1 SPECIFICATION OF SUPPLY

1.1 GAHP GS

Water-ammonia absorption heat pump, fed with natural gas or LPG, brine-water version, modulating and condensing, for alternate or simultaneous hot water production up to a delivery temperature of 65°C (70°C at 50% of maximum power), and cold water even at negative temperature, for indoor *or outdoor installation (for outdoor version only)*, consisting of:

- steel sealed circuit, externally treated with epoxy paint;
- sealed combustion chamber (type C) suitable for outdoor installations;
- metal mesh radiant burner equipped with ignition and flame detection device, controlled by an electronic control unit;
- titanium stainless steel shell-and-tube water exchanger (condenser), externally insulated;
- titanium stainless steel shell-and-tube water exchanger (evaporator), externally insulated;
- low power consumption refrigerant fluid oil pump;
- stainless steel, shell and tube recovery exchanger of flue gas latent heat.

Control and safety devices:

- electronic board with microprocessor;
- installation water flow meter (hot side);
- installation water flow switch (cold side);
- generator limit thermostat, with manual reset;
- flue gas temperature thermostat, with manual reset;
- generator fin temperature sensor;
- sealed circuit safety relief valve;
- by-pass valve, between high and low pressure circuits;
- ionisation flame controller;
- gas solenoid valve with double shutter;
- antifreeze function for water circuit;
- condensate discharge obstruction sensor.

1.2 GAHP WS

Water-ammonia absorption heat pump, fed with natural gas or LPG, water-water version, modulating and condensing, for alternate or simultaneous hot water production up to a delivery temperature of 65°C (70°C at 50% of maximum power), and cold water, for indoor *or outdoor installation (for outdoor version only)*, consisting of:

- steel sealed circuit, externally treated with epoxy paint;
- sealed combustion chamber (type C) suitable for outdoor installations;
- metal mesh radiant burner equipped with ignition and flame detection device, controlled by an electronic control unit;
- titanium stainless steel shell-and-tube water exchanger (condenser), externally insulated;
- titanium stainless steel shell-and-tube water exchanger (evaporator), externally insulated;
- low power consumption refrigerant fluid oil pump;
- stainless steel, shell and tube recovery exchanger of flue gas latent heat.

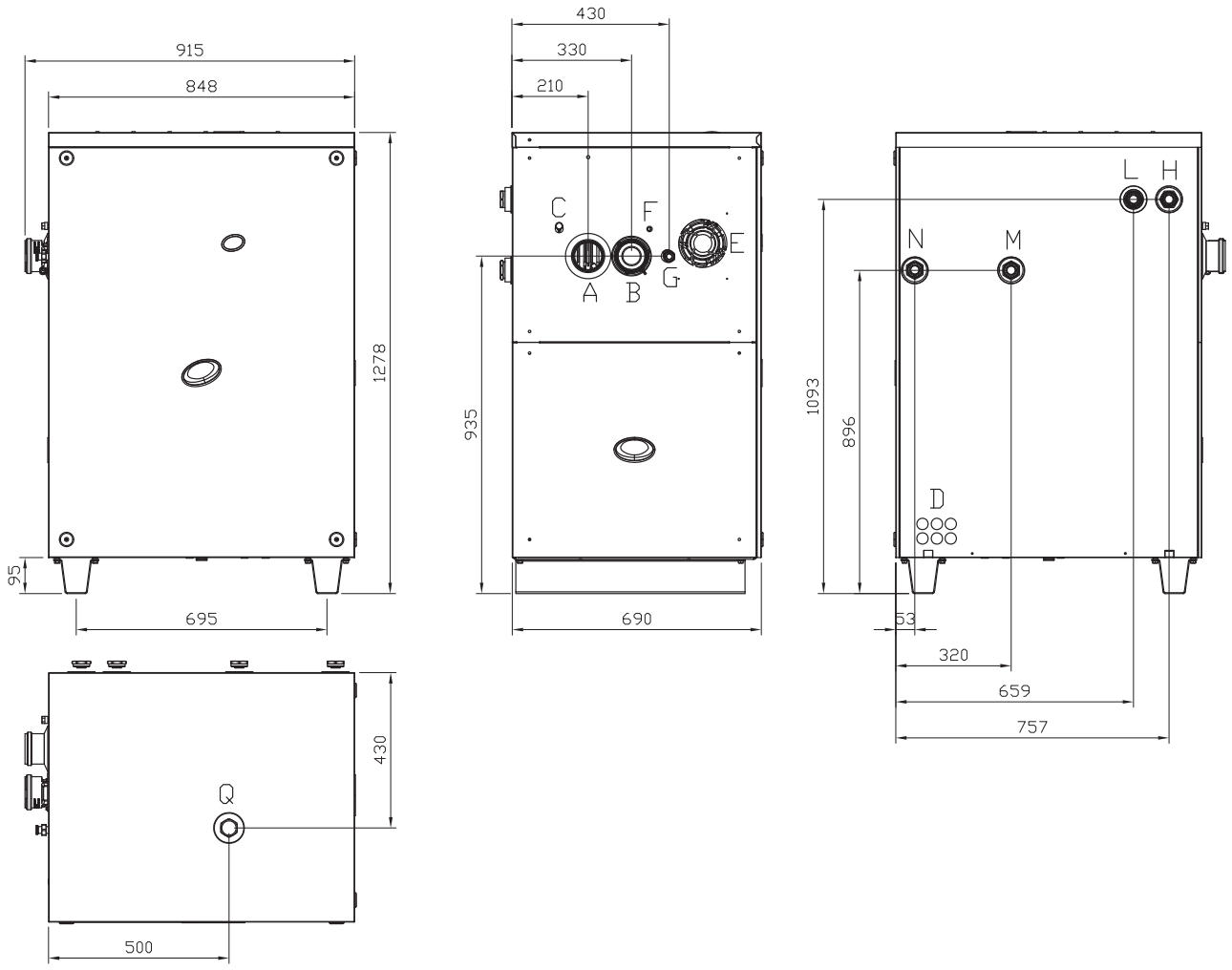
Control and safety devices:

- electronic board with microprocessor;
- installation water flow meter (hot side);
- installation water flow switch (cold side);
- generator limit thermostat, with manual reset;
- flue gas temperature thermostat, with manual reset;
- generator fin temperature sensor;
- sealed circuit safety relief valve;
- by-pass valve, between high and low pressure circuits;
- ionisation flame controller;
- gas solenoid valve with double shutter;
- antifreeze function for water circuit;
- condensate discharge obstruction sensor.

2 FEATURES AND TECHNICAL DATA

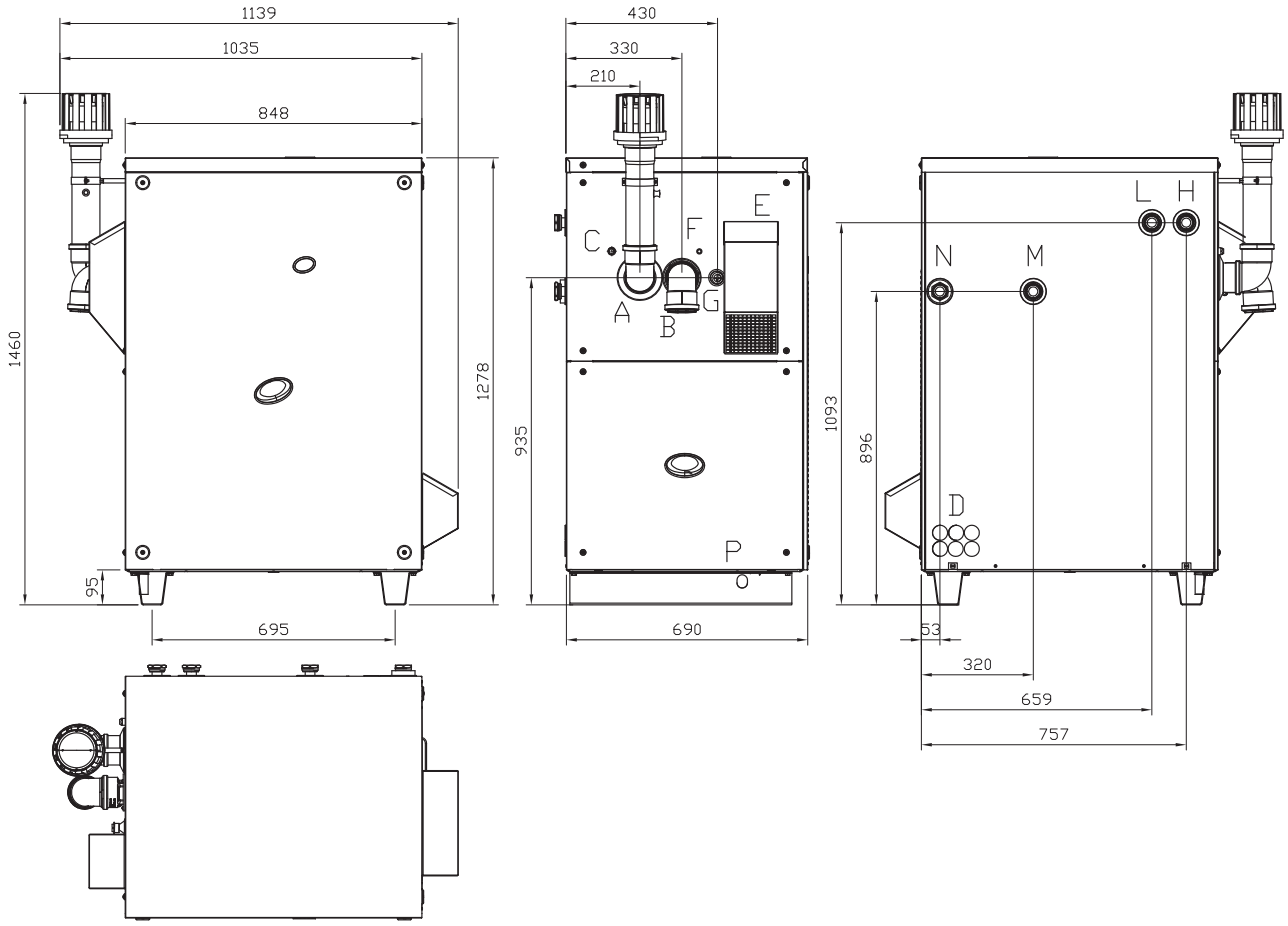
2.1 DIMENSIONS

Figure 2.1 *Indoor GAHP GS/WS dimensions*



A Flue gas output Ø 80
B Combustion air inlet Ø 80
C Fumes thermostat manual reset
D Power supply cables input
E Ventilation fan
F Burner on warning light
G Gas connection Ø 3/4"
H Hot water inlet Ø 1"¼
L Renewable source water return Ø 1"¼
M Renewable source water delivery Ø 1"¼
N Hot water delivery Ø 1"¼
Q Safety valve outlet ducting Ø 1"¼

Figure 2.2 *Outdoor GAHP GS/WS dimensional drawing*



A Flue gas output Ø 80
B Combustion air inlet Ø 80
C Fumes thermostat manual reset
D Power supply cables input
E Ventilation fan
F Appliance operation warning light
G Gas connection Ø 3/4"
H Hot water inlet Ø 1"¼
L Renewable source water return Ø 1"¼
M Renewable source water delivery Ø 1"¼
N Hot water delivery Ø 1"¼
P Condensate drain

2.2 OPERATION MODE

ON/OFF or modulating operation

The GAHP GS/WS units may operate in two modes:

- mode (1) ON/OFF, i.e. ON (at full power) or OFF, with circulating pumps at constant or variable flow (hot side only);
- mode (2) MODULATING, i.e. at variable load from 50% to 100% of power, with circulating pumps at variable flow (hot side) and constant flow (cold side).

For each mode, (1) or (2), specific control systems and devices are provided (Paragraph 2.3 *p. 3*).

2.3 CONTROLS

Control device

The appliance may only work if it is connected to a control device, selected from:

- (1) **DDC control**
- (2) **CCP/CCI control**
- (3) **external request**

2.3.1 Control system (1) with DDC (GAHP unit ON/OFF)

The DDC controller is able to control the appliances, a single

GAHP unit, or even several Robur GAHP/GA/AY units in cascade, only in ON/OFF mode (non modulating). For more information see Section C1.12.

2.3.2 Control system (2) with CCP/CCI (modulating GAHP unit)

The CCP/CCI control is able to control in heating only (and possibly passive cooling) up to 3 GAHP units in modulating mode (therefore A/WS/GS only, excluding AR/ACF/AY), plus any integration ON/OFF boiler. For more information see Section C1.12.

2.3.3 Adjustment system (3) with external request (GAHP unit ON/OFF)

The appliance may also be controlled via generic enable devices (e.g. thermostat, timer, button, contactor...) fitted with voltage-free NO contact. This system only provides elementary control (on/off, with fixed setpoint temperature), hence without the important functions of systems (1) and (2). It is advisable to possibly limit its use to simple applications only and with a single appliance. There are two control options: heating request or cooling request.

2.4 TECHNICAL CHARACTERISTICS

Table 2.1 *GAHP GS/WS technical data*

				GAHP GS HT	GAHP WS
Heating mode					
Seasonal space heating energy efficiency class (ErP)	medium-temperature application (55 °C)		-	A++	
	low-temperature application (35 °C)		-	A+	
Unitary heating power	Evaporator inlet temperature/Delivery temperature	B0W35	kW	41,6	-
		B0W50	kW	37,6	-
		B0W65	kW	31,4	-
		W10W35	kW	-	43,9
		W10W50	kW	-	41,6
		W10W65	kW	-	35,8
GUE efficiency	Evaporator inlet temperature/Delivery temperature	B0W35	%	165	-
		B0W50	%	149	-
		B0W65	%	125	-
		W10W35	%	-	174
		W10W50	%	-	165
		W10W65	%	-	142
Heating capacity	nominal (1013 mbar - 15 °C)		kW	25,7	
	real		kW	25,2	
Hot water delivery temperature	maximum for heating		°C	65	
	maximum for DHW		°C	70	
Hot water return temperature	maximum for heating		°C	55	
	maximum for DHW		°C	60	
	minimum temperature in continuous operation		°C	30 (1)	
Thermal differential	nominal		°C	10	
Heating water flow	nominal		l/h	3170	3570
	maximum		l/h	4000	
	minimum		l/h	1400	
Pressure drop heating mode	for nominal water flow (B0W50)		bar	0,49 (2)	-
	for nominal water flow rate(W10W50)		bar	-	0,57 (2)
Ambient air temperature (dry bulb)	maximum		°C	45	
	minimum		°C	0	
Renewable source operating conditions					
Power recovered from renewable source	Evaporator inlet temperature/Delivery temperature	B0W35	kW	16,4	-
		B0W50	kW	12,1	-
		B0W65	kW	7,0	-
		W10W35	kW	-	18,7
		W10W50	kW	-	16,6
		W10W65	kW	-	10,6
Renewable source water return temperature	maximum		°C	45	
Renewable source delivery water temperature	minimum		°C	-5	3
Renewable source water flow rate (with 25% glycol)	nominal (B0W50)		l/h	3020	-
	maximum		l/h	4000	-
	minimum		l/h	2000	-
Renewable source water flow rate	nominal (W10W50)		l/h	-	2850
	maximum		l/h	-	4700
	minimum		l/h	-	2300

(1) In transient operation, lower temperatures are allowed.
(2) For flows other than nominal see Design Manual, Pressure losses Paragraph.
(3) ±10% depending on power voltage and absorption tolerance of electric motors.
(4) PCI (G20) 34,02 MJ/m^3 (15 °C - 1013 mbar).
(5) PCI (G30/G31) 46,34 MJ/kg (15 °C - 1013 mbar).
(6) Sound power values detected in compliance with the intensity measurement methodology set forth by standard EN ISO 9614; C type installation.
(7) Maximum sound pressure levels in free field, with directionality factor 2, obtained from the sound power level in compliance with standard EN ISO 9614; C type installation.
(8) Indoor variant only.
(9) Overall dimensions excluding fumes pipes.

			GAHP GS HT	GAHP WS
Renewable source pressure drop	at nominal water flow	bar	0,51 (2)	0,38 (2)
Electrical specifications				
Power supply	voltage	V	230	
	type	-	SINGLE PHASE	
	frequency	50 Hz supply	50	
Electrical power absorption	nominal	kW	0,41 (3)	
Degree of protection	IP	-	X5D	
Installation data				
Gas consumption	methane G20 (nominal)	m^3/h	2,72 (4)	
	methane G20 (min)	m^3/h	1,34	
	G25 (nominal)	m^3/h	3,16	
	G25 (min)	m^3/h	1,57	
	G30 (nominal)	kg/h	2,03 (5)	
	G30 (min)	kg/h	0,99	
	G31 (nominal)	kg/h	2,00 (5)	
	G31 (min)	kg/h	0,98	
NO_x emission class		-	5	
NO_x emission		ppm	25,0	
CO emission		ppm	36,0	
Sound power L_w (max)		dB(A)	66,1 (6)	
Sound pressure L_p at 5 metres (max)		dB(A)	44,1 (7)	
Minimum storage temperature		°C	-30	
Maximum water pressure in operation		bar	4	
Maximum flow flue condensate		l/h	4,0	
Water content inside the apparatus	hot side	l	4	
	cold side	l	3	
Water fitting	type	-	F	
	thread	" G	1 1/4	
Gas connection	type	-	F	
	thread	" G	3/4	
Safety valve outlet channel fitting		" G	1 1/4 (8)	
Fume outlet	diameter (Ø)	mm	80	
	residual head	Pa	80	
	product configuration		C63	
Type of installation		-	C13, C33, C43, C53, C63, C83, B23P, B33	
Dimensions	width	mm	848 (9)	
	depth	mm	690	
	height	mm	1278	
Weight	in operation	kg	300	
General information				
Cooling fluid	ammonia R717	kg	7,0	7,2
	water H_2O	kg	10,0	9,6
Maximum pressure of the cooling circuit		bar	32	

(1) In transient operation, lower temperatures are allowed.
(2) For flows other than nominal see Design Manual, Pressure losses Paragraph.
(3) ±10% depending on power voltage and absorption tolerance of electric motors.
(4) PCI (G20) 34,02 MJ/m^3 (15 °C - 1013 mbar).
(5) PCI (G30/G31) 46,34 MJ/kg (15 °C - 1013 mbar).
(6) Sound power values detected in compliance with the intensity measurement methodology set forth by standard EN ISO 9614; C type installation.
(7) Maximum sound pressure levels in free field, with directionality factor 2, obtained from the sound power level in compliance with standard EN ISO 9614; C type installation.
(8) Indoor variant only.
(9) Overall dimensions excluding fumes pipes.

Table 2.2 *PED data*

			GAHP GS HT	GAHP WS
PED data				
Components under pression	generator	l	18,6	
	leveling chamber	l	11,5	
	evaporator	l	3,7	
	cooling volume transformer	l	4,5	
	absorber/condenser	l	3,7	
	cooling absorber solution	l	6,3	
	solution pump	l	3,3	
Test pressure (in air)		bar g	55	
Maximum pressure of the cooling circuit		bar g	32	
Filling ratio		kg of NH_3/l	0,146	0,150
Fluid group		-	group 1°	

2.4.1 Pressure drops

Condenser

Table 2.3 *p. 6* shows the condenser side pressure drop data referring to GAHP GS HT unit.

Table 2.3 *Pressure drop GAHP GS condenser side*

Water flow rate	Vector fluid temperature at outlet		
	35 °C	50 °C	65 °C
	Bar	Bar	Bar
2000 l/h	0,23	0,21	0,19
3000 l/h	0,46	0,43	0,38
4000 l/h	0,78	0,72	0,64

Table 2.4 *p. 6* shows the condenser side pressure drop data referring to GAHP WS unit.

Table 2.4 *Pressure drop GAHP WS condenser side*

Water flow rate	Vector fluid temperature at outlet		
	35 °C	50 °C	65 °C
	Bar	Bar	Bar
2000 l/h	0,23	0,21	0,19
3000 l/h	0,46	0,43	0,38
4000 l/h	0,78	0,72	0,64

Evaporator

Table 2.5 *p. 6* shows the evaporator side pressure drop data referring to GAHP GS HT unit.

Table 2.5 *Pressure drop GAHP GS evaporator side*

Water flow rate	Vector fluid temperature at outlet		
	-5 °C	0 °C	5 °C
	Bar	Bar	Bar
2500 l/h	0,43	0,40	0,38
3000 l/h	0,57	0,54	0,52
3500 l/h	0,74	0,70	0,67

The data refer to operation with 25% glycol water.

Table 2.6 *p. 6* shows the evaporator side pressure drop data referring to GAHP WS unit.

Table 2.6 *Pressure drop GAHP WS evaporator side*

Water flow rate	Vector fluid temperature at outlet	
	3 °C	7 °C
	Bar	Bar
2500 l/h	0,31	0,30
3000 l/h	0,44	0,43
3500 l/h	0,60	0,58

The data refer to operation with no glycol in water.

2.4.2 Performances

Heating

Table 2.7 *p. 6* shows the unitary thermal power at full load and stable operation, depending on hot water delivery temperature to the system and cold water return temperature from the renewable source for GAHP GS HT unit.
Please consider that, according to the actual heating request, the unit may often need to operate under partial load conditions and in non stationary operation.

Table 2.7 *GAHP GS HT heating power for each unit*

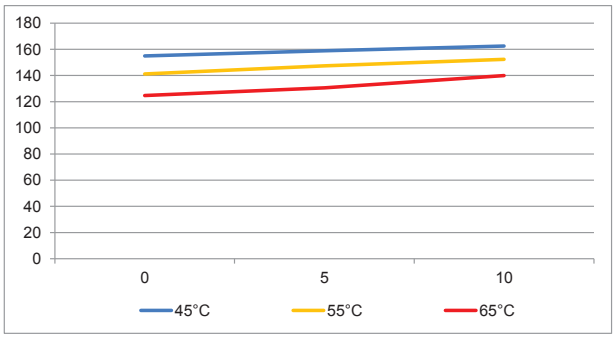
Evaporator inlet water temperature	Water delivery temperature							
	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C (1)
	KW	KW	KW	KW	KW	KW	KW	KW
0 °C	41,6	40,5	39,0	37,6	35,6	33,5	31,4	13,6
5 °C	42,2	41,7	40,0	39,0	37,1	35,2	32,9	13,9
10 °C	42,3	41,8	40,9	40,0	38,4	37,1	35,2	15,5
15 °C	42,6	42,2	41,7	40,9	39,6	39,0	37,1	16,0

(1) Thermal input reduced to 50%

Data refer to hot water delivery temperature to system (condenser outlet). The nominal thermal gradient is considered to be 10 °C.
Data refer to cold water return temperature from renewable source (evaporator inlet). The nominal thermal gradient is considered to be 5 °C.

Picture 2.3 *p. 6* shows the GUE trend at full load in heating mode and in stable operation for three representative delivery temperatures for GAHP GS HT unit.
Please consider that, according to the actual heating request, the unit may often need to operate under partial load conditions and in non stationary operation.

Figure 2.3 *GUE GAHP GS HT heating mode*



In abscissa the return water temperature from renewable source
In ordinate the full load GUE rate

Table 2.8 *p. 7* shows the unitary thermal power at full load and stable operation, depending on hot water delivery temperature to the system and cold water return temperature from the renewable source for GAHP WS unit.

Please consider that, according to the actual heating request, the unit may often need to operate under partial load conditions and in non stationary operation.

Table 2.8 *GAHP WS heating power for each unit*

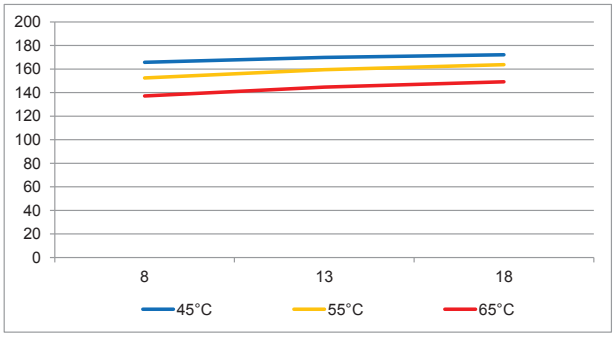
Evaporator inlet water temperature	Water delivery temperature							
	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C (1)
	KW	KW	KW	KW	KW	KW	KW	KW
10 °C	43,9	43,2	42,4	41,6	39,6	37,7	35,8	13,6
15 °C	43,9	43,6	43,1	42,6	40,6	38,8	36,9	14,1
20 °C	43,9	43,6	43,6	43,6	41,7	39,9	38,1	14,6
25 °C	43,9	43,6	43,6	43,6	42,8	41,0	39,2	15,1

(1) Thermal input reduced to 50%

Data refer to hot water delivery temperature to system (condenser outlet). The nominal thermal gradient is considered to be 10 °C.
Data refer to cold water return temperature from renewable source (evaporator inlet). The nominal thermal gradient is considered to be 5 °C.

Picture 2.4 *p. 7* shows the GUE trend at full load in heating mode and in stable operation for three representative delivery temperatures for GAHP WS unit.
Please consider that, according to the actual heating request, the unit may often need to operate under partial load conditions and in non stationary operation.

Figure 2.4 *GUE GAHP WS heating mode*



In abscissa the return water temperature from renewable source
In ordinate the full load GUE rate

Power recovered from renewable source

Conditioning efficiency corresponds to the power recovered from the renewable energy source

Table 2.9 *p. 7* shows the unitary power recovered from the renewable energy source at full load and stable operation, depending on hot water delivery temperature to the system and cold water return temperature from the renewable source for GAHP GS HT unit.
Please consider that, according to the actual heat exchange with the renewable source (or cooling request), the unit may often need to operate under partial load conditions and in non stationary operation.

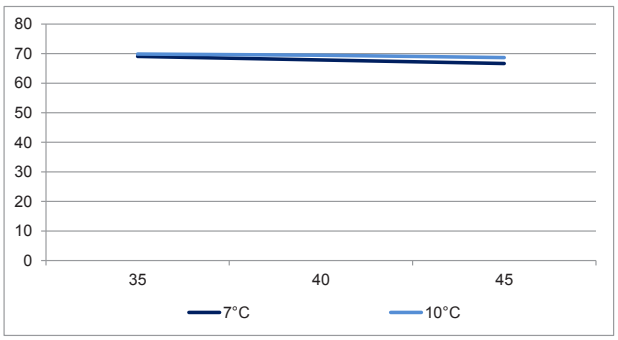
Table 2.9 *Power recovered from renewable source GAHP GS HT*

Evaporator inlet water temperature	Water delivery temperature					
	35 °C	40 °C	45 °C	50 °C	55 °C	60 °C
	KW	KW	KW	KW	KW	KW
12 °C	17,6	17,4	17,4	17,1	16,8	15,8
15 °C	17,9	17,7	17,6	17,5	17,3	16,6

Data refer to hot water delivery temperature to system (condenser outlet). The nominal thermal gradient is considered to be 10 °C.
Data refer to cold water return temperature from renewable source (evaporator inlet). The nominal thermal gradient is considered to be 5 °C.

Picture 2.5 *p. 7* shows the GUE trend at full load in conditioning mode and in stable operation for two representative delivery temperatures for GAHP GS HT unit.
Please consider that, according to the actual heat exchange with the renewable source (or cooling request), the unit may often need to operate under partial load conditions and in non stationary operation.

Figure 2.5 *GUE GAHP GS HT cooling mode*



In abscissa the return water temperature from renewable source
In ordinate the full load GUE rate

Table 2.10 *p. 8* shows the unitary power recovered from the renewable energy source at full load and stable operation, depending on hot water delivery temperature to the system and cold water return temperature from the renewable source for GAHP WS unit.
Please consider that, according to the actual heat exchange with the renewable source (or cooling request), the unit may often need to operate under partial load conditions and in non stationary operation.

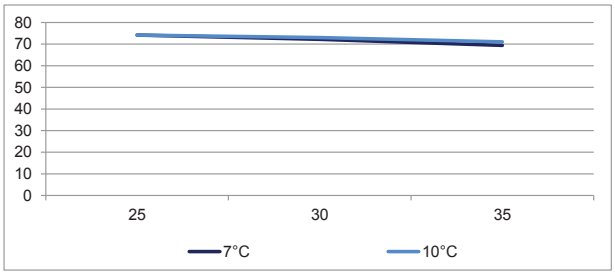
Table 2.10 *Power recovered from renewable source GAHP WS*

Evaporator inlet water temperature	Water delivery temperature			
	45 °C	50 °C	55 °C	60 °C
	KW	KW	KW	KW
12 °C	17,5	16,8	14,8	12,9
15 °C	17,9	17,4	15,4	13,6

Data refer to hot water delivery temperature to system (condenser outlet). The nominal thermal gradient is considered to be 10 °C.
Data refer to cold water return temperature from renewable source (evaporator inlet). The nominal thermal gradient is considered to be 5 °C.

Picture 2.6 *p. 8* shows the GUE trend at full load in conditioning mode and in stable operation for two representative delivery temperatures for GAHP WS unit.
Please consider that, according to the actual heat exchange with the renewable source (or cooling request), the unit may often need to operate under partial load conditions and in non stationary operation.

Figure 2.6 *GUE GAHP WS cooling mode*



In abscissa the return water temperature from renewable source
In ordinate the full load GUE rate

3 DESIGN

Compliance with installation standards

Design and installation must comply with applicable regulations in force, based on the installation Country and site, in matters of safety, design, implementation and maintenance of:

- heating systems;
- cooling systems;
- gas systems;
- flue gas exhaust;
- flue gas condensate discharge.

Design and installation must also comply with the manufacturer's provisions.

3.1 PLUMBING DESIGN

Please refer to Section C1.04.

3.2 FUEL GAS SUPPLY

Please refer to Section C1.09.

3.3 COMBUSTION PRODUCTS EXHAUST

Compliance with standards

The appliance is approved for connection to a combustion products exhaust duct for the types shown in Table 2.1 *p. 4*.

3.3.1 Flue gas exhaust connection

- Ø 80 mm (with gasket), on the left side, at the top, side panel (outlet A Pictures 2.1 *p. 2* and 2.2 *p. 3*).

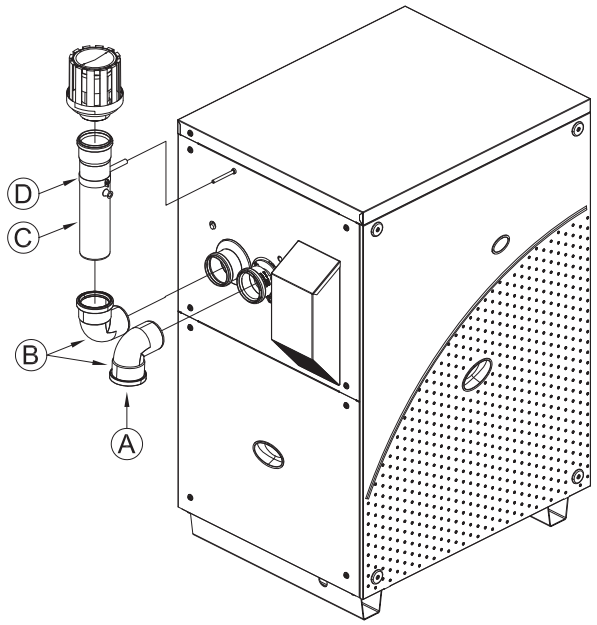
3.3.2 Indoor version

The appliance is supplied in configuration type B63.

3.3.3 Outdoor version

The appliance is supplied with flue gas exhaust kit, to be fitted by the installer, shown in Picture 3.1 *p. 9*.

Figure 3.1 *Flue gas exhaust outdoor version*

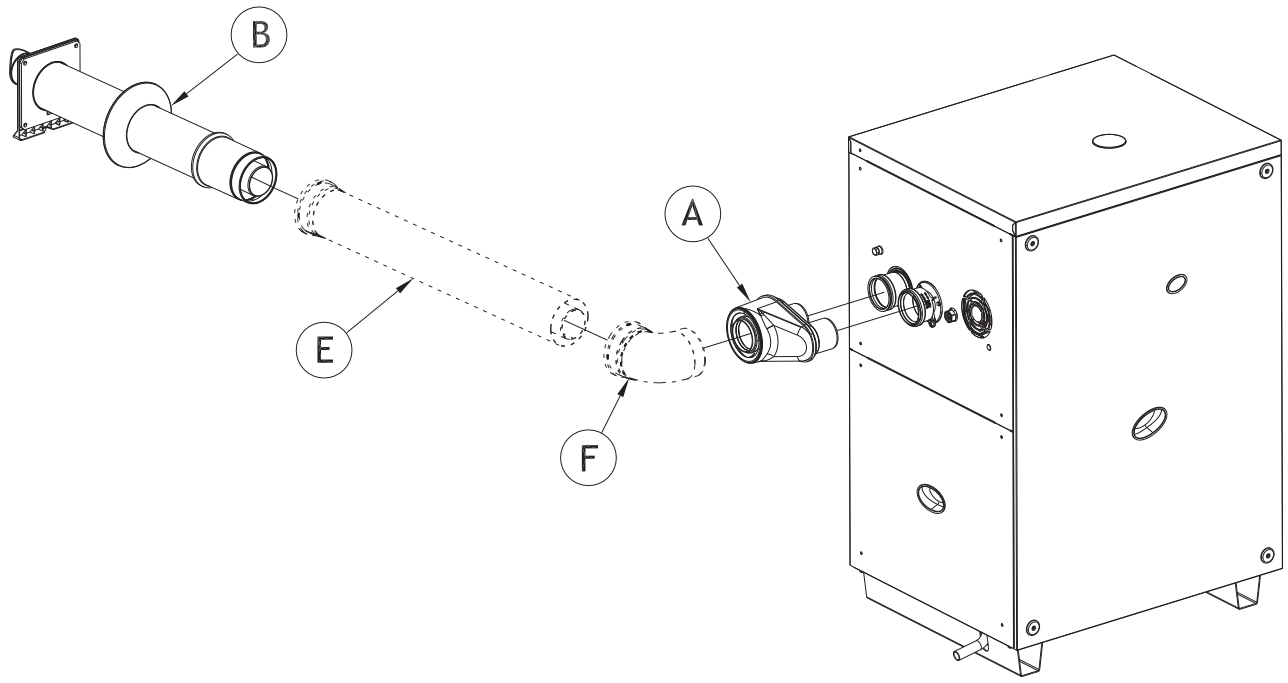


A Air intake
B 90° elbow Ø 80
C Pipe Ø 80 Lg.300 mm w/terminal
D Collar

3.3.4 Indoor version flue gas exhaust set-ups

The possible configurations are shown in the Figures 3.2 *p. 10*, 3.3 *p. 11*, 3.4 *p. 12*, 3.5 *p. 13*, 3.6 *p. 14*.

Figure 3.2 *Type C13 coaxial flue gas exhaust*



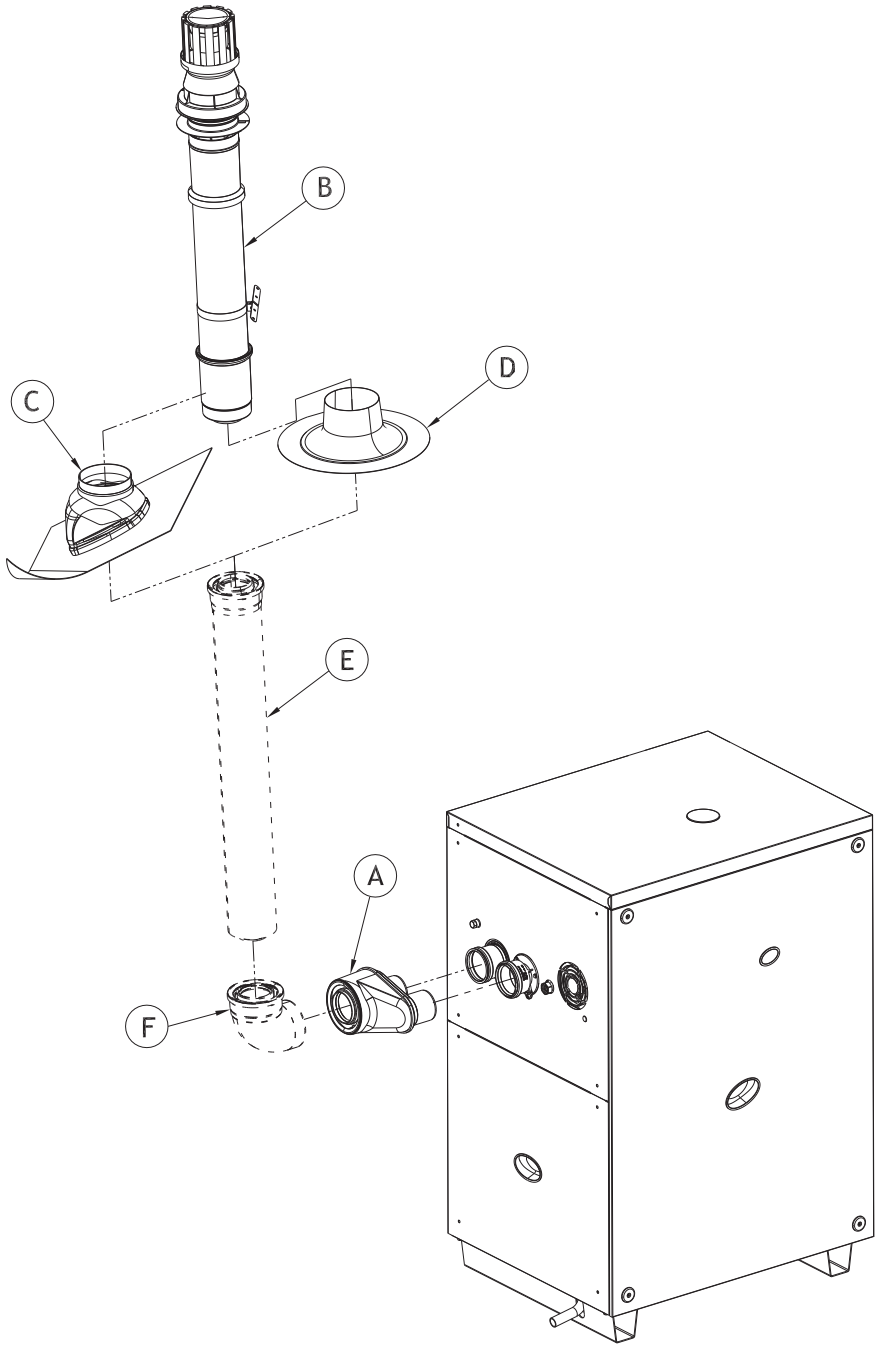
80/125

A Splitter DN80/125 2xDN80
B Wall coaxial terminal DN80/125
E Coaxial pipe 80/125 L= 1 m (o 2 m)
F Coaxial elbow 90° (or 45°) 80/125

60/100

A Splitter DN60/100 2xDN80
B Wall coaxial terminal DN60/100
E Coaxial pipe 60/100 L= 1 m (o 2 m)
F Coaxial elbow 90° (or 45°) 60/100

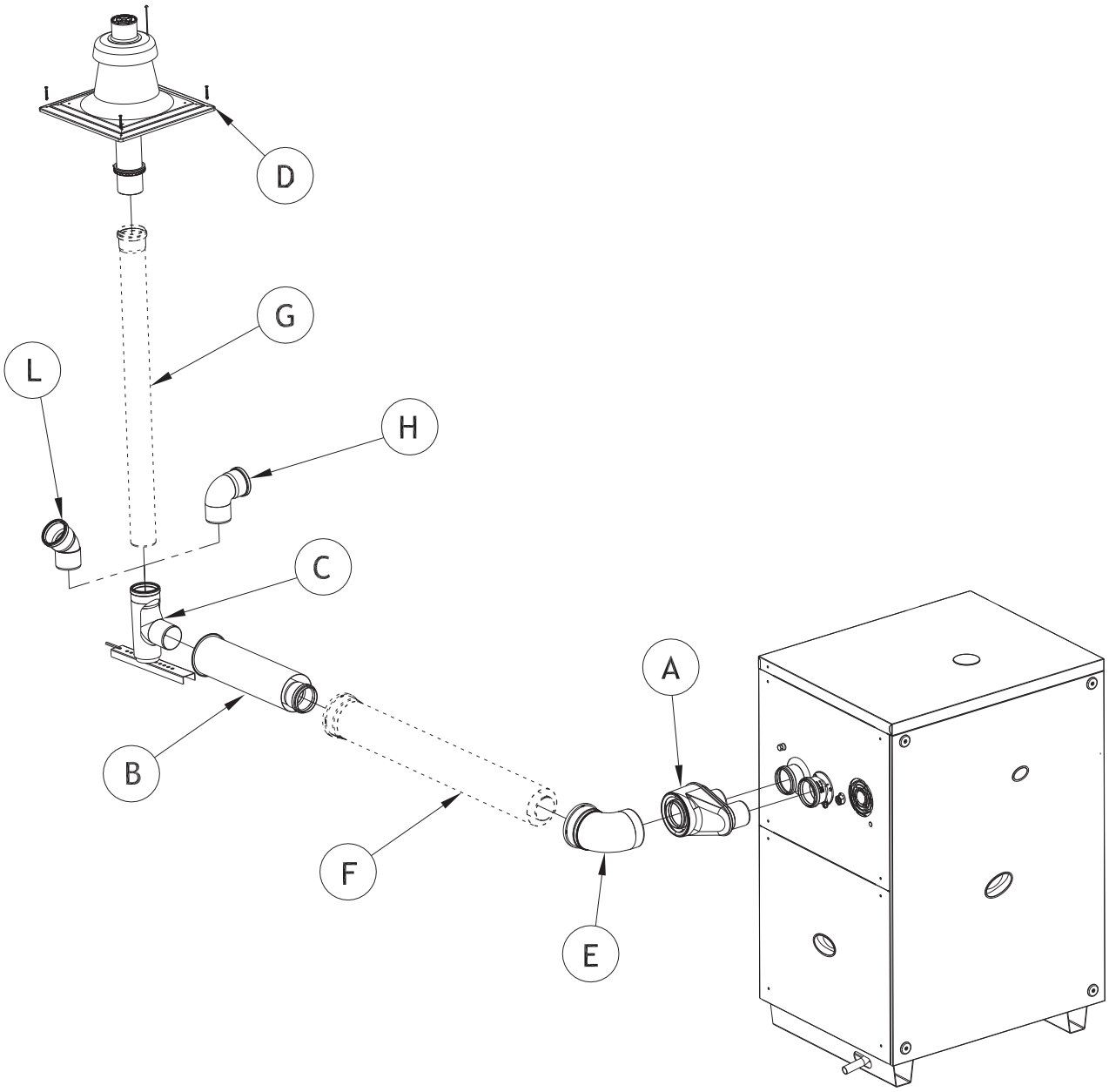
Figure 3.3 *Type C33 coaxial flue gas exhaust*



80/125
A DN80/125 2xDN80 double fitting
B Co-axial roof terminal 80/125
C Tile adaptor for sloped roof
D Tile adaptor for flat roof
E Roof coaxial pipe 80/125 L= 1 m (or 2 m)
F Coaxial elbow 90° (or 45°) 80/125

60/100
A DN60/100 2xDN80 double fitting
B Co-axial roof terminal 60/100
C Tile adaptor for sloped roof
D Tile adaptor for flat roof
E Roof coaxial pipe 60/100 L= 1 m (or 2 m)
F Coaxial elbow 90° (or 45°) 60/100

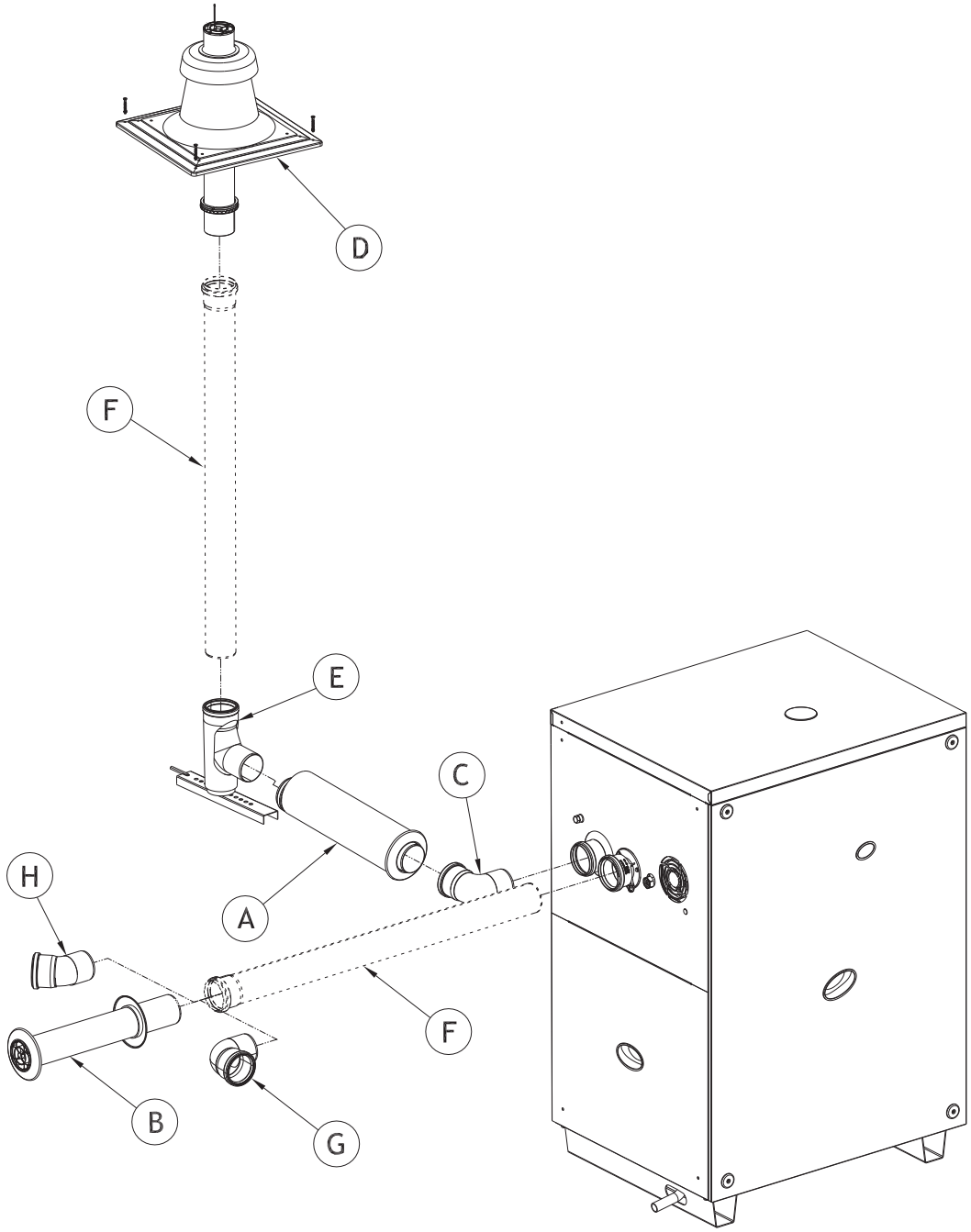
Figure 3.4 *Type C43 coaxial flue gas exhaust*



80/125
A Splitter DN80/125 2xDN80
B Wall passage DN 80/125
C Chimney support kit DN80
D Chimney cowl DN80 w/terminal
E Coaxial elbow 90° (or 45°) 80/125
G Pipe DN 80 L=1 m (or 2 m)
H 90° Elbow DN80
L 45° Elbow DN80

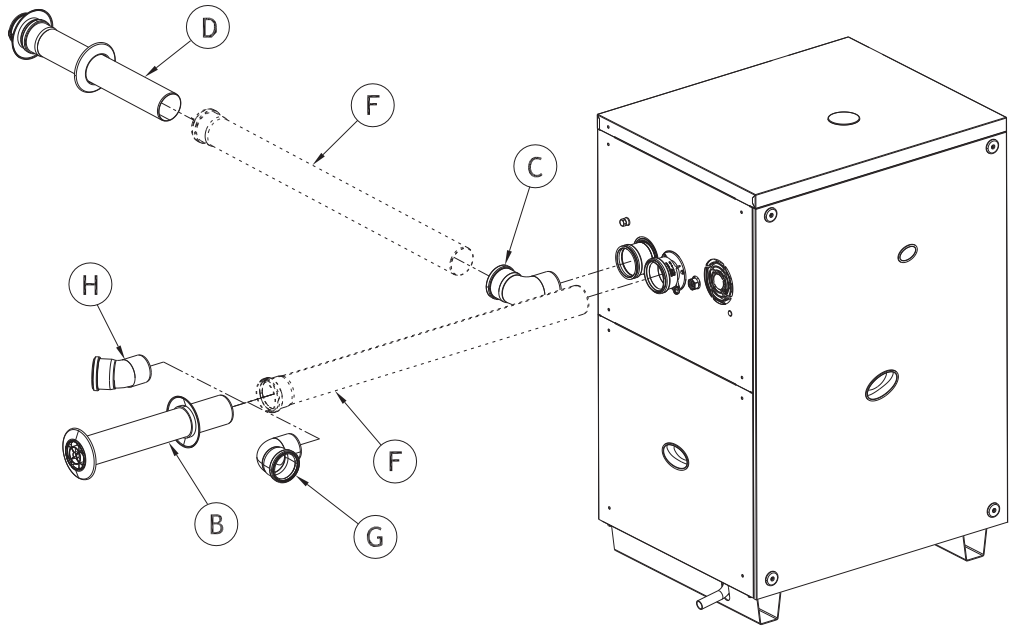
60/100
A Splitter DN60/100 2xDN80
B Wall passage DN 60/100
C Kit supporto camino DN60
D Chimney cowl DN60 w/terminal
E Coaxial elbow 90° (or 45°) DN60/100
F Coaxial pipe DN60/100 L=1 m (or 2m)
G Pipe DN 60 L=1 m (or 2 m)
H 90° Elbow DN60
L 45° Elbow DN60

Figure 3.5 *Type C53 roof flue gas exhaust*



80
A B C Split exhaust intake kit DN80
D Chimney cowl DN80 w/terminal
E Chimney support kit DN80
F Pipe DN80 L = 1 m (or 2 m)
G 90° Elbow DN80
H 45° Elbow DN80

Figure 3.6 *Type C53 split wall flue gas exhaust*



80
B C D Wall terminal kit DN80
F Pipe DN80 L=1 m (or 2 m)
G 90° Elbow DN80
H 45° Elbow DN80

3.3.5 Possible flue

If required, the appliance may be connected to a flue appropriate for condensing appliances.

- ► For flue sizing please refer to the specification sheet in Section C1.10.
- ► If several appliances are connected to a single flue, it is obligatory to install a check valve on the exhaust of each.
- ► The flue must be designed, sized, tested and constructed by a skilled form, with materials and components complying with the regulations in force in the country of installation.
- ► Always provide a socket for flue gas analysis, in an accessible position.

In case the flap valves are installed outside, an appropriate UV ray protection must be assured (if the valve is constructed in plastic material) as well as protection from potential winter freezing of condensate backflow into the siphon.

3.4 FLUE GAS CONDENSATE DISCHARGE

The GAHP GS HT and GAHP WS units are condensing appliances and therefore produce condensation water from combustion flue gas.

Condensate acidity and exhaust regulations

The flue gas condensate contains aggressive acid substances. Refer to applicable regulations in force for condensate exhaust and disposal.

- ■ If required, install an acidity neutraliser of adequate capacity.

Do not use gutters to discharge the condensate.

Do not discharge the fume condensate in gutters, due to the risk of materials corrosion and ice formation.

3.4.1 Flue gas condensate connection

The fitting for flue gas condensate discharge is located on the left side of the appliance (Figure 3.7 *p. 15*).

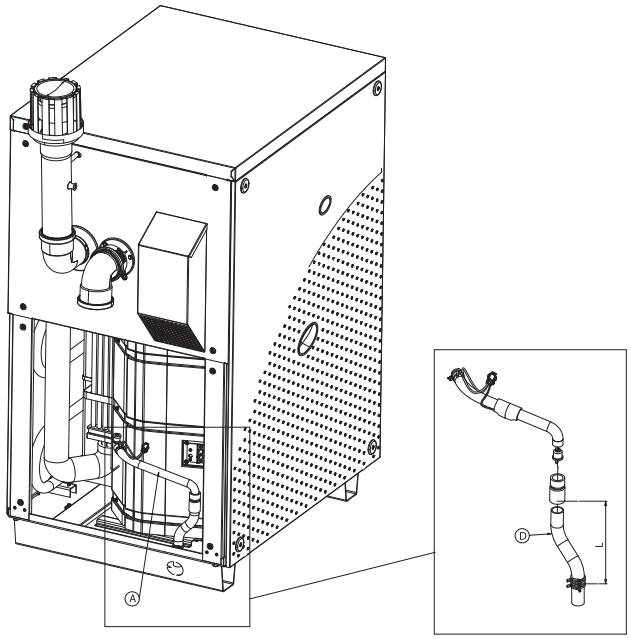
- ► The corrugated condensate discharge pipe must be connected to a suitable discharge manifold.
- ► The junction between the pipe and the manifold must remain visible.

3.4.2 Flue gas condensate discharge manifold

To make the condensate discharge manifold:

- ► Size the ducts for maximum condensation capacity (Table 2.1 *p. 4*).
- ► Use plastic materials resistant to acidity pH 3-5.
- ► Provide for min. 1% slope, i.e. 1 cm for each m of the length (otherwise a booster pump is required).
- ► Prevent icing.
- ► Dilute, if possible, with domestic waste water (e.g. bathrooms, washing machines, dish washers...), basic and neutralising.

Figure 3.7 *Flue gas condensate drain manifold*



A Condensate discharge hose
D Corrugated hose

3.5 SAFETY VALVE EXHAUST (INDOOR VERSION)

The safety valve drain must be mandatorily ducted outside. Failure to comply with this provision jeopardizes first start-up.

Do not install any shut off device on the exhaust duct between the safety valve and the outside exhaust.

3.5.1 Safety valve drain ducting

The exhaust ducting shall be made in steel pipes (do not use copper or its alloys). Table 3.1 *p. 15* provides sufficient criteria of pipe sizing; alternatively, less compelling sizing is accepted, provided it is compliant with specific applicable norms (the manufacturer cannot be held liable).

Table 3.1 *Safety valve drain ducting*

Diameter	DN	Maximum length (m)
1" 1/4	32	30
2"	50	60

The exhaust duct must have an initial straight section of at least 30 cm.

Place the drain terminal outside the room, away from doors, windows and aeration vents, and at such a height that any coolant leaks cannot be inhaled by any people.

3.6 ELECTRICAL AND CONTROL CONNECTIONS

3.6.1 Warnings

Earthing

- The appliance must be connected to an effective earthing system, installed in compliance with regulations in force.
- It is forbidden to use gas pipes as earthing.

Cable segregation

Keep power cables physically separate from signal ones.

Do not use the power supply switch to turn the appliance on/off

- Never use the external isolation switch (GS) to turn the appliance on and off, since it may be damaged in the long run (occasional black outs are tolerated).
- To turn the appliance on and off, exclusively use the suitably provided control device (DDC, CCP/CCI or external request).

Control of water circulation pumps

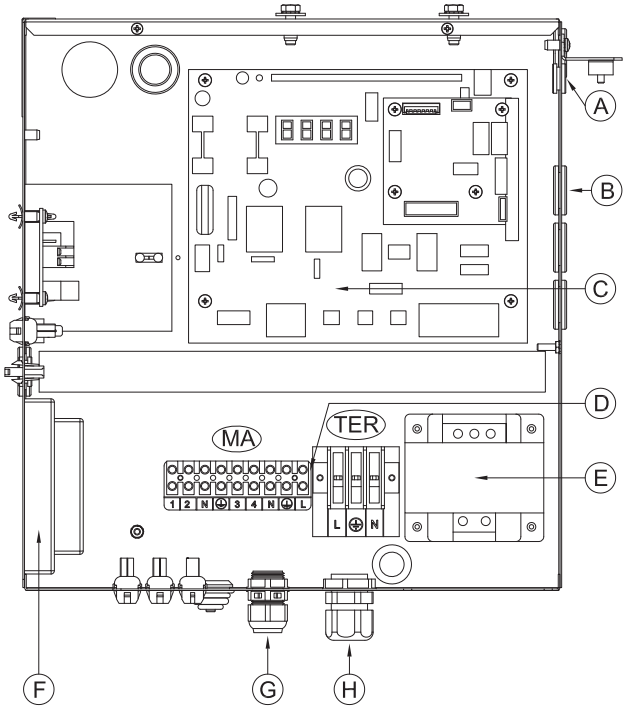
The two water circulation pumps of the water/primary circuit, hot side and cold side, must mandatorily be controlled by the appliance's electronic boards. It is not admissible to start/stop the circulating pump with no request from the appliance.

3.6.2 Electrical systems

Electrical connections must provide:

► (a) power supply;
► (b) control system.

Figure 3.8 *GAHP GS/WS Electrical Panel*



A CAN-BUS cable gland
B Signal cable gland 0...10 V pump Wilo Stratos Para
C Electronic boards S61+Mod10+W10
D Terminal blocks
E Transformer 230/23 V AC
F Flame control box
G Circulation pump power supply and control cable gland
H GAHP power supply cable gland

Terminals:
TER terminal box
L-(PE)-N phase/earth/neutral GAHP power supply

MA terminal box
N-(PE)-L neutral/earth/phase circulation pump power supply
3-4 circulation pump enable

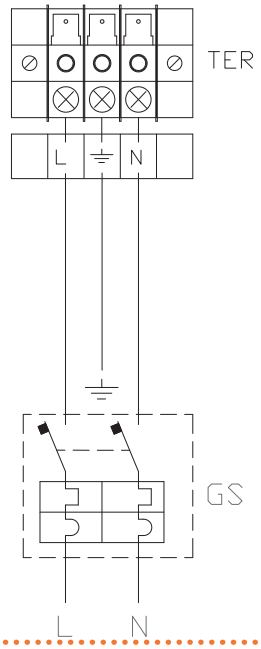
3.6.3 Electrical power supply

Power supply line

Provide (by the installer) a protected single phase line (230 V 1-N 50 Hz) with:

- ► 1 three-pole cable type FG7(O)R 3Gx1.5;
- ► 1 two-pole switch with two 5A type T fuses, (GS) or one 10A magnetothermic breaker.

Figure 3.9 *Electrical wiring diagram - Example of connection of appliance to 230 V 1 N - 50 Hz electricity supply*



TER terminal block
L phase
N neutral

Components NOT SUPPLIED
GS general switch

The switches must also provide disconnector capability, with min contact opening 4 mm.

3.6.4 Set-up and control

Control systems, options (1) (2) (3)

Three separate adjustment systems are provided, each with specific features, components and diagrams (see 3.11 *p. 17*, 3.12 *p. 18*):

- ► System (1), with **DDC control** (with CAN-BUS connection).
- ► System (2), with **CCP/CCI control** (with CAN-BUS connection).
- ► System (3), with an **external request**.

CAN-BUS communication network

The CAN-BUS communication network, implemented with the cable of the same name, makes it possible to connect and remotely control one or more Robur appliances with the DDC or CCP/CCI control devices.
It entails a certain number of serial nodes, distinguished in:

- ► intermediate nodes, in variable number;
- ► terminal nodes, always and only two (beginning and end);

Each component of the Robur system, appliance (GAHP, GA, AY, ...) or control device (DDC, RB100, RB200, CCI, ...), corresponds to a node, connected to two more elements (if it is an intermediate node) or to just one other element (if it is a terminal node) through two/one CAN-BUS cable section/s, forming an open linear communication network (never star or loop-shaped).

CAN-BUS signal cable

The DDC or CCP/CCI controllers are connected to the appliance through the CAN-BUS signal cable, shielded, compliant to Table 3.2 *p. 17* (admissible types and maximum distances).
For lengths ≤200 m and max 4 nodes (e.g. 1 DDC + 3 GAHP), a simple 3x0.75 mm shielded cable may even be used.

Table 3.2 *CAN BUS cables type*

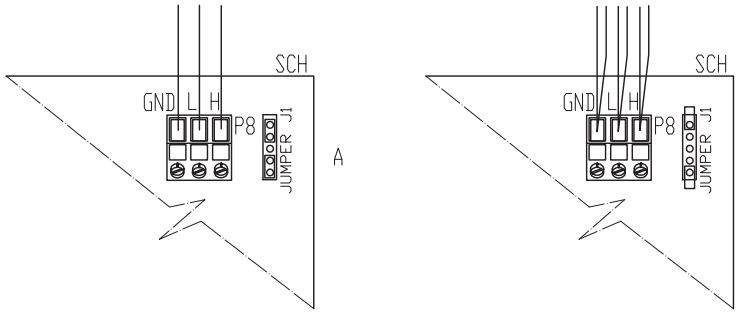
CABLE NAME	SIGNALS / COLOR			MAX LENGTH	Note
Robur					Ordering Code OCVO008
ROBUR NETBUS	H= BLACK	L= WHITE	GND= BROWN	450 m	
Honeywell SDS 1620					In all cases the fourth conductor should not be used
BELDEN 3086A	H= BLACK	L= WHITE	GND= BROWN	450 m	
TURCK type 530					
DeviceNet Mid Cable					
TURCK type 5711	H= BLUE	L= WHITE	GND= BLACK	450 m	
Honeywell SDS 2022					
TURCK type 531	H= BLACK	L= WHITE	GND= BROWN	200 m	

How to connect the CAN BUS cable to the appliance

To connect the CAN-BUS cable to the S61 electronic board, located in the Electrical Panel inside the appliance, (Pictures 3.10 *p. 17* and 3.11 *p. 17*):

1. Access the Electrical Board of the appliance according to the Procedure 3.6.2 *p. 15*);
2. Connect the CAN-BUS cable to terminals GND, L and H (shielding/earthing + two signal conductors);
3. Place the CLOSED J10 Jumpers (Detail A) if the node is terminal (one connected CAN-BUS cable section only), or OPEN (Detail B) if the node is intermediate (two connected CAN-BUS cable sections);
4. Connect the DDC or the CCP/CCI to the CAN-BUS cable according to the instructions in the following Paragraphs and the DDC or CCP/CCI Manuals.

Figure 3.10 *Electrical wiring diagram - Connection cable CAN BUS to electronic board*

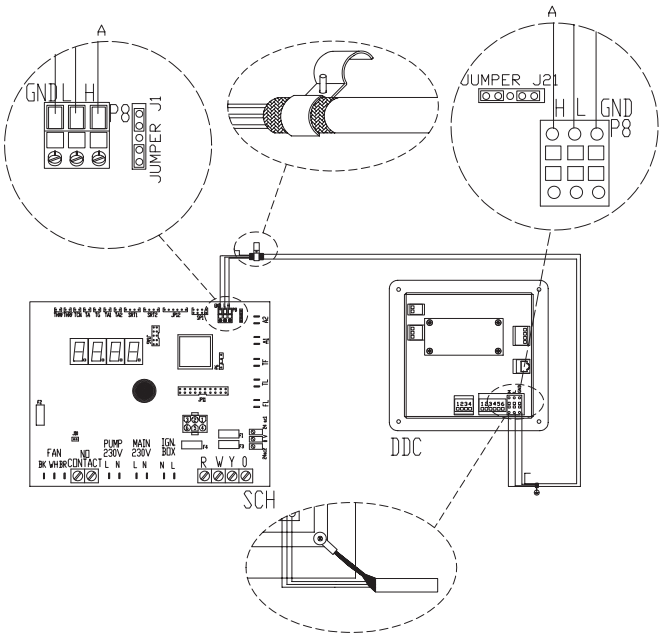


SCH Electronic board
GND Common data
L Data signal LOW
H Data signal HIGH
J1 Jumper CAN-BUS in board
A detail of "terminal node" case (3 wires; J1=jumper "closed")
B Detail of "intermediate node" case (6 wires; J1=jumper "open")
P8 CAN port/connector

GAHP Configuration (S61) + DDC or CCP/CCI

Systems (1) and (2), Figure 3.11 *p. 17*, see also Paragraph 2.3 *p. 3*.

Figure 3.11 *CAN-BUS connection for systems with one unit*



DDC Direct Digital Control
SCH electronic board S61
J1 Jumper CAN-BUS in board S61
J21 Jumper CAN-BUS in board DDC
A terminal node connection (3 wires; J1 and J21 = "closed")
H,L,GND data signal wires (ref. cables table)

External request

System (3), Figures 3.12 *p. 18*, 3.13 *p. 18*, see also Paragraph 2.3 *p. 3*.

It is required to arrange:

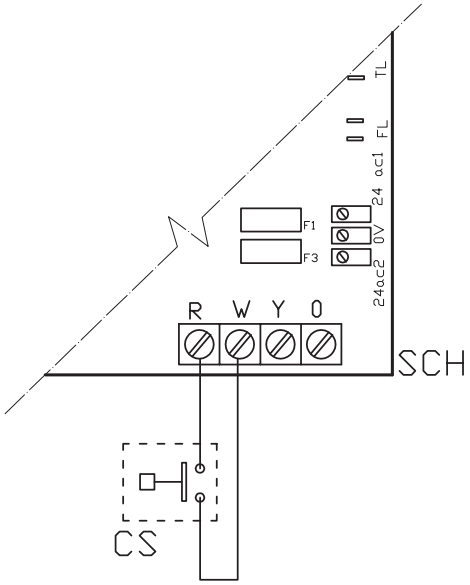
► request device (e.g. thermostat, clock, button, ...) fitted with a voltage-free NO contact.

How to connect the external request

Connection of external request is effected on the S61 board located in the Electrical Panel inside the appliance (Figure 3.12 *p. 18* 3.13 *p. 18*):

1. Access the Electrical Board of the appliance according to the Procedure 3.6.2 *p. 15*.
2. connect the voltage-free contact of the external device (Detail CS) through two lead wires to **terminals R and W** of electronic board S61, respectively common 24 V AC and heating request, if the unit works with heating priority, or to **terminals R and Y**, respectively common 24 V AC and cooling request, if the unit works with cooling priority.

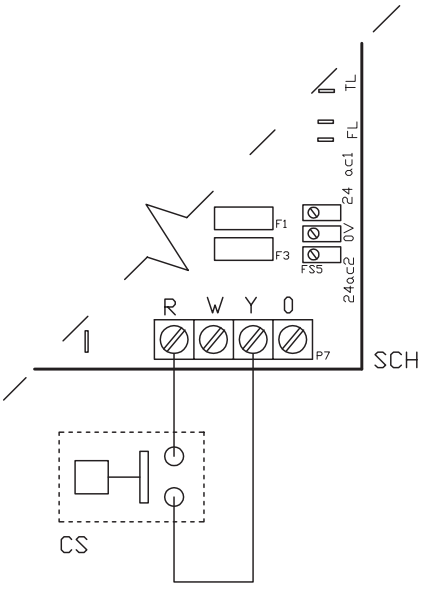
Figure 3.12 *Wiring diagram, external heating enable connection*



SCH Electronic board
R Common
W Terminal consensus warming

Components NOT SUPPLIED
CS external request

Figure 3.13 *Wiring diagram, external cooling enable connection*



SCH Electronic board
R Common
Y Cooling request terminal

Components NOT SUPPLIED
CS External request

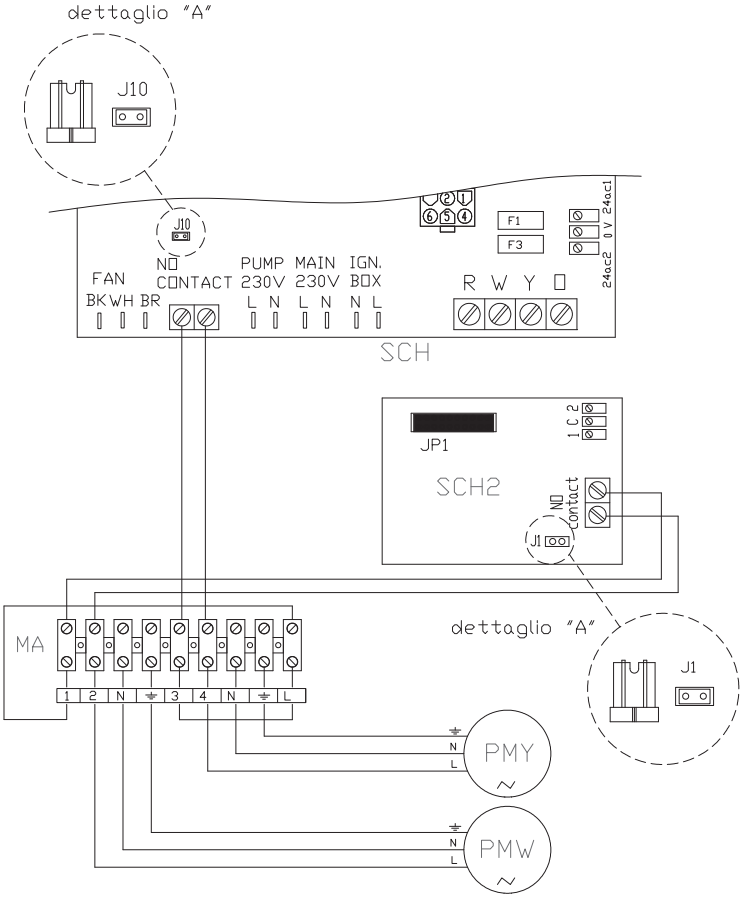
3.6.5 Water circulation pumps

Option (1) CONSTANT FLOW circulating pumps

The two primary pumps, hot side and cold side, must obligatorily be controlled by electronic board S61.

The diagram in Figure 3.14 *p. 19* is for pumps < 700 W. For pumps > 700 W it is necessary to add a control relay and arrange Jumper J1 (hot side pump) and J10 (cold side pump) OPEN.

Figure 3.14 *Constant rate pumps connection wiring diagram*



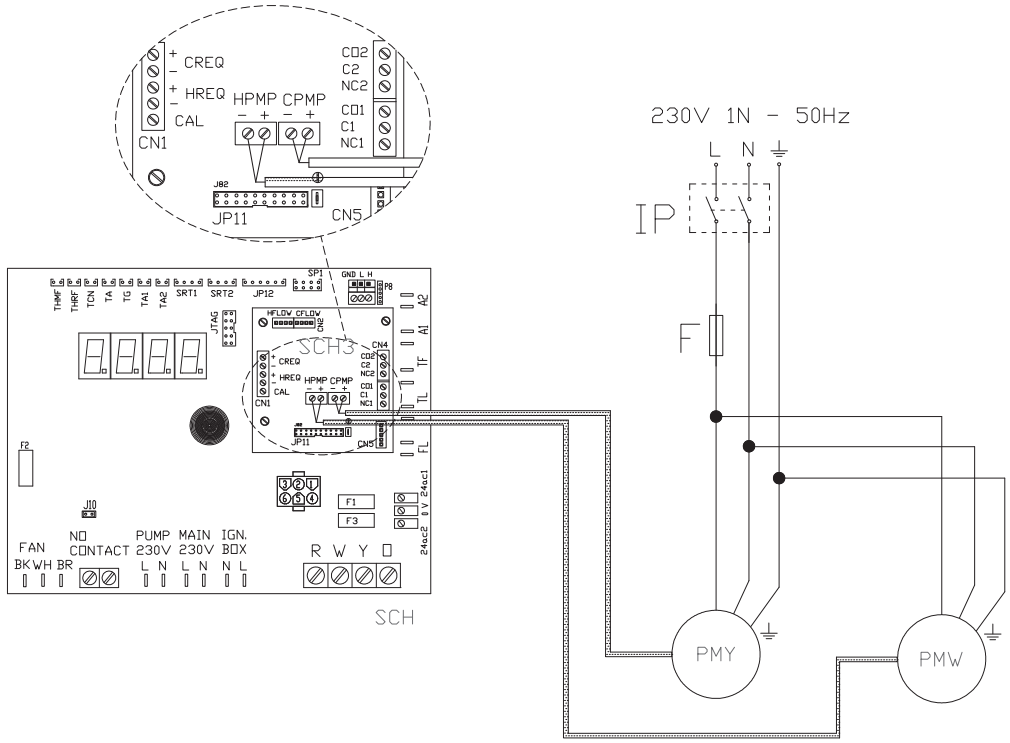
SCH electronic board
SCH2 circuit board
J10 closed jumper (cold side pump)
J1 closed jumper (hot side pump)
N.O. CONTACT N.O voltage free contacts
MA unit terminal block
L phase
N neutral

Components NOT SUPPLIED
PMW hot side water pump < 700W
PMY cold side water pump < 700W

3.6.5.1 Option (2) VARIABLE FLOW circulating pumps

The two primary pumps must obligatorily be controlled by electronic board Mod10 (built into S61).
The Wilo Stratos Para pump is already standard supplied with the power supply cable and signal cable, both 1.5m long.
For longer distances, use respectively cable FG7 3Gx1.5mm^2 m and shielded cable 2x0.75 mm^2 suitable for 0-10V signal.
Only the hot side pump will actually be controlled with variable flow. The cold side pump will in any case be controlled with constant flow.

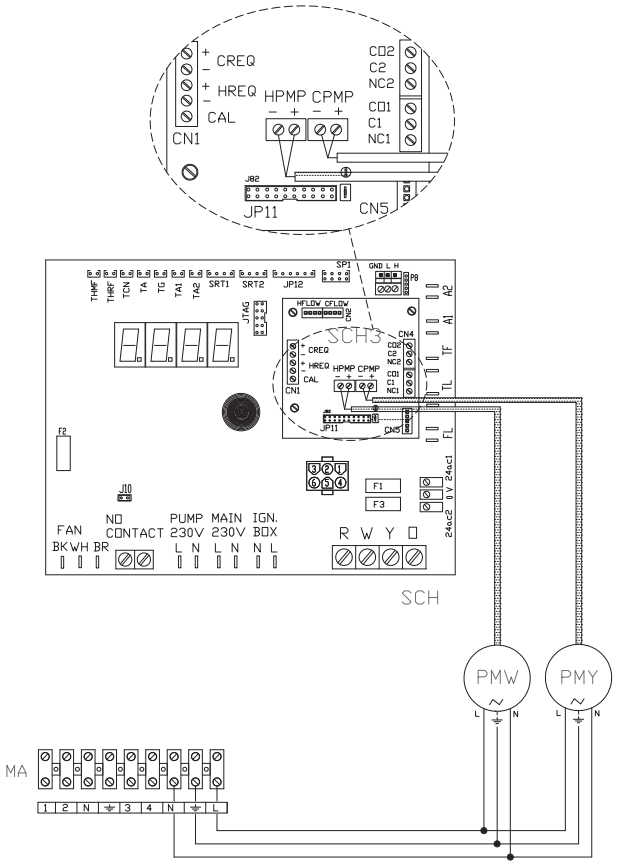
Figure 3.15 *Wiring diagram for connection of Wilo Stratos Para variable rate pumps*



IP Two-position pump power switch
F Fuse
PMW Hot side water circulation pump (primary circuit)
PMY Cold side water circulation pump
Pump signal 0-10V wire colours

brown connect to -ve
white connect to +ve
black isolate
blue isolate

Figure 3.16 *Wiring diagram for hooking up the Wilo Stratos Para variable rate pumps powered by the unit*



PMW Hot side water circulation pump (primary circuit)
PMY Cold side water circulation pump
MA unit terminal block
Pump signal 0-10V wire colours
brown connect to -ve
white connect to +ve
black isolate
blue isolate