

A-Cubed

Gas Absorption Heat Pump



Working towards
a cleaner future

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The Potterton Commercial A-Cubed is a packaged gas absorption heat pump (air-to-water) with all major components of the refrigeration cycle contained within a single, enclosure suitable for outdoor installation. A-Cubed is an air source derivative gas absorption heat pump which uses a combination of air energy and natural gas as the thermal input to achieve the heat output at exceptionally high fuel efficiencies.

What is a Gas Absorption Heat Pump?

Gas absorption heat pumps are comparable with conventional electrical heat pumps, the main difference being that gas-fired models are powered by a gas flame and not by electricity. With gas absorption heat pumps, the conventional electric compressor is replaced with a thermodynamic one which uses a heat supply to 'pump' energy. This is what we call the absorption process, in which ammonia dissolved in water is used as a coolant to take energy from a heat source.

Why use a Gas Absorption heat pump?

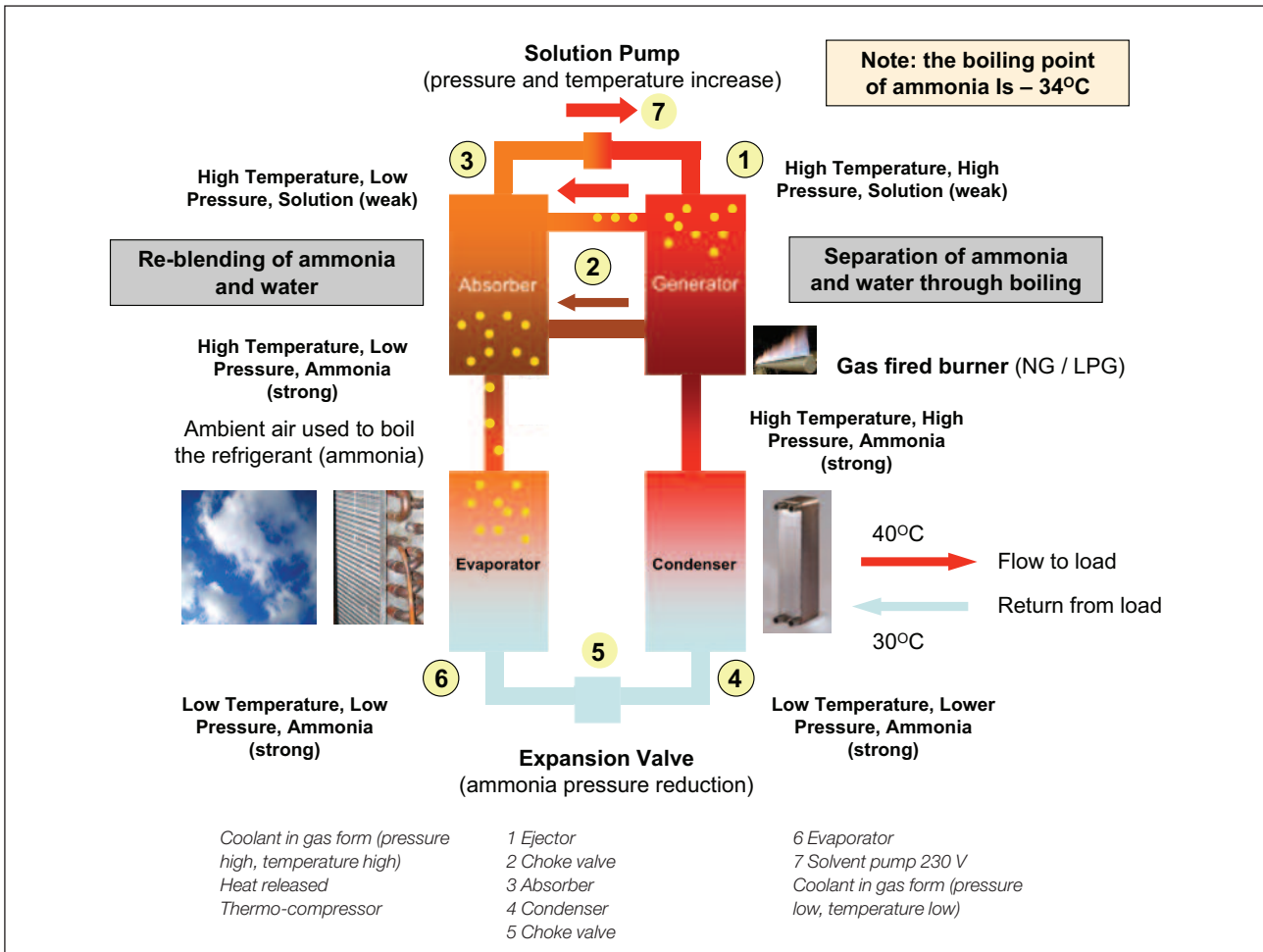
- Potential fuel efficiencies of around 144% (gross CV)
- Gas fired renewable solution
- Saves energy and reduces operating costs
- Offers significant reduction in carbon emissions
- Efficiencies in line with expected requirements of ErP Directive
- Ammonia used as refrigerant offering zero ODP and low GWP

Features and Benefits

- Evaporation cycle driven by condensing gas burner supplemented by air
- Low NO_x, Class 5 burner
- Weatherproof steel casing for outdoor installations
- Cascade operation possible with up to 48 units
- Cascade with condensing boiler possible
- Supports wide range of systems and solutions
- Siemens controls platform with Building Energy Management System interface
- Automatic defrosting valve
- Uses primary energy efficiently (up to 165% efficiency)
- Highly efficient, even at low outside temperatures
- Flow temperature up to 65°C
- Low electrical connected load value
- Continuous heating, even in thaw phase
- Reduces CO₂ emissions
- Can be combined with existing heating systems
- 80mm diameter flue outlet with discharge temperatures suitable for use with plastic flue pipes
- Suitable for natural gas and LPG operation

Application Support provided by Baxi Commercial Division

- Review of project hydraulic schematic
- Telephone and on-site installation and application support including pre-commissioning visit where applicable
- Commissioning and controls set-up of A-Cubed system



Principle of Operation

With traditional air-to-water heat pumps, electricity is used to power an induction motor which drives the refrigeration compressor. The A-Cubed gas absorption heat pump uses a gas burner to initiate and sustain the refrigeration cycle, assisted by the available energy from the surrounding ambient air. The Potterton Commercial A-Cubed uses the heat generated to supply LTHW heating systems or the production of domestic hot water via an indirect cylinder.

The process in detail

The gas burner heats the mixture in the ejector (1). The coolant evaporates, and separates from the water. The water passes via the choke valve (2) into the absorber (3). The ammonia vapour passes to the condenser (4), where it condenses and passes the heat of condensation to the heating water. The liquid ammonia flows via the choke valve (5) to the evaporator (6), where it evaporates, absorbing heat from the outside air. The vapour then flows into the absorber, where it meets the low-

ammonia water. Here, the coolant is absorbed in the solution, which is what gives the process its name. The water absorbs the vapour, creating an ammonia-rich solution. The heat this releases and the residual heat from the ejector are passed to the heating water, making the heat pump more efficient. The solvent pump (7) carries the rich solution to the ejector (1), and the whole process starts all over again.

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Heat pump performance

How efficient different kinds of heat pumps are is expressed in different units. How efficient an electric heat pump is, is often expressed as its performance or CoP (Coefficient of Performance). CoP is calculated by dividing useful energy by input electrical energy. If one unit of electrical energy has to be input to obtain four units of heat energy, we say the CoP is 4. A German power station generating efficiency has an efficiency of around 33%, which means every unit of electrical energy requires three units of primary energy.

That means it takes three units of primary energy (gas, coal) to get four units of useful heat energy. If we divide useful energy by primary energy, we get the thermal coefficient or PER (Primary Energy Ratio).

Applications

The A-Cubed gas absorption heat pump can be used in schemes that would traditionally use boilers for space heating applications. As the heat pump is suitable for outdoor installations, the plant room size could be reduced, thereby saving valuable space.

As with all forms of heat pumps, the most suitable application for the A-Cubed

is low temperature hot water applications such as underfloor heating. The A-Cubed is also capable of producing domestic hot water with temperatures in excess of 65°C via an indirect cylinder, in a similar manner to conventional commercial boilers, although efficiency at this temperature would be compromised.

If a larger output is required, A-Cubed heat pumps can be connected in cascade via an additional DDC controller with up to 48 units. This equates to a combined installed capacity of circa 1.9 MW through the creation of a heat pump 'network'.

Operation

A-Cubed gas absorption heat pumps work just like conventional ones. They take heat from the air, can be set up outside freely, and run on gas instead of electricity, converting ambient energy, like cold air at 10°C, to something that can be used, such as hot water at 50°C. Using ambient energy means A-Cubed gas absorption heat pumps achieve the maximum possible rating in the future ECO heating system design table. They are suitable for use in apartment blocks, commercial and local authority buildings which need > 80 kW of heat.

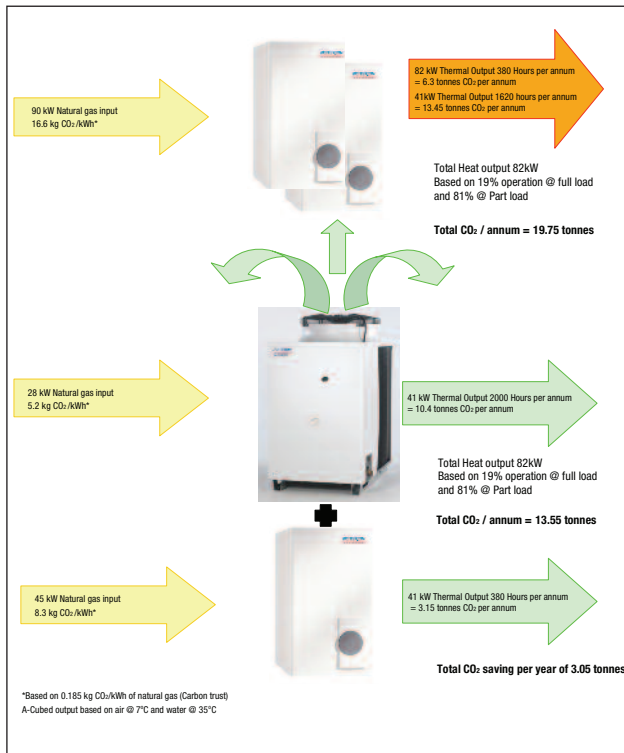
Potential uses

A-Cubed gas absorption heat pumps are generally used as baseload suppliers in combination with gas condensing boilers in heating systems with system temperatures up to 65°C.

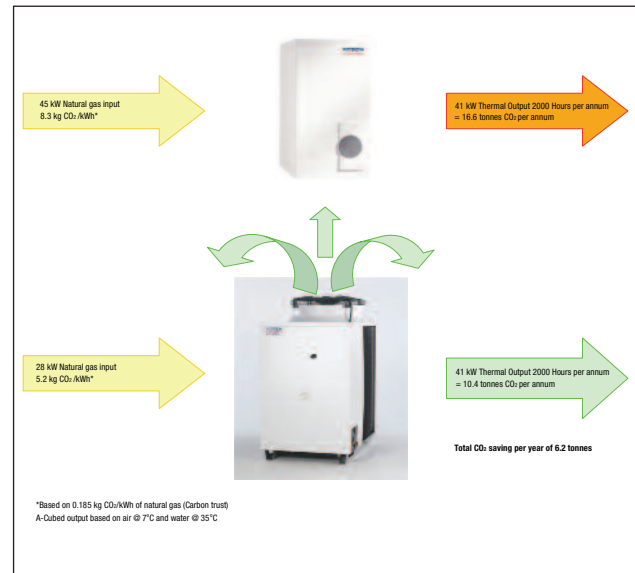
As lead boilers in heating systems, combined with highly-efficient Potterton Commercial condensing boilers, A-Cubed gas absorption pumps should achieve more than 4,000 operating hours a year for their high efficiency to achieve maximum energy savings and CO₂ reduction.

Application with Boilers

Cascade with boiler



Standalone



Example CO₂ emissions with A-Cubed application (tonnes/year)

Cascade with boilers

Gas Consumption		Average Saving
2 No. Condensing Boilers	10009m ³ per annum	
Condensing boiler and A-Cubed	6832m ³ per annum	3177m ³ per annum
CO ₂ Emissions		
2 No. Condensing Boilers	19.75 tonnes per annum	
Condensing boiler and A-Cubed	13.55 tonnes per annum	6.2 tonnes per annum

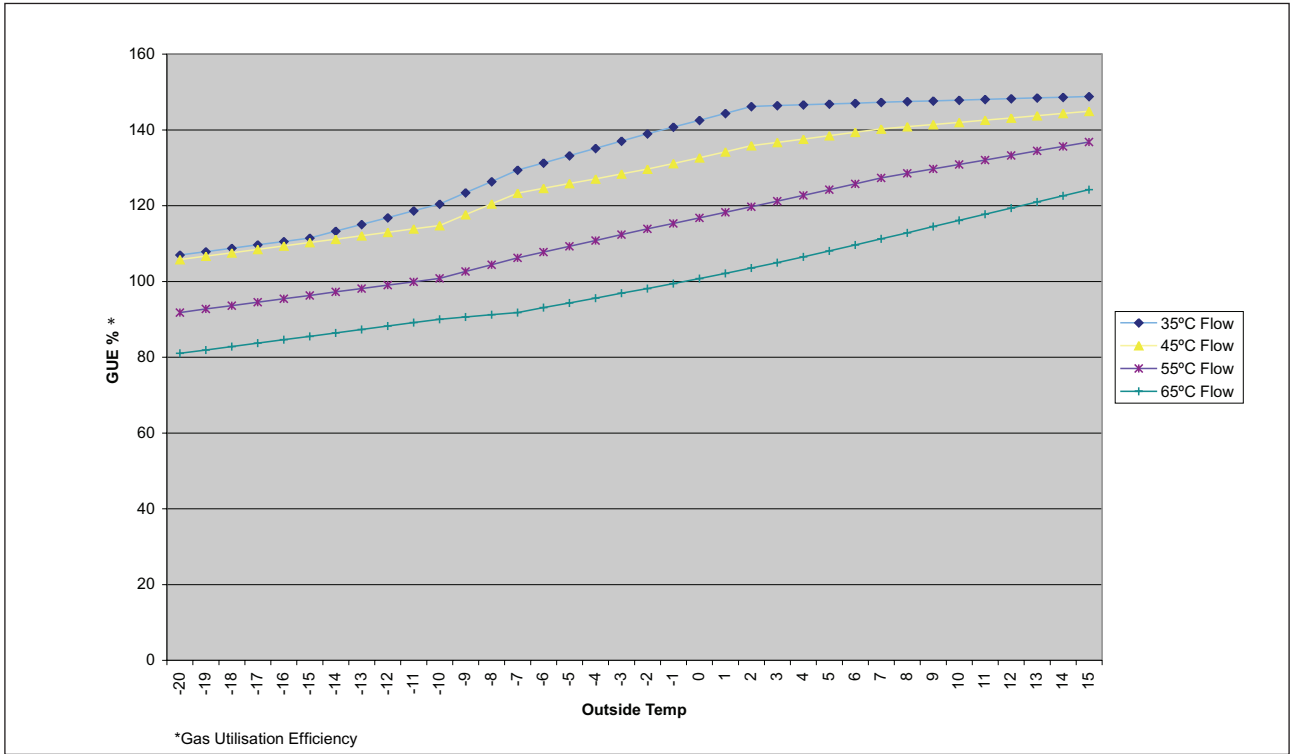
Standalone Operation

Gas Consumption		Average Saving
Condensing boiler	8411m ³ per annum	
A-Cubed	5234m ³ per annum	3177m ³ per annum
CO ₂ Emissions		
Condensing Boiler	16.6 tonnes per annum	
A-Cubed	10.4 tonnes per annum	6.2 tonnes per annum

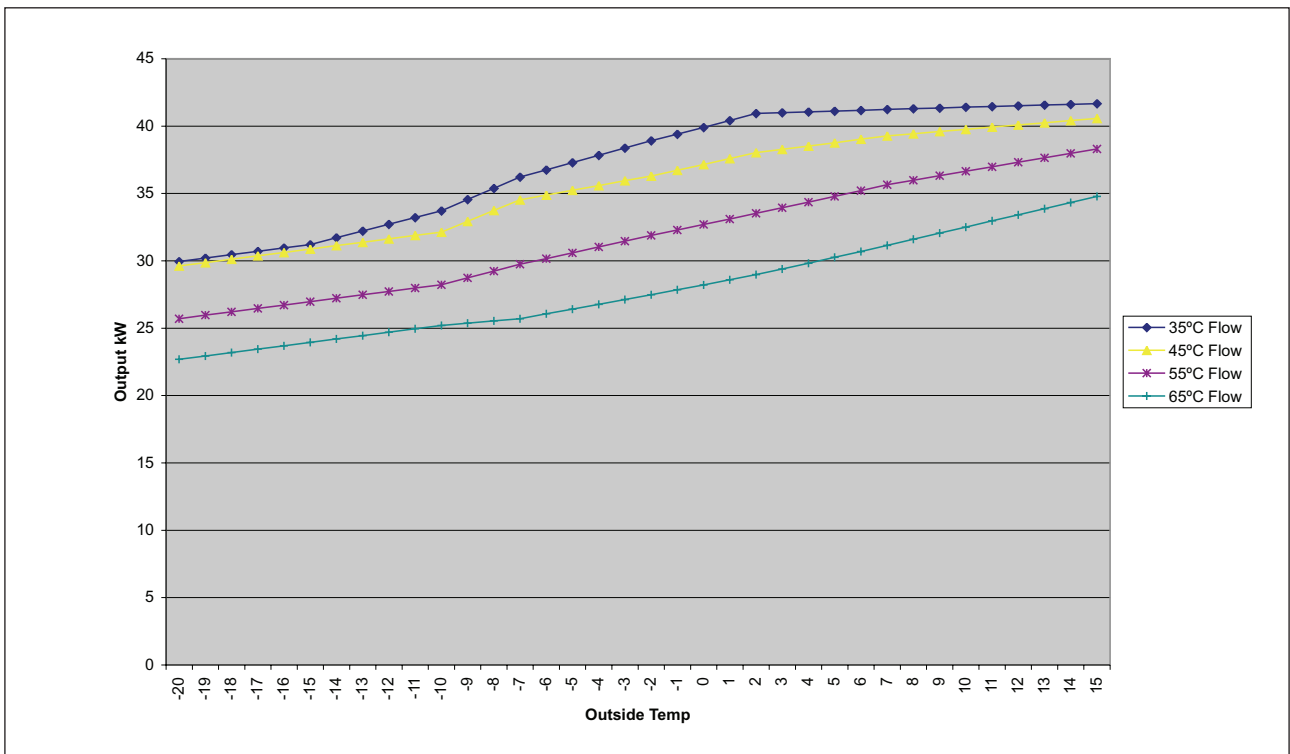
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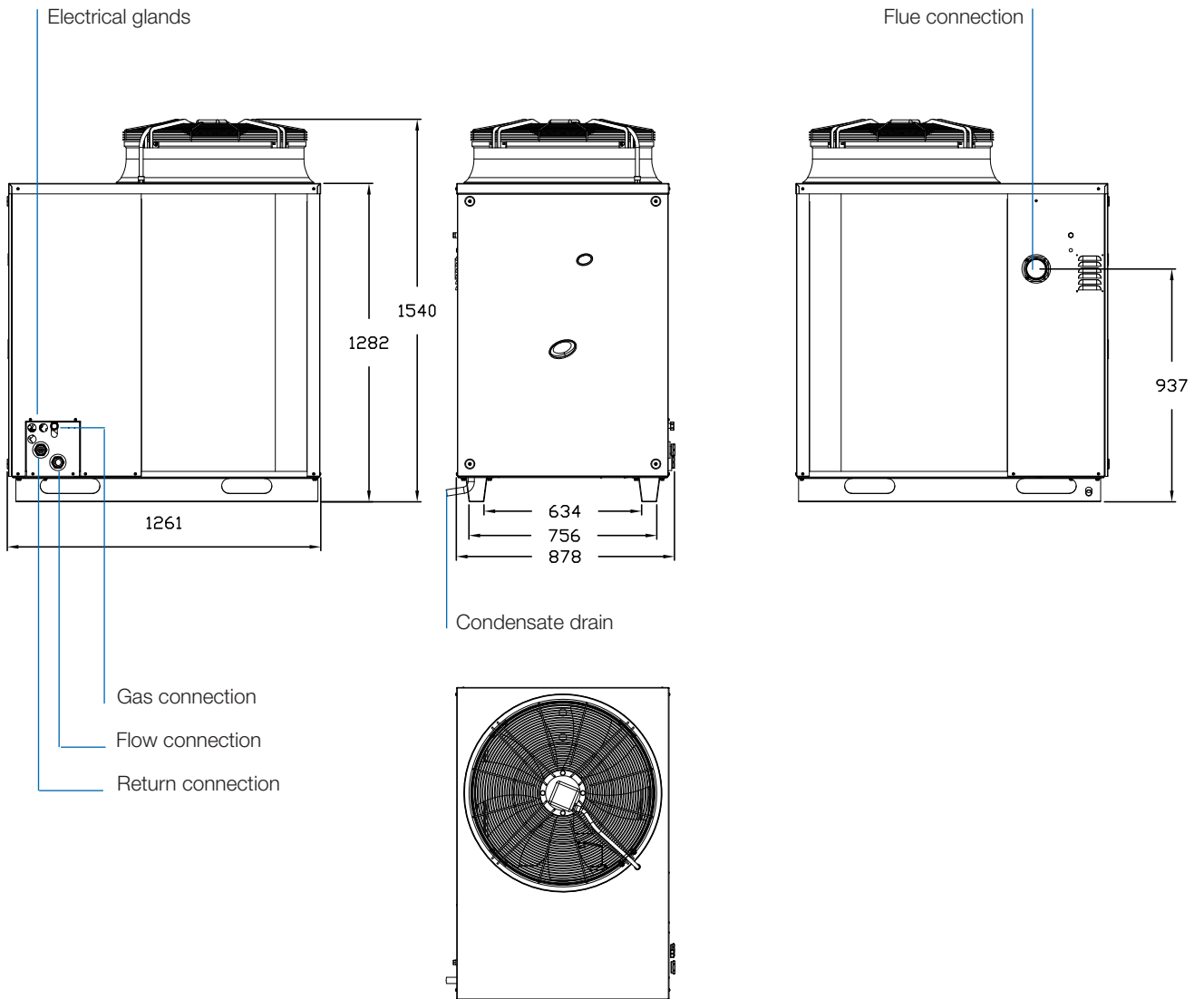
Efficiency Chart



kW Output Chart



Dimensions



Connections

Water Flow and Return	Gas	Flue Gas Connection	Dry Weight
1 1/4"	3/4"	80mm	400kg

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Optional Extras

DDC (Direct Digital Control)



- Sequence controller for up to 32 units
- Provides direct temperature control of flow temperature



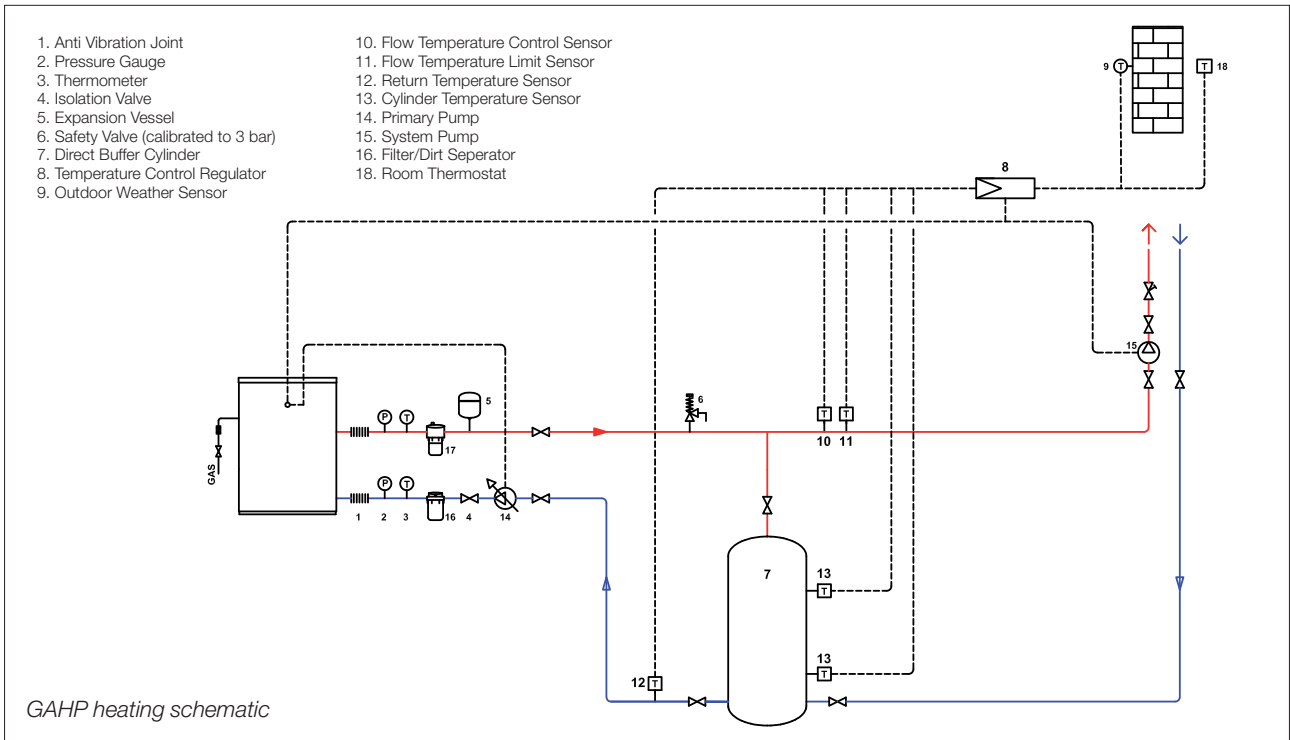
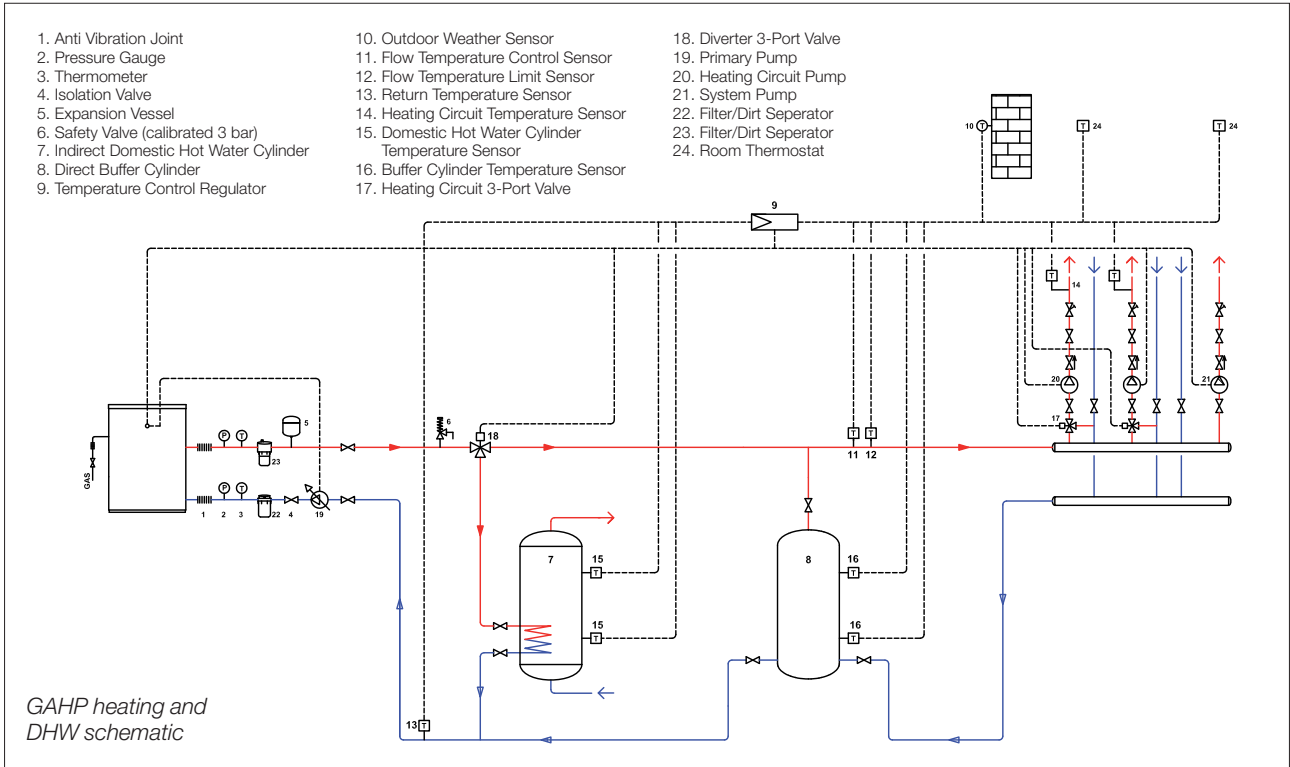
The RB100 acts as an interface between the DDC, and on-site BMS systems where it will accept a heat request from a BMS as a VFC or a 0-10Vdc input to automatically provide a compensated flow temperature.

If the BMS system does not provide weather compensation then with the use of an additional sensor the DDC can provide this function.

The RB100 can also provide outputs to control motorised valves and provide status information to the BMS system such as system fault.

When the RB100, DDC and A-Cubed heat pumps are connected together the system automatically recognises and configures the plant using CANbus.

The DDC is a panel mounted controller and the RB100 can be installed inside an electrical cabinet close to the BMS system.



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Specification & Technical Data

HEATING OPERATION			High Temp
Operating point A7/W35	G.U.E.* Gross CV	%	147.1
	G.U.E.* Nett CV	%	163.3
	heating capacity	kW	41.2
Operating point A7/W50	G.U.E.* Gross CV	%	136.8
	G.U.E.* Nett CV	%	151.8
	heating capacity	kW	38.3
Operating point A7/W65	G.U.E.* Gross CV	%	107.1
	G.U.E.* Nett CV	%	118.8
	heating capacity	kW	30
Nominal water flow rate ($\Delta T = 10\text{ }^{\circ}\text{C}$)		m ³ /h	2.96
Nominal pressure drops at nominal flow rate (A7/W50)		kPa	43
Output water temperature	maximum for heating	$^{\circ}\text{C}$	55
	maximum for domestic hot water	$^{\circ}\text{C}$	70
Inlet water temperature	maximum for heating	$^{\circ}\text{C}$	45
	maximum for domestic hot water	$^{\circ}\text{C}$	60
Outside air temperature (dry bulb)	max	$^{\circ}\text{C}$	45
	min	$^{\circ}\text{C}$	-30
BURNER CHARACTERISTICS			
Heating input (gross CV of natural gas)		kW	28
Gas consumption	natural gas G20	m ³ /h	2.62
	LPG G31	kg/h	2.0
Gas supply pressure		mbar	17-25
ELECTRICAL CHARACTERISTICS			
Voltage		230 V – 50 Hz	
Nominal electrical power		kW	1.09
Protection degree		IP	X5D
INSTALLATION DATA			
Operational weight		kg	400
Connections	water	" F	1½
	gas	" F	¾
	exhaust gas	mm	80
Exhaust gas pipe residual head		Pa	80
Dimensions	width	mm	852
	depth	mm	1244
	height	mm	1515
Sound pressure level @ 10m		dB(A)	45
Sound pressure level @ 1m		dB(A)	65

* Gas Utilisation Efficiency

Efficiency Table

Model	Air Temperature ($^{\circ}\text{C}$)	Water Temperature ($^{\circ}\text{C}$)	Heat Output (kW)	Fuel Input (m ³ /hour)	Gross CV of Gas MJ/m ³	Gross Fuel Input (kW)	Efficiency Gross CV of Fuel	Electricity Consumption (kWe) (nominal)	Net Efficiency Gross CV of Fuel	ErP Directive Benchmark	ErP Directive Indicative Rating
Air to Water GA HP	7	35	41.2	2.62	38.5	28.0	147.1%	1.09	143.3%	>132%	A+++
Air to Water GA HP	7	50	38.3	2.62	38.5	28.0	136.8%	1.09	132.9%	>132%	A+++
Air to Water GA HP	7	65	30.0	2.62	38.5	28.0	107.1%	1.09	103.3%	>100%	A+
Air to Water GA HP	-7	50	31.5	2.62	38.5	28.0	112.5%	1.09	108.6%	>100%	A+

* Based on natural gas

Notes

Commercial Sales Technical & Service Enquiries

Sales: 0845 070 1056
Technical: 0845 070 1057
Fax: 0845 070 1059
e-mail: potterton.commercial@baxicommercialdivision.com
web: www.pottertoncommercial.co.uk

Spares

Potterton Commercial spares are available nationwide through the interpart network of approved stockists. Alternatively please contact:-

Interpart, Brooks House, Coventry Road Warwick CV34 4LL
Tel: 0844 871 1540

Applications & Installations

Our experienced technical support team are available to offer advice on any aspect of heating system design and boiler installation.

Please contact: 0845 070 1057

Service and Maintenance

heateam

Commercial Service

Our service organisation, **heateam Commercial Service** covers the whole of the UK to look after your needs for all Potterton Commercial products.

Our service office offers a wide range of specialised services including:

- Burner commissioning for all fuels
- Boiler service contracts
- Breakdown and repair services
- Burner and boiler replacement
- Oil/gas conversions
- Water treatment and descaling
- Packaged units



For more information, or to talk to an advisor, call

0845 070 1058

All descriptions and illustrations contained within this leaflet have been carefully prepared, but we reserve the right to make changes and improvements in our products which may affect the accuracy of the information in this leaflet.



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