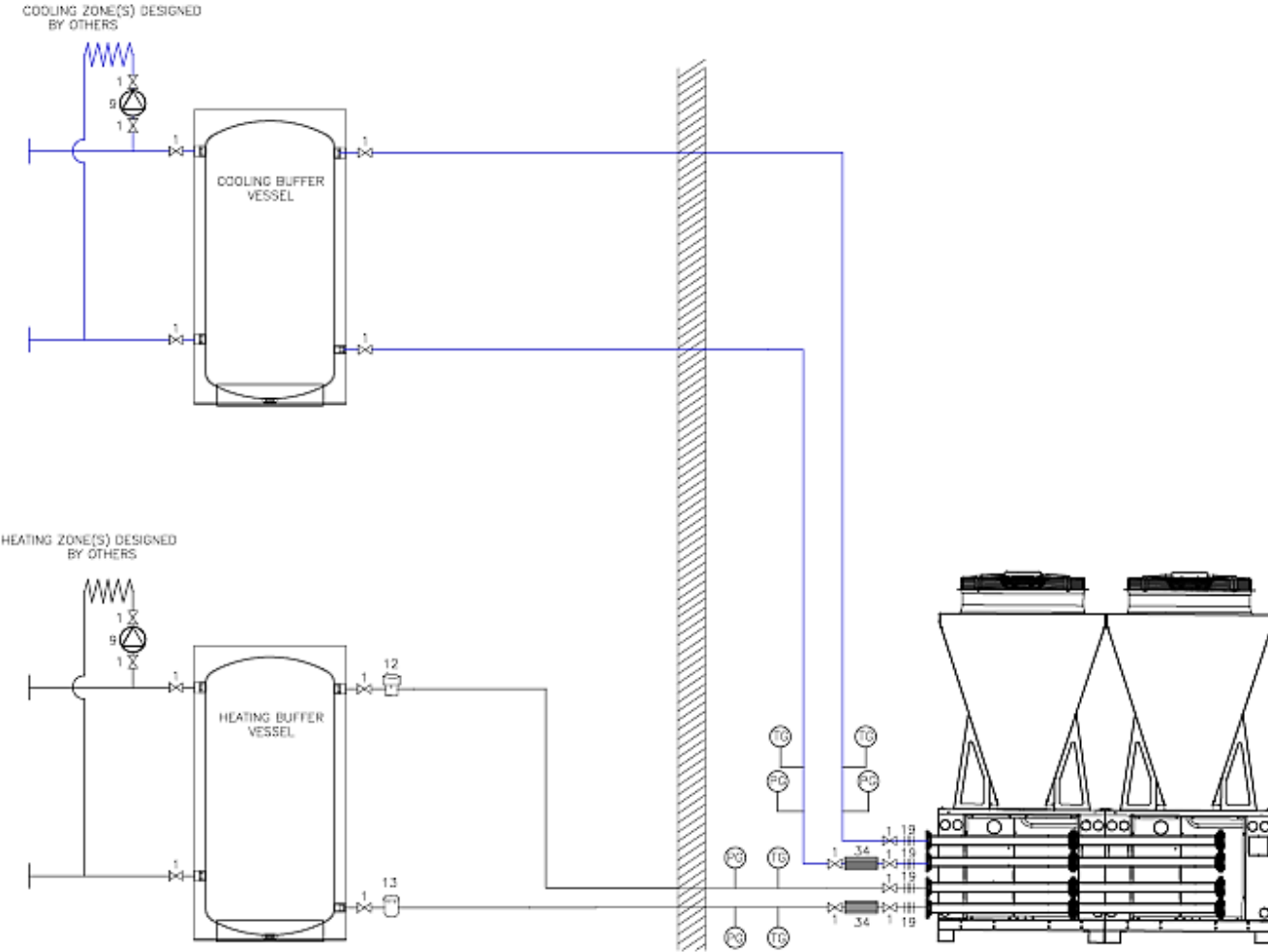
Dimensions 4 pipe units

Table 14 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





8 Lombard Way, The MXL Centre, Banbury, Oxon, OX16 4TJ

Tel: +44(0) 1295 269 981, Fax: +44(0) 1295 271 640, Email: info@lochinvar.ltd.uk

www.lochinvar.ltd.uk