ROBUR®

caring for the environment

Installation, use and maintenance manual

GA ACF

absorption chiller

gas powered

Revision: P
Code: D-LBR323

INDEX OF CONTENTS

I INTRODUCTION

Installation, use and maintenance manual

This Manual is an integral part of the GA ACF unit and must be handed to the end user together with the appliance.

I.1 RECIPIENTS

This Manual is intended for:

- ► End user, for appropriate and safe use of the appliance.
- ► Qualified installer, for correct appliance installation.
- ► Planner, for specific information on the appliance.

I.2 CONTROL DEVICE

In order to be able to work, the GA ACF unit needs a control device (DDC or external request), which must be connected by the installer.

II SYMBOLS AND DEFINITIONS

II.1 KEY TO SYMBOLS

DANGER

WARNING

NOTE

PROCEDURE

REFERENCE (to other document)

II.2 TERMS AND DEFINITIONS

GA Appliance/Unit = equivalent terms, both used to designate the GA Gas Absorption chiller.

AT = Robur Authorised Technician.
External request = generic control device (e.g. thermostat, timer or any other system) equipped with a voltage-free NO contact and used as control to start/stop the GA unit.
DDC Control (Direct Digital Controller) = optional Robur adjustment device to control one or more Robur appliances (GAHP heat pumps, GA chillers and AY00-120 boilers) in ON/OFF mode.
RB100/RB200 Devices (Robur Box) = optional interface devices complementary to DDC, which may be used to broaden its functions (heating/cooling/DHW production service demands, and control of system components such as third party generators, adjustment valves, circulators, probes).
GUE (Gas Utilization Efficiency) = efficiency index of gas chiller, equal to the ratio between the chilling energy produced and the energy of the fuel used (relative to NCV, net calorific value).
First start-up = appliance commissioning operation which may only and exclusively be carried out by an AT.
S61 Board = electronic board on the GA unit, to control all functions and to provide interface with other devices and with the user.

III WARNINGS

III.1 GENERAL AND SAFETY WARNINGS

Installer's qualifications

Installation must exclusively be performed by a qualified firm and by skilled personnel, with specific knowledge on heating, electrical systems and gas appliances, in compliance with the laws in force in the Country of installation. The manufacturer will not accept responsibility for personal injuries or property damage resulting from improper installation.

Declaration of conformity

Upon completing installation, the installing firm shall issue to the owner/client the appliance's workmanlike conformity declaration, according to national/local regulations in force and the manufacturer's instructions/provisions.

Misuse

The appliance must only be used for the purposes for which it has been designed. Any other use is deemed hazardous. Incorrect use may affect operation, duration and safety of the appliance. Adhere to the manufacturer's instructions. Steps must be taken to avoid improper use and potential dangers.

Hazardous situations

- Do not start the appliance in hazardous conditions, such as: gas smell, problems with the plumbing/electrical/gas system, parts of the appliance under water or damaged, malfunctioning, disabling or bypassing control and safety devices.
- Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control, which has been underwater.

- In case of danger, request intervention by qualified personnel.
- In case of danger, switch off the electrical power and gas supplies only if this can be done in total safety.
- Do not entrust children, persons with physical, sensory or mental disabilities or persons with poor knowledge and experience with use of the appliance.

Gas component tightness

- Before performing any operation on gas ducting components, close the gas valve.
- Upon completing any procedure, perform the tightness test according to regulations in force.

Gas smell

If you smell gas:
- Do not use electrical devices such as telephones, multimeters or other equipment that may cause sparks next to the appliance.
- Shut off the gas supply by turning the valve off.
- Switch off the power supply via the external disconnect switch in the power supply electrical panel.
- Use a telephone away from the appliance to ask for intervention from qualified personnel.

Moving parts

The appliance contains moving parts.
- Do not remove guards during operation, and in any case prior to disconnecting the power supply.

Burn hazard

The appliance contains very hot parts.
- Do not open the appliance and do not touch internal components before the appliance has cooled down.

Pressure vessels

The appliance has a sealed circuit classified as pressure vessel, the tightness of which is tested by the manufacturer.
- Do not carry out any intervention on the sealed circuit or on the appliance's valves.

Water-ammonia solution

The GA unit uses the ammonia-water absorption cycle. The water-ammonia solution is contained in the sealed circuit. The solution is harmful for health if it is ingested, inhaled or comes in contact with the skin.
- In the event of coolant leak keep away and disconnect the power and gas supply (only if it is possible to do so with no danger).
- It is recommended that no work be performed on the sealed circuit except by a **qualified service technician or engineer**.
- Care should be taken not to disturb or handle the valves of the sealed circuit.

Electrocution hazard

- Disconnect the electrical power supply before any operation on appliance components.
- For electrical connections exclusively use compliant components and according to the specifications provided by the manufacturer.
- Ensure the appliance cannot be accidentally switched back on.

Grounding

Electrical safety depends on effective grounding system, correctly connected to the appliance and installed according to the regulations in force.

Distance from combustible or flammable materials

- Do not deposit flammable materials (paper, diluents, paints, etc.) near the appliance.

Limescale and corrosion

Depending on the chemical/physical properties of the system water, limescale or corrosion may damage the appliance (Paragraph 3.7 *p. 23*).
- Check system sealing.
- Avoid frequent top-ups.

Chloride concentration

The concentration of chlorides or free chlorine in the system water must not exceed the values in Table 3.2 *p. 23*.

Aggressive substances in the air

Halogenated hydrocarbons containing chlorine and fluorine compounds cause corrosion. The air of the installation site must be free from aggressive substances.

Switching the appliance off

Disconnecting the power supply while the appliance is running may cause permanent damage to internal components.
- Except in the case of danger, do not disconnect the power supply to switch off the appliance, but always and exclusively act through the provided control device (DDC or external request).

In the event of failure

Operations on internal components and repairs may exclusively be carried out by an AT, using only original parts.
- In the event of failure of the appliance and/or breakage of any component, do not attempt to repair and/or restore and immediately contact the AT.

Routine maintenance

Proper maintenance assures the efficiency and good operation of the appliance over time.
- Maintenance must be performed according to the manufacturer's instructions (see Chapter 7 *p. 36*) and in compliance with current regulations.
- Appliance maintenance and repairs may only be entrusted to firms legally authorised to work on gas appliances and systems.
- Enter into a maintenance contract with an authorised specialised firm for routine maintenance and for servicing in case of need.

- Use only original parts.

Decommissioning and disposal

If the appliance is to be disposed of, contact the manufacturer for its disposal.

Keep the Manual

This Installation, use and maintenance manual must always accompany the appliance and must be handed to the new owner or installer in the event of sale or removal.

III.2 CONFORMITY

The installation of the appliance must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the latest edition of the **National Fuel Gas Code, ANSI Z223.1**. If the unit is installed in Canada, the installation must conform to the **Canadian Gas Association Standard CAN1 B149.1 and .2**.
The appliance's electrical connections and grounding must be in accordance with the latest edition of the **National Electrical Codes, ANSI/NFPA No. 70 (CSA Standard C22.1 when installed in Canada)** and with any local codes. To ensure the electrical safety of this appliance, it must be correctly connected to an efficient grounding system. The manufacturer is not responsible for any damages caused by the failure of the grounding system.

Other applicable provisions and standards

The design, installation, operation and maintenance of the systems shall be carried out in compliance with current applicable regulations, depending on the Country and location, and in accordance with the manufacturer's instructions. In particular, regulations regarding the following shall be complied with:

- ► Gas systems and equipment.
- ► Electrical systems and equipment.
- ► Heating and cooling systems, heat pumps and chillers.
- ► Fire safety and prevention.
- ► Any other applicable law, standard and regulation.

III.3 EXCLUSIONS OF LIABILITY AND WARRANTY

Any contractual or extra-contractual liability of the manufacturer for any damage caused by incorrect installation and/or improper use and/or failure to comply with regulations and with the manufacturer's directions/instructions shall be disclaimed.

The manufacturer cannot be held responsible for any damages to persons, animals or goods due to improper, erroneous or irrational installation of these appliances.

In particular, the warranty on the appliance may be rendered void by the following conditions:

- Incorrect installation.
- Misuse.
- Failure to comply with the manufacturer's indications on installation, use and maintenance.
- Alteration or modification of the product or any part thereof.
- Extreme operational conditions or however outside of the operational ranges set forth by the manufacturer.
- Damages caused by external agents such as salts, chlorine, sulphur or other chemical substances contained in the installation water or present in the air of the installation site.
- Abnormal actions transmitted to the appliance by the plant or installation (mechanical stresses, pressure, vibrations, thermal expansion, electrical surges...).
- Accidental damages or due to force majeure.

1 FEATURES AND TECHNICAL DATA

1.1 FEATURES

Operation

Based on the thermodynamic water-ammonia absorption cycle (H_20–NH_3), the appliance produces chilled water using natural gas (or LPG) as primary energy and dissipating heat directly to the outside air.
The thermodynamic cycle takes place within a hermetically sealed circuit, in welded construction, perfectly tight, factory-tested, which does not require any maintenance or coolant top-ups.

Mechanical and thermo-hydraulic components

- Steel sealed circuit, externally treated with epoxy paint.
- Multigas pre-mixing burner equipped with ignition and flame detection managed by an electronic control unit.
- Titanium stainless steel shell-and-tube water exchanger (evaporator), externally insulated.
- Air exchanger (condenser) with finned coil, with steel pipe and aluminium fins.
- Variable-flow microprocessor-controlled helicoidal motor-fan.

Control and safety devices

- S61 electronic board with microprocessor, LCD display and knob.
- Circuit water flow switch.
- Generator limit thermostat, with manual reset.
- Automatically resettable flue gas thermostat.
- Differential air pressure switch on the combustion circuit.
- Sealed circuit safety relief valve.
- Bypass valve, between high and low-pressure circuits.
- Ionization flame control box.
- Dual gas valve.
- Antifreeze functions for hydraulic circuit.
- Heat recovery exchanger circulating pump relay (HR version only).

Versions

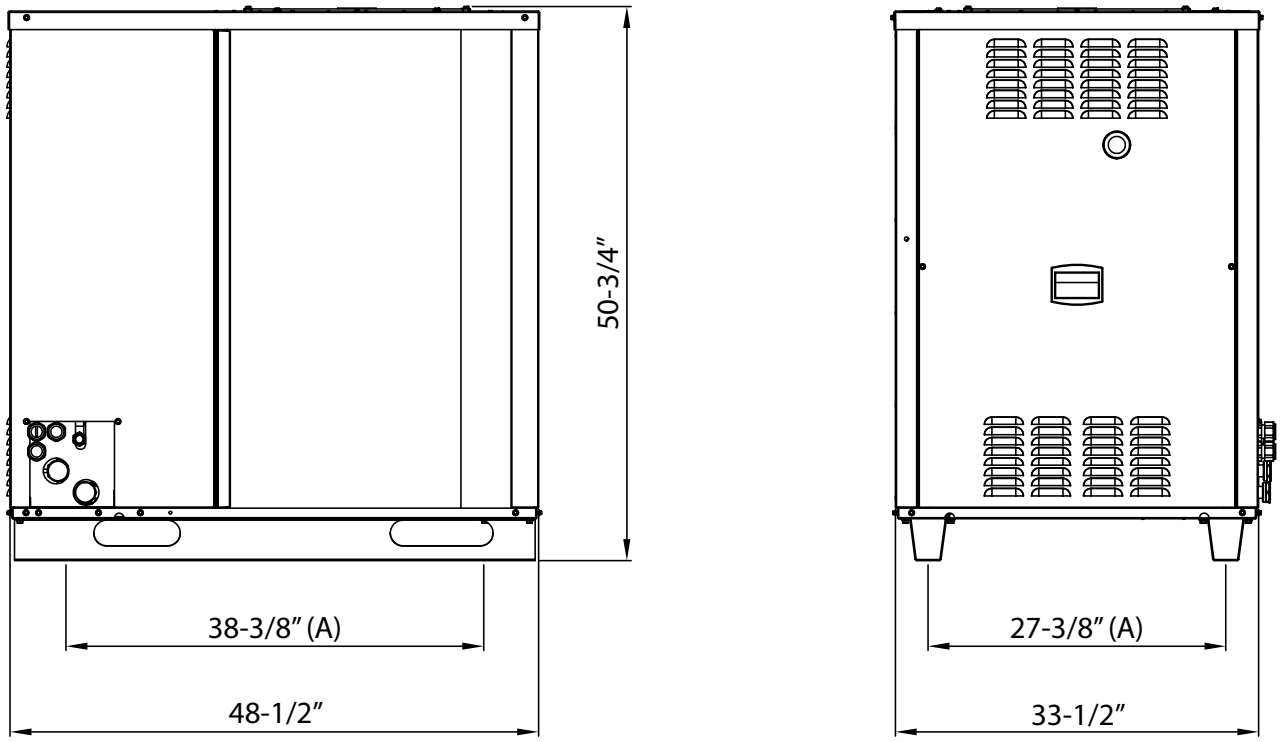
The GA ACF unit is available in the following versions:

- ACF standard, for residential/retail/industrial cooling systems with chilled water down to 37.4 °F.
- HR with heat recovery exchanger, for residential/retail/industrial cooling systems with chilled water down to 37.4 °F, plus recovery exchanger hot water up to 176 °F (e.g. DHW production).
- TK for heavy duty use, for process systems and applications with chilled water down to 37.4 °F, in continuous operation all year round.
- HT for very hot climates, for residential/retail/industrial cooling systems with chilled water down to 41 °F, with outside air up to 131 °F.
- LB for negative temperatures, for cooling systems with chilled water down to 14 °F (with an appropriate concentration of glycol).

Models ACF, TK, LB and HT have 2 chilled water inlet/outlet fittings, model HR has 4 chilled water and heat recovery exchanger hot water inlet/outlet fittings.

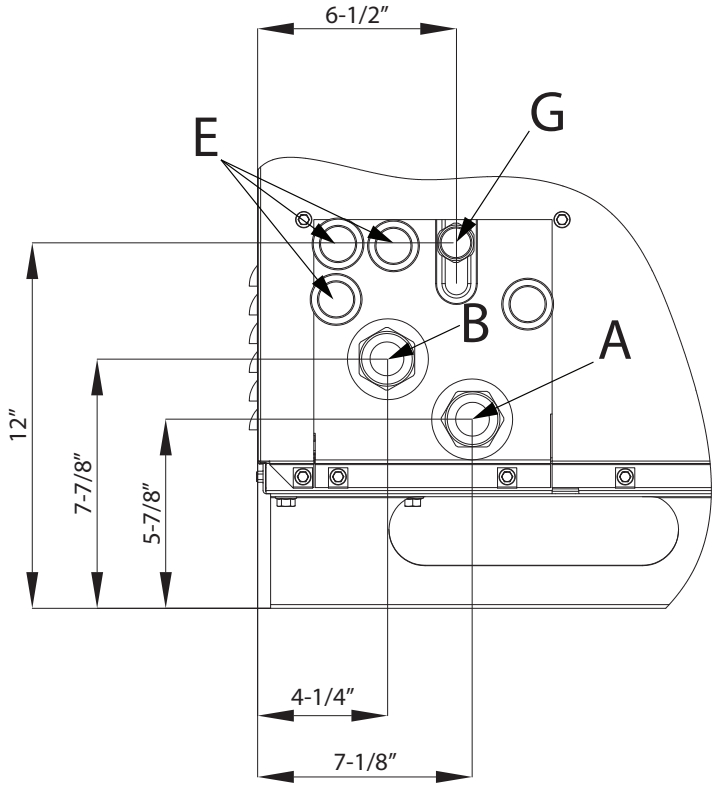
1.2 DIMENSIONS

Figure 1.1 *ACF standard version dimensions*



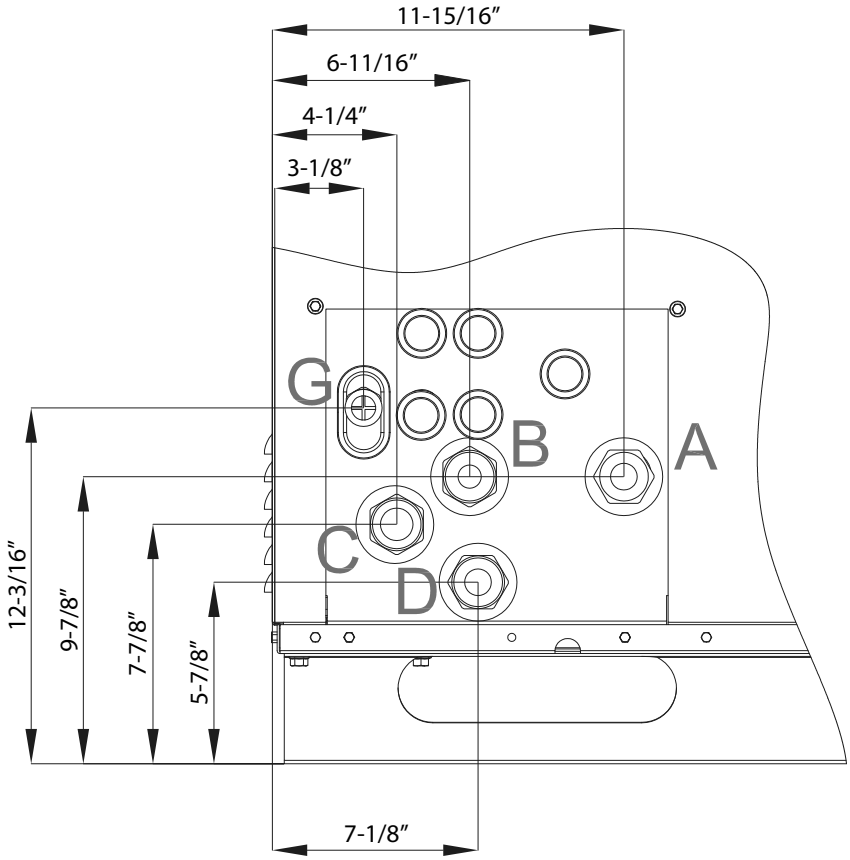
A Position of holes for fixing of anti-vibration joints

Figure 1.2 *ACF Service plate with plumbing and gas connections*



A Water outlet connection Ø 1 1/4" F
B Water inlet connection Ø 1 1/4" F
E Electrical knockouts Ø 7/8"
G Gas fitting Ø 1/2" F

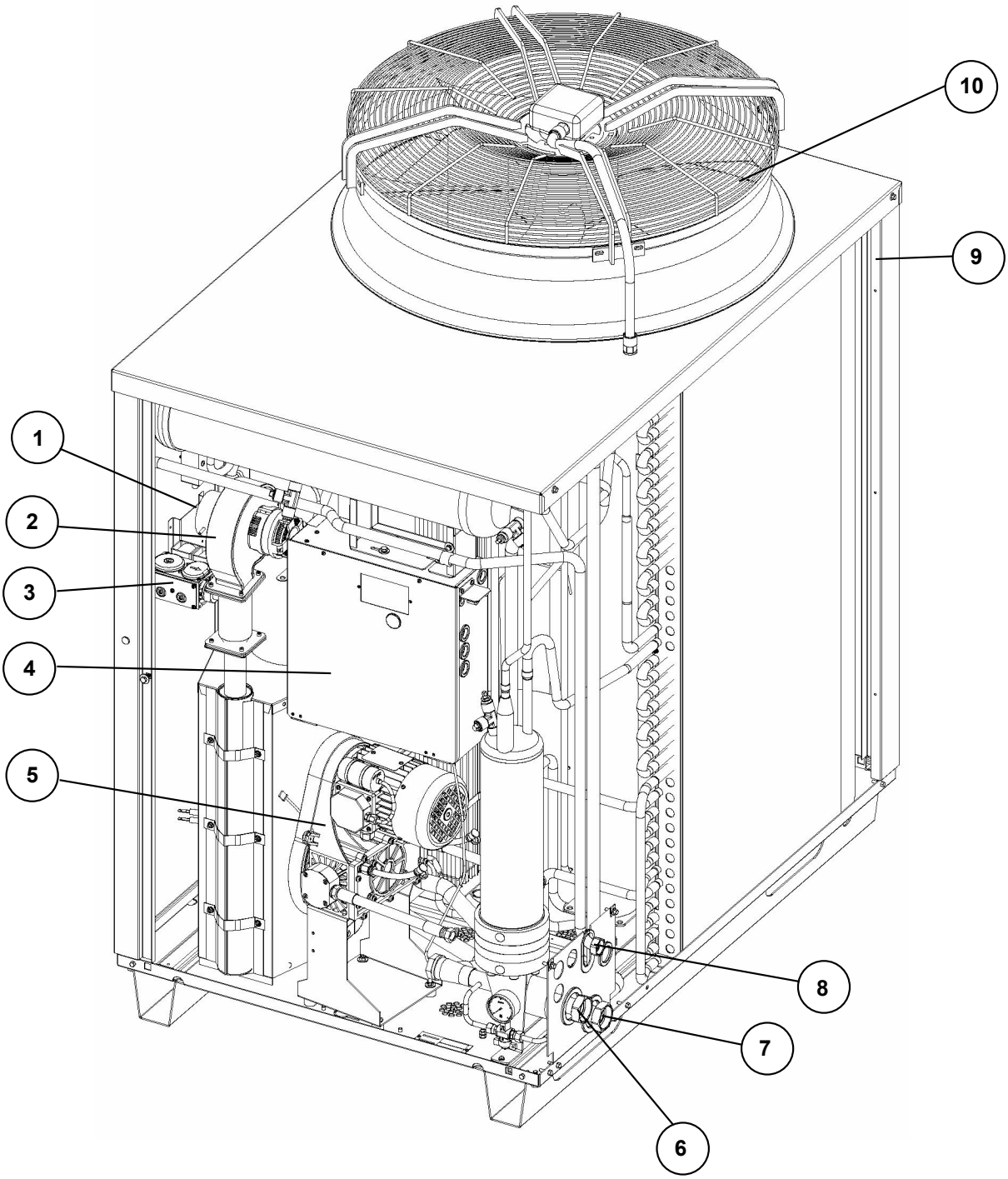
Figure 1.3 *ACF-HR Service plate with plumbing and gas connections*



G Gas fitting Ø 1/2" F
Chiller - CHILLED WATER
D Outlet water fitting Ø 1 1/4" F
C Water inlet connection Ø 1 1/4" F
Recovery exchanger - HOT WATER
A Water outlet connection Ø 1 1/4" F
B Water inlet connection Ø 1 1/4" F

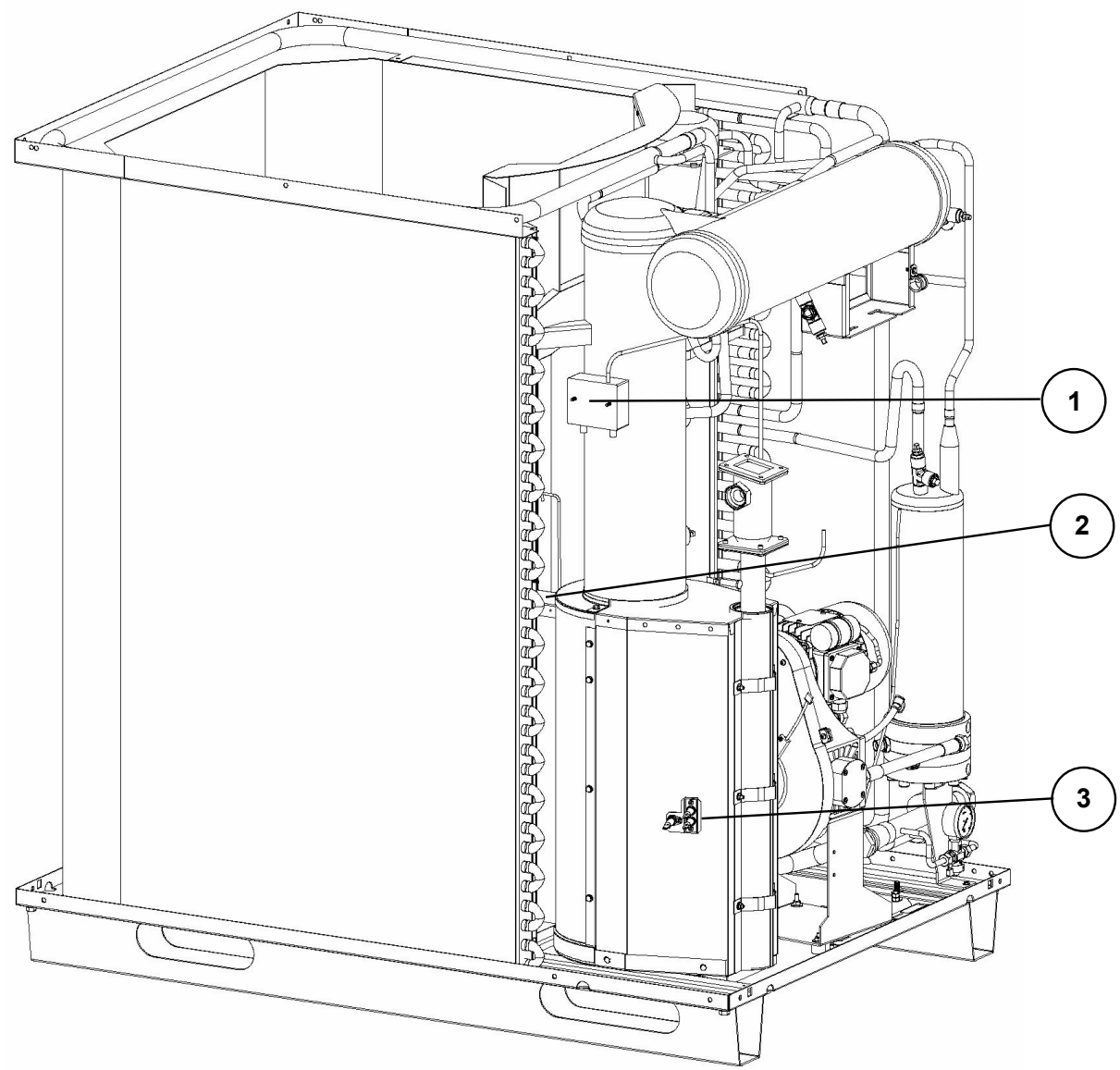
1.3 COMPONENTS

Figure 1.4 *Internal components - front view*



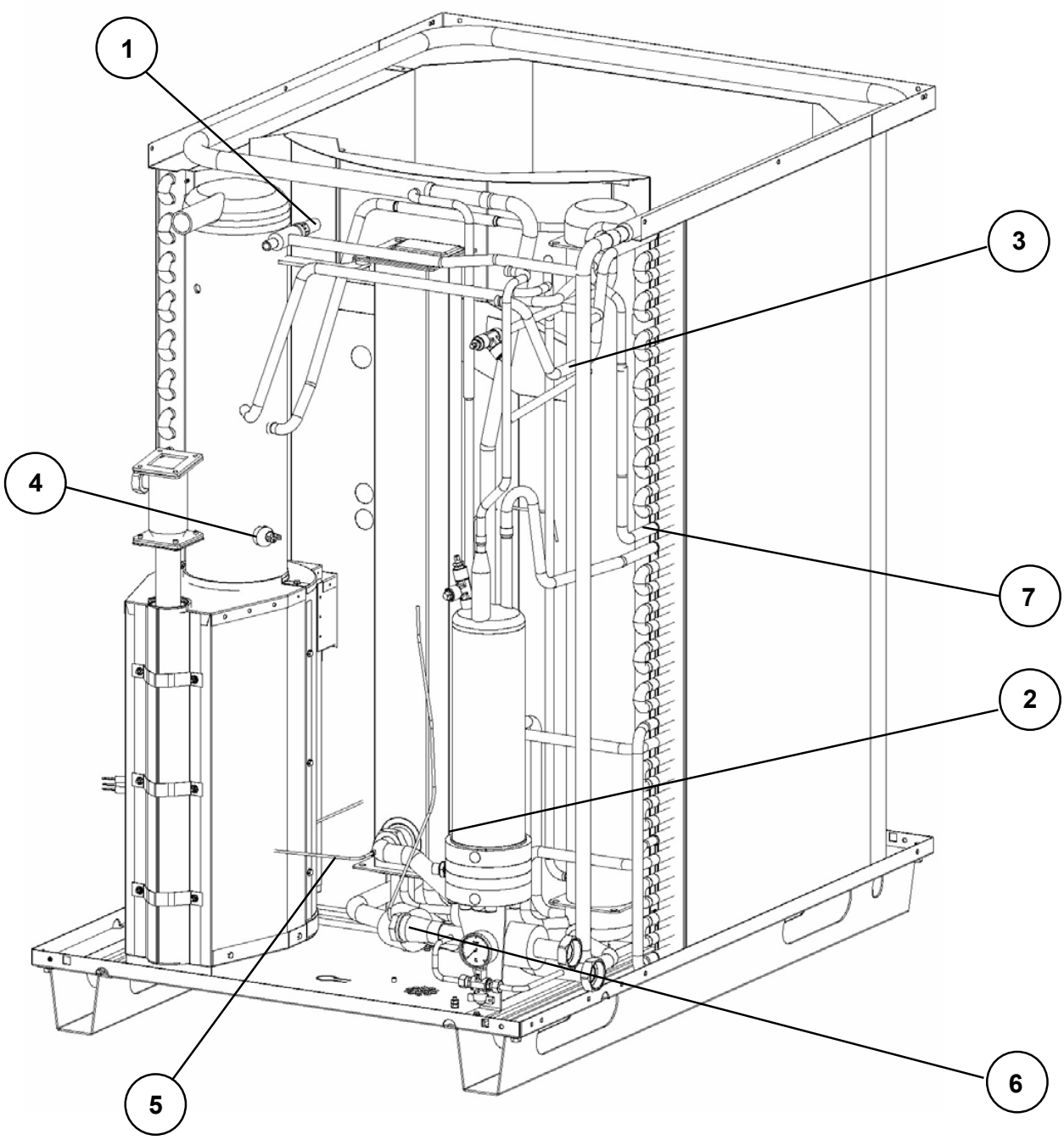
1	Combustion air intake	5	Oil pump	9	Room temperature probe
2	Combustion blower	6	Water inlet connection Ø 1 1/4" F	10	Fan
3	Gas valve	7	Water outlet connection Ø 1 1/4" F		
4	Electrical panel	8	Gas connection Ø 1/2" F		

Figure 1.5 *Internal components - left side view*



1 Ignition transformer
2 Flue thermostat
3 Ignitor and flame detectors

Figure 1.6 *Internal components - right side view*



1 Safety valve
2 Return temperature probe
3 TG generator temperature probe
4 Limit thermostat
5 Flow temperature probe
6 Flow switch
7 TCN probe

1.4 ELECTRICAL WIRING DIAGRAM

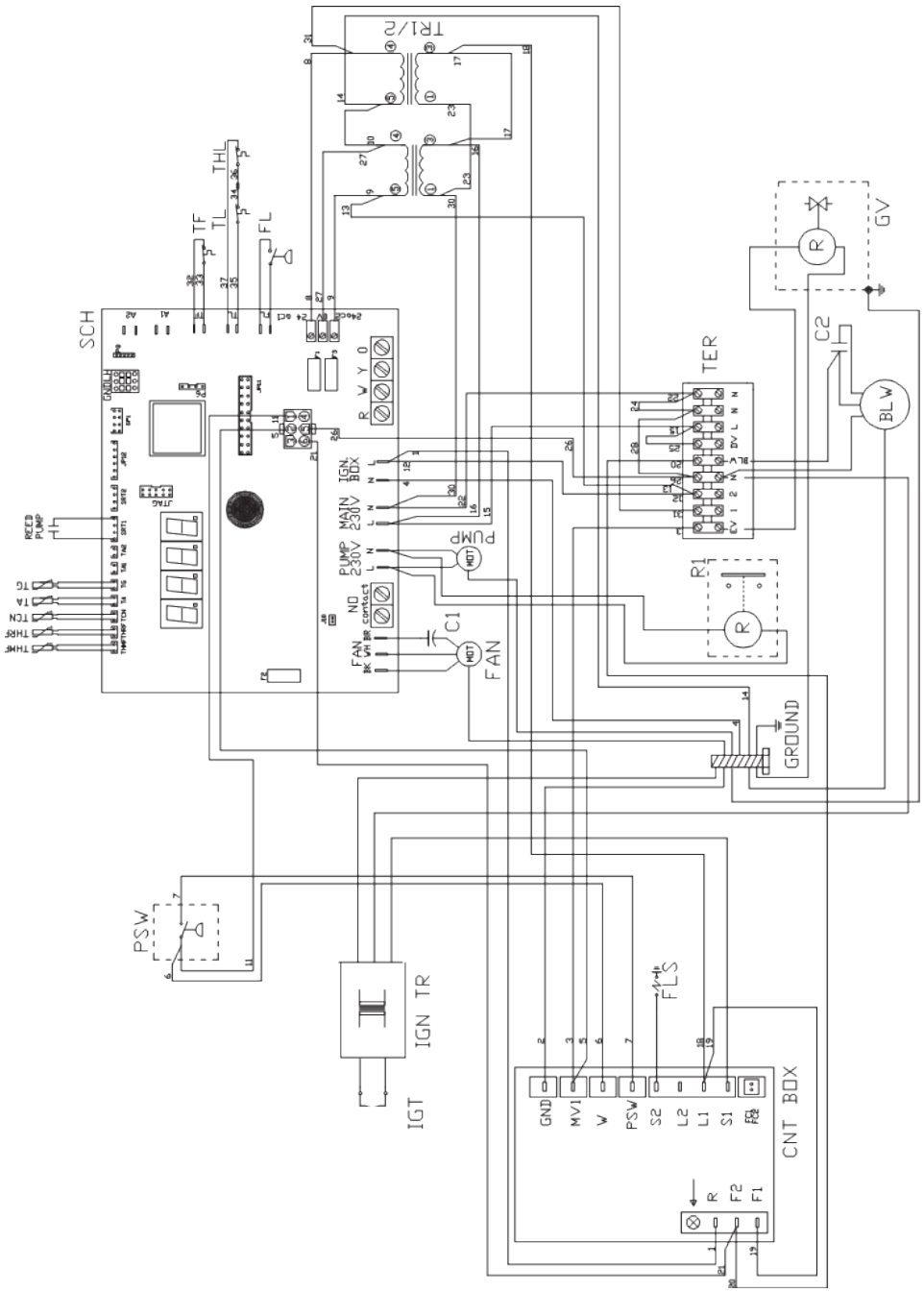
If any of the original wire as supplied with the unit must be replaced, it must be replaced with thermoplastic 221 °F wire, except ground, high temperature and pressure switch wires, which must be 392 °F or equivalent.

Igniter and flame sensor wire have to be replaced with Robur spare parts.

Label all wires prior to disconnection when servicing the controls. Wiring errors can cause improper and dangerous operation.

In Figure 1.7 *p. 12*, below, thermostat THL (hot water outlet thermostat) is placed only on ACF 60-00 HR.

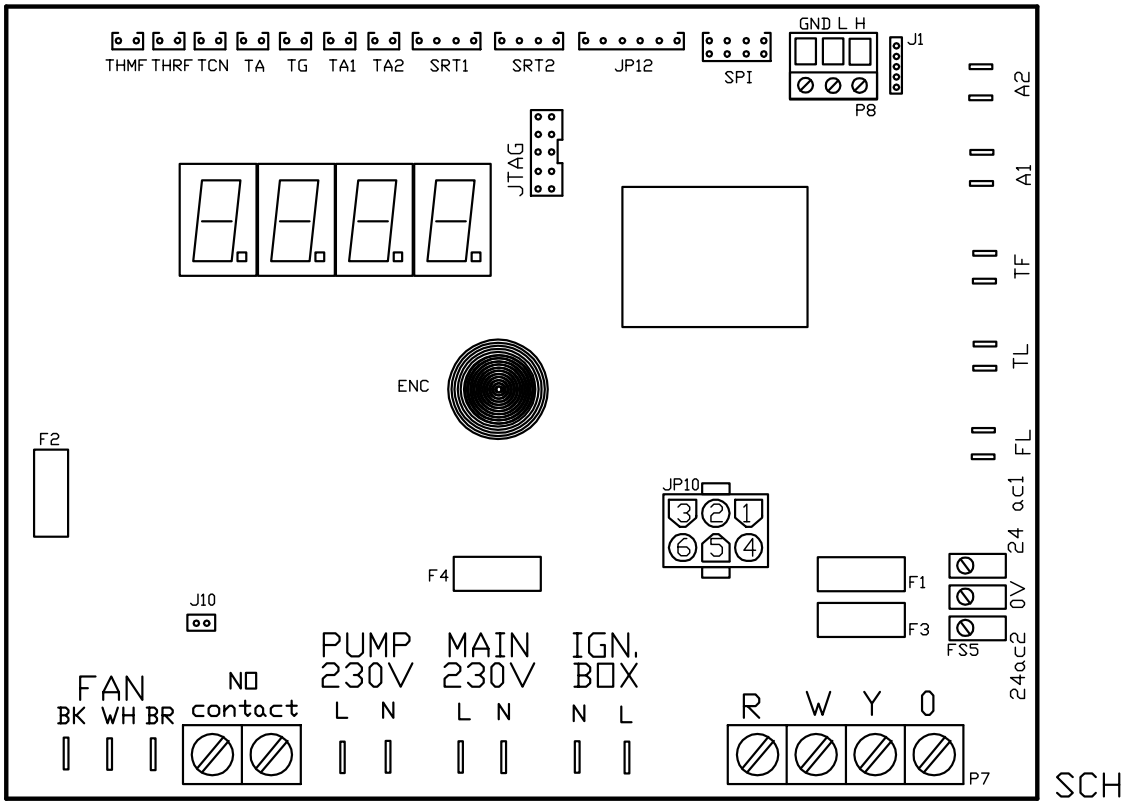
Figure 1.7 *GA ACF unit wiring diagram*



1.5 ELECTRONIC BOARDS

The appliance's electrical panel contains:
Electronic board S61 (Figure 1.8 *p. 13*), with microprocessor, it controls the appliance and displays data, messages and operative codes. The appliance is monitored and programmed by interacting with the display and the knob.

Figure 1.8 *Electronic board S61*



SCH	Electronic board S61	P8	(GND, L, H) CAN BUS connector	N.O. Contact	Circuit water circulating pump controller terminals
THMF	Water delivery temperature probe input	J1	CAN bus Jumper	J10	Circuit water circulating pump controller jumper
THRF	Water return temperature probe input	A1, A2	Auxiliary inputs (not used)	FAN	(BK, WH, BR) Fan output
TCN	Condenser outlet temperature probe input	TF	Flue gas thermostat input	JTAG	S61 board programming connector
TA	Ambient air temperature probe input	TL	Generator limit thermostat input	ENC	Knob
TG	Generator temperature probe input	FL	Water flow switch input	JP10	6-pole flame controller connector
TA1	Not used	FS5	Board supply input 24 Vac	F1	T 2A fuse
TA2	Not used	P7	(R, W, Y, O) operation request inputs	F2	T 10A fuse
SRT1	Oil pump rotation sensor input	IGN.BOX	(L, N) flame controller supply input 230 Vac	F3	T 2A fuse
SRT2	Not used	MAIN	board supply input 230 Vac	F4	T 3.15A fuse
JP12	Not used	PUMP	230V (L, N) oil hydraulic pump supply output		
SPI	Not used				

1.6 CONTROLS

Control device

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

- ► DDC controller
- ► external request

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

The DDC controller is able to control appliances, a single GA unit, or even several Robur GAHP/GA/AY units in cascade, only in ON/OFF mode (non modulating). For more details refer to the DDC, RB100, RB200 Manuals and the Design Manual.

DDC Controller

The main functions are:

- ► Setup and control of one (or more) Robur units of the absorption line (GAHP, GA, AY).
- ► Data display and parameters setting.
- ► Hourly programming.
- ► Climatic curve control.
- ► Diagnostics.
- ► Errors reset.
- ► Possibility to interface with a BMS.

DDC functionality may be extended with auxiliary Robur devices RB100 and RB200 (e.g. service requests, DHW production, Third Party generator control, probe control, system valves or circulating pumps, ...).

1.6.2 Control system (2) with external request for heating or cooling (GAHP unit ON/OFF)

The appliance may also be controlled via generic enable devices (e.g. thermostat, timer, switch, 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 system (1). It is advisable to possibly limit its use to simple applications only and with a single appliance.

For connection of the selected device to the appliance's electronic board please refer to Paragraph 4.4 *p. 26*.

1.7 TECHNICAL DATA

Table 1.1 *GA ACF technical data*

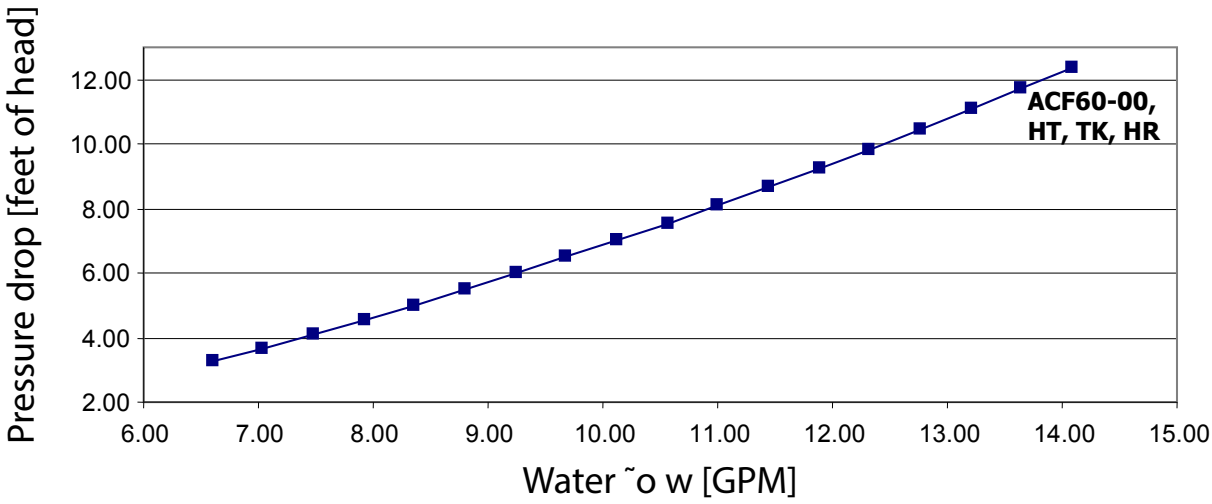
				ACF 60-00	ACF 60-00 HR	ACF 60-00 TK	ACF 60-00 HT	ACF 60-00 LB
Operation in cooling mode								
Cooling capacity	nominal		Btu/hr	60500 (1)			58400 (1)	45400 (2)
Gas input (HHV)	nominal		Btu/hr	94900				
GUE	nominal		%	71			68	53
Cold water outlet temperature	minimum		°F	37.4			41	14
Cold water inlet temperature	maximum		°F	113				
Water flow rate	maximum		GPM	14.1				12.8
	nominal		GPM	12.2			11.8	11.4
	minimum		GPM	11.0				10.1
ΔT	nominal		°F	10				9
Internal pressure drop	at nominal water flow		Feet of Head psig	9.7 4.2			9.1 3.9	14.1 6.1
Ambient operating temperature	maximum		°F	120			131	120
	minimum		°F	32		10.4	32	10.4
Condenser air flow (3)	nominal		CFM	6000				
	minimum		CFM	2000				
Operating recovery circuit								
Cooling capacity with heat recovery	nominal		Btu/hr		61240 (4)			
Recovery unit heat capacity	nominal		Btu/hr	-	86400 (5)		-	
GUE	nominal (cooling+recovery)		%	-	155		-	
Hot water flow rate (ΔT = 18 °F)	maximum		GPM	-	11.0		-	
	minimum		GPM	-	0		-	
	nominal		GPM	-	9.6		-	
Internal recovery circuit pressure drop	at nominal water flow		Feet of Head psig		4.34 3			
Electrical specifications								
Power supply	voltage		V	208-230				
	type		-	single-phase				
	frequency		Hz	60				
Condenser fan motor (variable speed)	HP		-	1/2				
	nominal ampacity	full load / locked rotor	A	3.1 / 6.2				
Oil pump motor	HP		-	0.35				
	nominal ampacity	full load / locked rotor	A	2.03 / 7.7				
Premix blower motor	HP		-	1/50				
	nominal ampacity	full load / locked rotor	A	0.55 / 0.75				
Total electrical operating consumption (6)	unit only		kW	0.75				
Minimum circuit ampacity (MCA)	unit only		A	8.0				
Maximum over current protection (MOCP)			A	10.9				
Installation data								
Gas consumption	natural gas (nominal)		CFM	1.58 (7)				
Water content inside the apparatus	hot side		gallons	-	0.79		-	
	cold side		gallons	0.79				
Water fitting	thread		FPT	1 1/4				
Gas connection	thread		FPT	1/2				
Dimensions	width		"	33 1/2				
	depth		"	48 1/2				
	height		"	50 3/4				
Weight	in operation		pounds	750	815		816	
	shipping		pounds	795	860		860	
General information								
Cooling fluid	ammonia R717		pounds	15.0	15.9	17.4	15.7	15.9
	water H_2O		pounds	22.0	22.7	22.0	23.1	

(1) Cooling capacity at standard conditions of 95 °F ambient temperature. Chilled water outlet temperature 45 °F, inlet 55 °F.
(2) Cooling capacity at standard conditions of 95 °F ambient temperature. Chilled water outlet temperature 23 °F (with 40% ethylene glycol), inlet 32 °F.
(3) Fan speed is reduced when external temperature is less than 91.4 °F.
(4) Cooling capacity at standard conditions (with recovery) of 95 °F ambient temperature. Chilled water outlet temperature 45 °F, inlet 55 °F. Heat recovery delivery temperature 122 °F, inlet 104 °F. For conditions other than nominal, apply the correction factors in following tables.
(5) Heating capacity at standard conditions (with recovery) of 95 °F ambient temperature. Chilled water outlet temperature 45 °F, inlet 55 °F. Heat recovery delivery temperature 122 °F, inlet 104 °F. For conditions other than nominal, apply the correction factors in following tables.
(6) ±10% according to the power supply voltage and tolerance on electrical motors consumption. Measured at outdoor temperature of 86 °F.
(7) HHV (natural gas) 1014 Btu/CU.FT.

1.7.1 Pressure drops

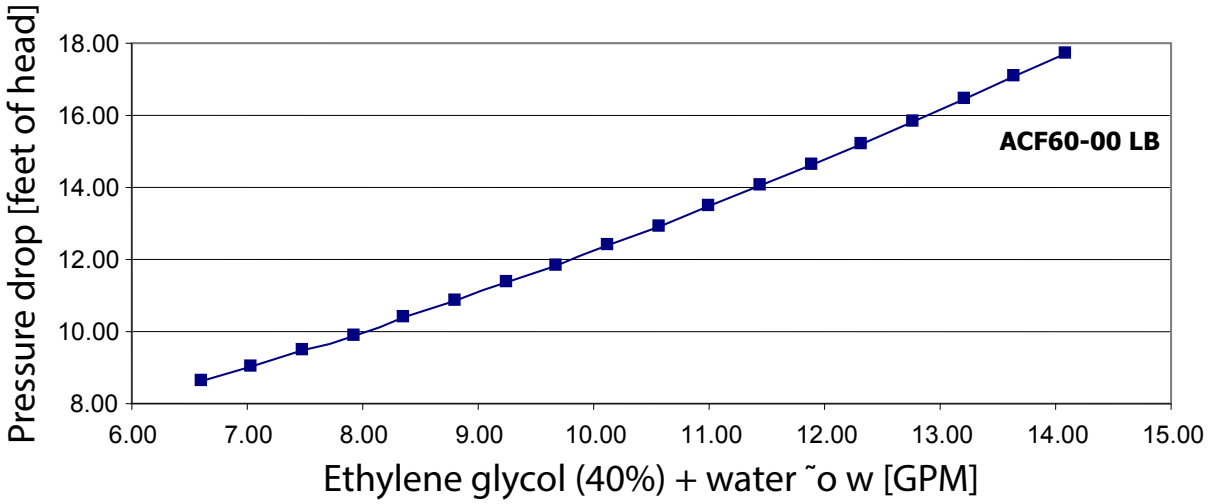
ACF standard, HR, TK, HT

Figure 1.9 *ACF60-00 (standard, HT, TK, HR) unit internal pressure drop as a function of water flow rate, outlet water temperature 44.6 °F*



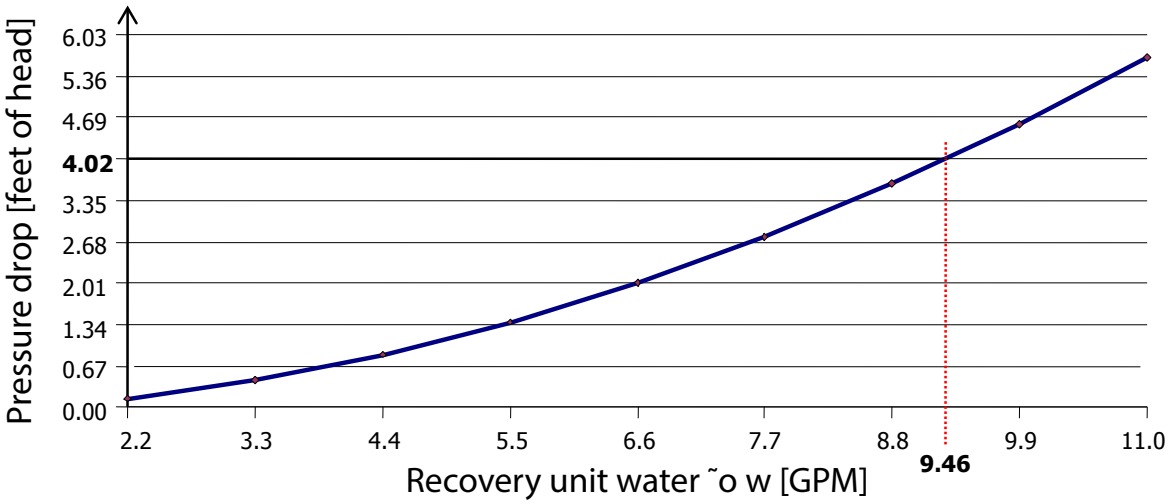
LB

Figure 1.10 *ACF60-00 LB unit internal pressure drop as a function of water flow rate*



HR recovery exchanger

Figure 1.11 *ACF60-00 HR heat recovery unit internal pressure drop as a function of water flow rate, return water temperature 68.0 °F*



1.7.2 Performances

Interpolations between tabled values below are permissible, but do not extrapolate. For capacities at ambient temperatures higher than in table, contact Robur or your authorized distributor.

ACF standard

Table 1.2 *p. 16* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF 60-00 unit.

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

Table 1.2 *ACF60-00 cooling capacity [Btu/hr]*

Ambient air temperature [°F]	Chilled water outlet temperature [°F]			
	37.4	41.0	44.6	48.2
32	59307	59912	61123	62323
41	59307	59912	61123	62333
50	59307	59912	61123	62323
59	59307	59912	61123	62333
68	59307	59912	61123	62323
77	58701	59912	61123	62333
86	54465	59307	61123	62333
95	40546	52650	60517	61727
104	-	-	53255	56281
113	-	-	40546	47203
120	-	-	-	39336

TK

Table 1.3 *p. 16* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF 60-00 TK unit.

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

Table 1.3 *ACF60-00 TK cooling capacity [Btu/hr]*

Ambient air temperature [°F]	Chilled water outlet temperature [°F]			
	37.4	41.0	44.6	48.2
10.4	71410	71410	72015	72620
17.6	70805	70805	71410	72015
24.8	70200	70200	70200	71410
32.0	69595	69595	69595	70200
39.2	68989	68989	68989	69595
46.4	67779	68384	68384	68989
53.6	67779	67779	67779	68384
60.8	67174	67174	67779	67779
68.0	65964	65964	67174	67174
75.2	64148	64148	66569	66569
82.4	59307	61727	65358	65358
89.6	51439	57491	62938	64148
95.0	41757	52650	60517	62333
100.4	-	-	56886	59912
107.6	-	-	50229	55070
113.0	-	-	-	49624
120.0	-	-	-	42057

HT

Table 1.4 *p. 16* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF 60-00 HT unit.

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

Table 1.4 *ACF60-00 HT cooling capacity [Btu/hr]*

Ambient air temperature [°F]	Chilled water outlet temperature [°F]				
	41.0	44.6	50.0	54.5	57.2
32.0	59637	59637	59637	59637	60222
35.6	59637	59637	59637	59637	60222
39.2	59637	59637	59637	59637	60222
42.8	59637	59637	59637	59637	60222
46.4	59637	59637	59637	59637	60222
50.0	59637	59637	59637	59637	60222
53.6	59637	59637	59637	59637	60222
57.2	59637	59637	59637	59637	60222
60.8	59637	59637	59637	59637	60222
64.4	59637	59637	59637	59637	60222
68.0	59637	59637	59637	59637	60222
71.6	59637	59637	59637	59637	60222
75.2	59637	59637	59637	59637	60222
78.8	59053	59637	59637	59637	60222

Ambient air temperature [°F]	Chilled water outlet temperature [°F]				
	41.0	44.6	50.0	54.5	57.2
82.4	59053	59637	59637	59637	60222
86.0	59053	59637	59637	59637	60222
89.6	57883	59637	59637	59637	60222
93.2	56129	59053	59053	59053	59637
95.0	54960	58368	58468	59053	59637
96.8	53791	57883	58468	58468	59637
100.4	50867	56714	57883	57883	59053
104.0	47944	54375	56714	57299	58468
107.6	-	51452	54960	56714	57883
111.2	-	47944	53206	55545	56714
114.8	-	-	50282	53791	55545
118.4	-	-	46774	50867	53206
131.0	-	-	-	47359	50282

Ambient air temperature [°F]	Chilled water outlet temperature [°F]				
	14.0	19.4	23.0	28.4	32.0
93.2	41003	43602	46201	47981	49760
95.0	39847	42635	45400	47299	49174
96.8	38614	41599	44584	46557	48530
98.6	37302	40491	43681	45753	47825
100.4	35907	39309	42711	44884	47057
102.2	34428	38051	41673	43949	46225
104.0	32863	36713	40564	42945	45325
105.8	31208	35295	39383	41869	44356
107.6	29461	33794	38126	40720	43314
109.4	27620	32206	36793	39496	42198
111.2	25682	30531	35379	38193	41006
113.0	23645	28765	33885	36810	39735
120.0	-	-	28004	31587	35176

LB

Table 1.5 *p. 17* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF 60-00 LB unit.
Please consider that, according to the actual cooling request, the unit may often need to operate under partial load conditions and in non stationary operation.

Table 1.5 *ACF60-00 LB cooling capacity [Btu/hr]*

Ambient air temperature [°F]	Chilled water outlet temperature [°F]				
	14.0	19.4	23.0	28.4	32.0
23.0	52007	52217	52426	52801	53176
24.8	52007	52217	52426	52801	53176
26.6	52007	52217	52426	52801	53176
28.4	52007	52217	52426	52801	53176
30.2	52007	52217	52426	52801	53176
32.0	52007	52217	52426	52801	53176
33.8	52007	52217	52426	52801	53176
35.6	52007	52217	52426	52801	53176
37.4	52007	52217	52426	52801	53176
39.2	52007	52217	52426	52801	53176
41.0	52007	52217	52426	52801	53176
42.8	52007	52217	52426	52801	53176
44.6	52007	52217	52426	52801	53176
46.4	52007	52200	52392	52784	53176
48.2	52007	52183	52358	52767	53176
50.0	52007	52166	52324	52750	53176
51.8	51965	52127	52290	52733	53176
53.6	51904	52080	52256	52716	53176
55.4	51822	52022	52221	52699	53176
57.2	51718	51952	52187	52681	53176
59.0	51588	51884	52181	52678	53176
60.8	51430	51793	52157	52666	53176
62.6	51241	51677	52113	52644	53176
64.4	51020	51533	52047	52610	53172
66.2	50763	51360	51957	52563	53169
68.0	50469	51155	51841	52503	53166
69.8	50134	50915	51696	52423	53149
71.6	49757	50638	51520	52314	53107
73.4	49334	50322	51311	52174	53038
75.2	48864	49965	51067	52002	52937
77.0	48343	49564	50785	51795	52805
78.8	47771	49117	50464	51551	52637
80.6	47143	48622	50101	51267	52432
82.4	46458	48076	49694	50941	52188
84.2	45713	47476	49240	50571	51901
86.0	44905	46822	48738	50155	51571
87.8	44033	46109	48186	49690	51194
89.6	43093	45337	47580	49174	50768
91.4	42084	44502	46919	48605	50291

HR

Table 1.6 *p. 17* shows the cooling capacity multiplication correctional factors at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF 60-00 HR unit for cooling mode only, without heat recivery.
Table 1.7 *p. 17* shows the same data, referring to the ACF 60-00 HR unit in simultaneous operation for cooling and heat recovery.
Please consider that, according to the actual cooling request, the unit may often need to operate under partial load conditions and in non stationary operation.

Table 1.6 *ACF60-00 HR - Cooling capacity multiplication correction factors in cooling mode (no recovery) for external air temperatures and water flow rates different than the nominal ones*

Operating mode: cooling only				
Ambient air temperature [°F]	Chilled water outlet temperature [°F]			
	37.4	41	44.6	48.2
32	0.98	0.99	1.01	1.03
41	0.98	0.99	1.01	1.03
50	0.98	0.99	1.01	1.03
59	0.98	0.99	1.01	1.03
68	0.98	0.99	1.01	1.03
77	0.97	0.99	1.01	1.03
86	0.90	0.98	1.01	1.03
95	0.67	0.87	**1.00**	1.02
104	—	—	0.88	0.93
113	—	—	0.67	0.78

Table 1.7 *ACF60-00 HR - Cooling capacity multiplication correction factors in cooling+recovery mode for external air temperatures and water flow rates different than the nominal ones*

Operating mode: cooling and heat recovery				
Ambient air temperature [°F]	Chilled water outlet temperature [°F]			
	37.4	41	44.6	48.2
32	0.97	0.98	1.00	1.02
41	0.97	0.98	1.00	1.02
50	0.97	0.98	1.00	1.02
59	0.97	0.98	1.00	1.02
68	0.97	0.98	1.00	1.02
77	0.96	0.98	1.00	1.02
86	0.89	0.97	1.00	1.02
95	0.73	0.91	**1.00**	1.02
104	—	0.89	0.95	0.96
113	—	—	0.80	0.85

Following Tables show the unitary recoverable heat output at full load and in stable operating mode, depending on the temperature of the thermal input fluid to the recuperator and the

outdoor temperature for different water flow rates to the recuperator, referring to the ACF 60-00 HR unit.
Consider that in the absence of a refrigeration request no recoverable heat output will be available.

Table 1.8 *ACF60-00 HR - Heat capacity of the heat recovery unit for conditions other than nominal ones; flow rate = 2.2 GPM*

Heat capacity [Btu/hr] (flow rate = 2.2 GPM)							
Hot water return temperature to the recovery [°F]	Ambient air temperature [°F]						
	59	68	77	86	95	104	113
50	92210	92893	93576	93917	95283	96308	97333
68	72743	75134	76978	78549	80188	83330	85379
86	52628	55667	58570	61644	65162	68577	72231
104	35859	39275	42007	46071	50954	55667	61507
122	21857	24248	27356	31761	37567	43714	50818
140	9563	12226	15368	18783	25033	31420	40982
158	—	—	8196	8982	13831	21003	30395

Table 1.9 *ACF60-00 HR - Heat capacity of the heat recovery unit for conditions other than nominal ones; flow rate = 4.4 GPM*

Heat capacity [Btu/hr] (flow rate = 4.4 GPM)							
Hot water return temperature to the recovery [°F]	Ambient air temperature [°F]						
	59	68	77	86	95	104	113
68	92210	99040	102797	106895	109286	—	—
86	71719	78208	83604	85755	89546	95625	102455
104	47983	54643	61473	65162	71719	78549	85584
122	27765	34083	41426	45149	53004	59868	65640
140	10246	16051	21447	25682	34152	40299	46105
158	—	—	8538	11953	19330	23906	31078

Table 1.10 *ACF60-00 HR - Heat capacity of the heat recovery unit for conditions other than nominal ones; flow rate = 6.6 GPM*

Heat capacity [Btu/hr] (flow rate = 6.6 GPM)							
Hot water return temperature to the recovery [°F]	Ambient air temperature [°F]						
	59	68	77	86	95	104	113
68	96991	102455	109286	—	—	—	—
86	75134	81964	88795	93269	100406	105871	110993
104	50886	60107	66596	72368	80257	87429	93917
122	30224	38592	44295	50203	56931	64137	71377
140	10929	17076	22779	28346	34152	40982	47813
158	—	—	10587	14344	21174	29029	33469

Table 1.11 *ACF60-00 HR - Heat capacity of the heat recovery unit for conditions other than nominal ones; flow rate = 8.8 GPM*

Heat capacity [Btu/hr] (flow rate = 8.8 GPM)							
Hot water return temperature to the recovery [°F]	Ambient air temperature [°F]						
	59	68	77	86	95	104	113
68	97333	104709	110993	—	—	—	—
86	76158	83399	91868	97333	—	—	—
104	51228	61302	72094	78549	85106	92210	99040
122	30258	39275	47813	54643	59902	66596	76158
140	14002	17144	24111	29678	35859	42690	49520
158	—	—	12704	17076	22882	29712	35859

Table 1.12 *ACF60-00 HR - Heat capacity of the heat recovery unit for conditions other than nominal ones; flow rate = 11.0 GPM*

Heat capacity [Btu/hr] (flow rate = 11.0 GPM)							
Hot water return temperature to the recovery [°F]	Ambient air temperature [°F]						
	59	68	77	86	95	104	113
68	103924	—	—	—	—	—	—
86	81281	88795	102455	—	—	—	—
104	57033	64888	76295	82613	88795	97572	102455
122	36884	41255	49520	58058	63454	71104	79061
140	17452	21345	26331	31112	38113	45798	55736
158	—	—	13285	18100	23906	30737	39275

2 TRANSPORT AND POSITIONING

2.1 WARNINGS

Damage from transport or installation

The manufacturer shall not be liable for any damage during appliance transport and installation.

On-site inspection

- Upon arrival at the site, ensure there is no transport damage on packing, metal panels or finned coil.
- After removing the packing materials, ensure the appliance is intact and complete.

Packing

- Only remove the packing after placing the appliance on site.
- Do not leave parts of the packing within the reach of children (plastic, polystyrene, nails...) since they are potentially dangerous.

Weight

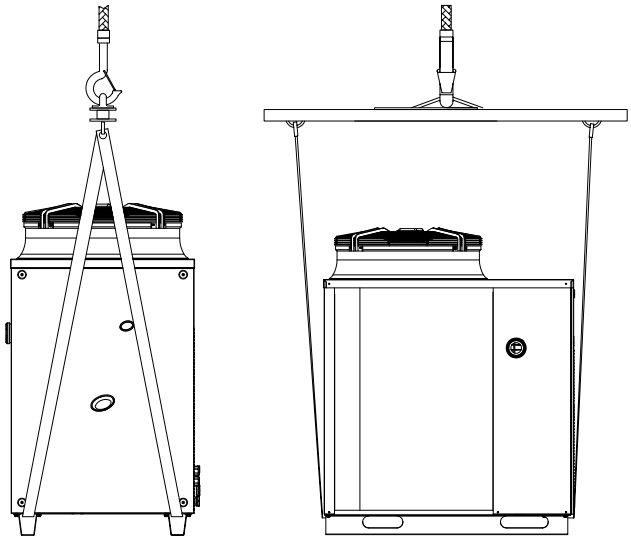
- The crane and lifting equipment must be suitable for the load.
- Do not stand under suspended loads.

2.2 HANDLING

Handling and lifting

- ► Always handle the appliance in its packing, as delivered by the factory.
- ► To lift the appliance use straps or slings inserted in the holes of the base (Figure 2.1 *p. 19*).
- ► Use lifting beams to avoid damaging the outer panels and finned coil (Figure 2.1 *p. 19*).
- ► Comply with safety regulations at the installation site.

Figure 2.1 *Instruction for lifting*



In the event of handling with forklift or pallet truck, comply with the handling instructions shown on the packing.

2.3 APPLIANCE POSITIONING

Do not install inside a room

The appliance is type-approved for external installation.

- Do not install inside a room, not even if it has openings.
- In no event start the appliance inside a room.

GA Unit ventilation

- The aerothermic appliance requires a large space, ventilated and free from obstacles, to enable smooth flow of air to the finned coil and free air outlet above the mouth of the fan, with no air recirculation.
- Incorrect ventilation may affect efficiency and cause damage to the appliance.
- The manufacturer shall not be liable for any incorrect choices of the place and setting of installation.

Where to install the appliance

- The appliance may be installed at ground level, on a terrace or on a roof, compatibly with its dimensions and weight.
- It must be installed outside buildings, in an area of natural air circulation, outside the dripping path of drainpipes or similar. It does not require protection from weathering.
- No obstruction or overhanging structure (e.g. protruding roofs, canopies, balconies, ledges, trees) shall interfere either with the air flowing from the top of the appliance or with the exhaust flue gas.
- Do not install near the exhaust of flues, chimneys or hot polluted air. In order to work correctly, the appliance needs clean air.

Acoustic issues

- Pre-emptively assess the appliance's sound effect in connection to the site, taking into account that building corners, enclosed courtyards, restricted spaces may amplify the acoustic impact due to the reverberation phenomenon.

2.4 MINIMUM CLEARANCE DISTANCES

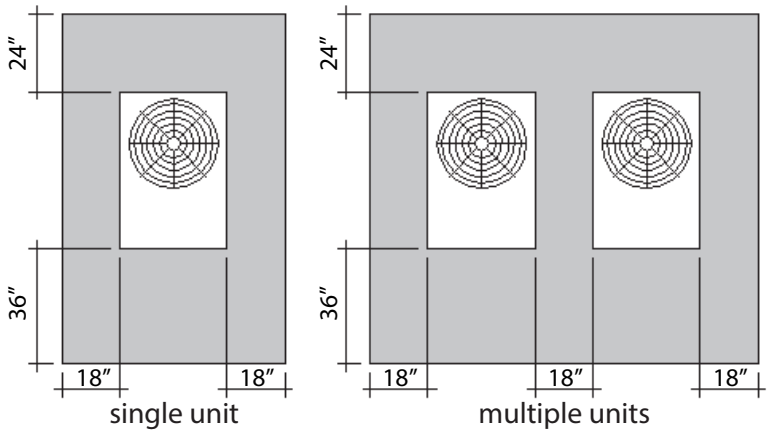
Distances from combustible or flammable materials

- Keep the appliance away from combustible or flammable materials or components, in compliance with applicable regulations.

Clearances around the appliance

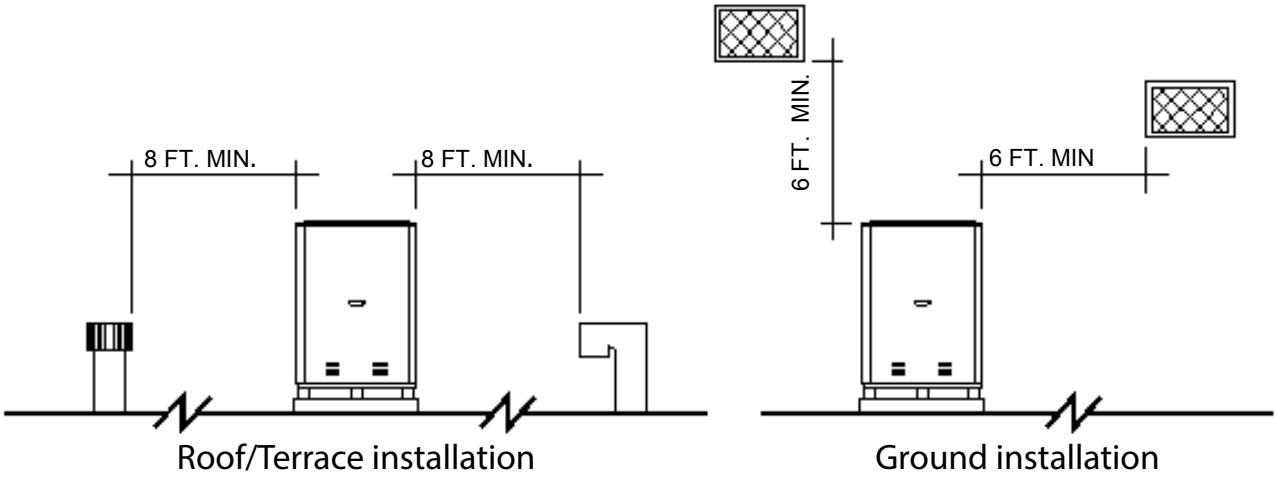
There must be a minimum clearance of 4 feet horizontally from electric meters, gas meters, regulators, and relief equipment and in no case the appliance can be located above or below these items unless a 4 feet horizontal distance is maintained.
The minimum clearance distances shown in Figure 2.2 *p. 19* (bar any stricter regulations) are required for safety, operation and maintenance.

Figure 2.2 *Clearances for correct installation of the appliances*



When the appliance is installed in close proximity to buildings, keep the appliance away from the roof edge drip line. In no case should the appliance be placed within 6 feet of any external air intakes of the building. For installations on balconies or roofs, the appliance should not be located within 8 feet from chimney flues, outlets and other such vents. It is important that the appliance is located so that hot or contaminated air **IS NOT** drawn into the air intakes of the unit (Figure 2.3 *p. 20*).

Figure 2.3 *Clearances from vent outlets, chimney flues and air intake openings*



2.5 MOUNTING BASE

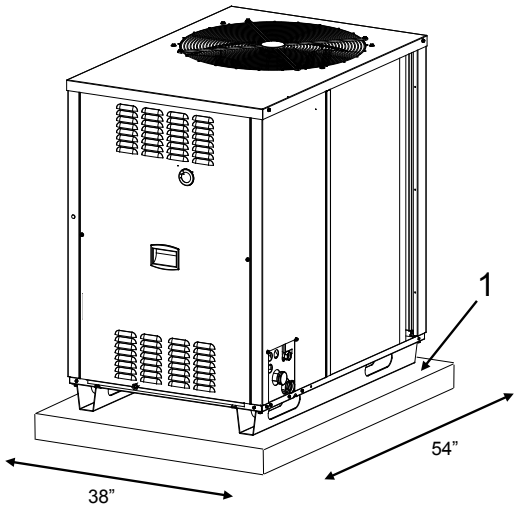
Mounting base constructive features

► Place the appliance on a level flat surface made of fireproof material and able to withstand its weight.

(1) - installation at ground level

► Failing a horizontal supporting base, make a flat and level concrete base, with a minimum thickness of 4" and larger than the unit base by at least 4÷6" on each side (Figure 2.4 *p. 20*). Local soil conditions will actually dictate the slab thickness required to prevent shifting.
► Do not allow the concrete slab to touch the foundation of a structure. Unit operational noises can be transmitted inside the structure if they are connected.

Figure 2.4 *Dimenstions of the unit bed*



1 4" concrete slab

(2) - installation on terrace or roof

► The structure of the building must support the total weight of the appliance and the supporting base.
► If necessary, provide a maintenance walkway around the appliance.
► Although approved for installation on a combustible base, the appliance must not be installed directly on the roof surface. Use base supports for the installation (Figure 2.4 *p. 20*).
► Installation on roofs directly above sleeping quarters should be avoided if possible. If not possible, special consideration must be given to the transmission characteristics of the building structure. The use of vibration isolators under the equipment (acoustically insulated bases) and approved flexible connections (vibration-damping pipe fittings) between the unit and the piping system is recommended.

2.5.1 Leveling

The unit should be level both front to back and side to side. Place a level on the top of the unit to check for level. If the unit is not level, metal shims are recommended for use under proper corners to obtain level. If the shim(s) thickness exceeds 1/2", support shims should be inserted under the center of the unit.

Anti vibration mountings

Although the appliance's vibrations are minimal, resonance phenomena might occur in roof or terrace installations.
► Ground level installations should use vibration-damping base supports, available from the factory. Another option is to use 4" thick concrete slabs positioned under the unit, instead of the factory base supports.
► Also provide anti-vibration joints between the appliance and water and gas pipes.

3 SYSTEM DESIGN

3.1 WARNINGS

General warnings

Read the warnings in Chapter III.1 *p. 4*, providing important information on regulations and on safety.

Compliance with installation standards

The installation of the appliance must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the latest edition of the **National Fuel Gas Code, ANSI Z223.1**. If the unit is installed in Canada, the installation must conform to the **Canadian Gas Association Standard CAN1 B149.1 and .2**.
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

Installation must also comply with the manufacturer's provisions.

The manufacturer cannot be held responsible for any damages to persons, animals or goods due to improper, erroneous or irrational installation of these appliances.

3.2 HYDRAULIC SYSTEM

Primary and secondary circuit

► In many cases it is advisable to divide the hydraulic system into two parts, primary and secondary circuit, uncoupled by a hydraulic separator, or possibly by a tank that also acts as inertial tank/buffer.

Water flow rate

The GA unit works with constant, water flow and ON/OFF operative mode.
System and components must be designed and installed consistently. The water lines should also be sized so the maximum velocity of the water/monoethylene glycol solution in the lines does not exceed 6 feet per second to avoid excessive noise.
There must be correct water flow when the unit is operating and during the shutdown cycle (600 seconds, between turning the burner off and complete shutdown of the appliance).

Minimum water content

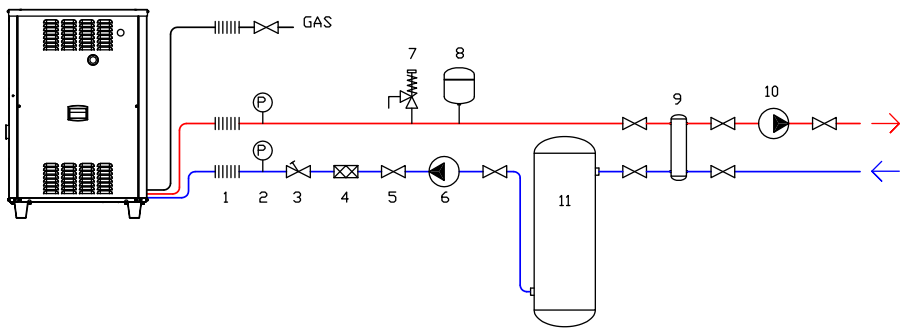
High thermal inertia is conducive to efficient appliance operation. Very short ON/OFF cycles are to be avoided.

► For each GA unit provide a minimum water content in the installation of at least 20 gallons.

Buffer tank

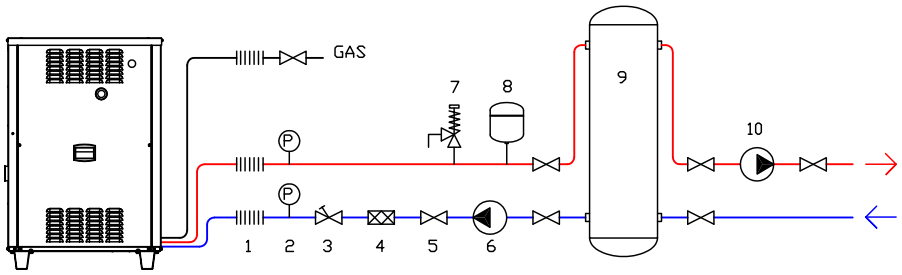
If using a buffer tank, it can be with 2 or 4 hydraulic connections, as shown in the following two diagrams (Figure 3.1 *p. 21*, 3.2 *p. 22*).

Figure 3.1 *2-pipe tank diagram*



1 Anti-vibration connection
2 Pressure gauge
3 Inlet flow control device
4 Water filter
5 Shut-off valves
6 Water pump (primary circuit)
7 Safety valve
8 Expansion tank
9 Hydraulic separator
10 Water pump (secondary circuit)
11 2-connection inertial buffer tank

Figure 3.2 *4-pipe tank diagram*



1 Anti-vibration connection
2 Pressure gauge
3 Inlet flow control device
4 Water filter
5 Shut-off valves
6 Water pump (primary circuit)
7 Safety valve
8 Expansion tank
9 4-connection inertial buffer tank
10 Water pump (secondary circuit)

3.3 HYDRAULIC CONNECTIONS

Plumbing fittings

on the right, at the bottom, connection plate
Versions ACF/TK/LB/HT (Figure 1.2 *p. 8*).

- ► A (= out) 1 1/4" F - chilled WATER OUTLET (m = outlet to the system)
- ► B (= in) 1 1/4" F - chilled WATER INPUT (r = inlet from the system)

HR Version with heat recovery exchanger (Figure 1.3 *p. 8*).

- ► A (= out) 1 1/4" F - hot WATER OUTLET (m = outlet to the system)
- ► B (= in) 1 1/4" F - hot WATER INPUT (r = inlet from the system)
- ► D (= out) 1 1/41" F - chilled WATER OUTLET (m = outlet to the system)
- ► C (= in) 1 1/4" F - chilled WATER INPUT (r = inlet from the system)

Hydraulic pipes, materials and features

- ► Use pipes for heating/cooling installations, protected from weathering, insulated for thermal losses, with vapour barrier to prevent condensation.

Pipe cleaning

- Before connecting the appliance,accurately wash the water and gas piping and any other system component, removing any residue.

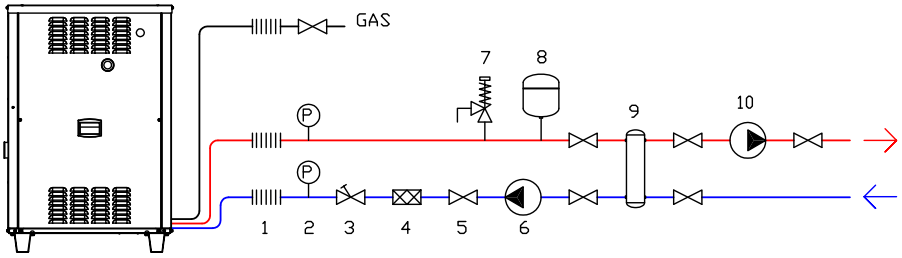
Minimum components of primary plumbing circuit

Always provide, near the appliance:

- ► on water piping, both output and input
  - 2 antivibration joints on water fittings
  - 2 pressure gauges
  - 2 isolation ball valves
- ► on the inlet water piping
  - 1 separator filter
  - 1 inlet flow control device, if the circulation pump is with constant flow
  - 1 water circulation pump, towards the appliance
- ► on the output water piping
  - 1 safety valve
  - 1 expansion tank of the individual unit

The appliance is not equipped with an expansion tank: therefore it is necessary to install a suitable expansion tank, sized in relation to the maximum heat excursion and maximum operating pressure of the system's water.

Figure 3.3 *Hydraulic plan*



1 Anti-vibration connection
2 Pressure gauge
3 Inlet flow control device
4 Water filter
5 Shut-off valves
6 Water pump (primary circuit)
7 Safety valve
8 Expansion tank
9 Hydraulic separator / inertial tank with 4 fittings
10 Water pump (secondary circuit)

3.4 WATER CIRCULATION PUMP

The circulation pump (flow and head) must be selected and installed based on pressure losses of plumbing/primary circuit (piping + components + exchange terminals + appliance).
For the appliance pressure losses refer to Table 1.1 *p. 14* and to Paragraph 1.7.1 *p. 15*.

Constant flow circulation pump

The primary circulating pump must be obligatorily controlled by the appliance's electronic board (S61) (see Paragraph 1.5 *p. 12*).

3.5 ANTIFREEZE FUNCTION

Antifreeze self-protection

The appliance is equipped with an active antifreeze self-protection system to prevent freezing. The antifreeze function (deactivated by default) automatically starts the primary circulation pump when the outside temperature approaches 32 °F.

Electrical continuity

The active antifreeze self-protection is only effective if the power supply is assured. Otherwise, antifreeze liquid might be required.

3.6 ANTIFREEZE LIQUID

To ensure the correct operation of the unit and to avoid water freezing, add antifreeze glycol to the system water as needed for the minimum external temperature of the installation zone (Table 3.1 *p. 23*).

A minimum concentration of 10% by volume of ethylene glycol (or 15% propylene glycol) is required in all heating and cooling applications, including warm regions and even if the water circuit is to be drained during winter months. This is necessary to protect the unit's heat exchanger from freezing during light load operating conditions or off periods. Otherwise, damage to the heat exchanger will result.

Always use glycol that is permanently inhibited. Do not use automotive antifreeze.

Precautions with glycol

The manufacturer disclaims any liability for any damage caused by improper glycol use.

- Always check product suitability and its expiry date with the glycol supplier. Periodically check the product's preservation state.
- Do not use zinc-coated piping and fittings (incompatible with glycol).
- Glycol modifies the physical properties of water (density, viscosity, specific heat...). Size the piping, circulation pump and thermal generators accordingly.
- With automatic system water filling, a yearly check of the glycol content is required.

Type of antifreeze glycol

Inhibited type glycol is recommended to prevent oxidation phenomena.

Glycol effects

The Table 3.1 *p. 23* shows, indicatively, the effects of using a glycol depending on its %.

Table 3.1 *Technical data for filling the hydraulic circuit*

Propylene glycol correction factors							
Percent propylene glycol	15%	20%	25%	30%	35%	40%	50%
Approximate freezing point in °F	24	18	15	9	5	-5	-30
Capacity factor multiplier (1)	0.992	0.986	0.972	0.960	0.950	0.928	0.878
Pressure drop multiplier (2)	1.04	1.08	1.13	1.21	1.26	1.47	2.79

Ethylene glycol correction factors							
Percent ethylene glycol	10%	15%	20%	25%	30%	35%	40%
Approximate freezing point in °F	25	21	17	11	5	0	-10
Capacity factor multiplier (1)	0.98	0.96	0.95	0.93	0.92	0.91	0.89
Pressure drop multiplier (2)	1.08	1.11	1.16	1.21	1.27	1.32	1.38

1 At standard ARI 590 conditions: 54 °F entering fluid temperature, 44 °F leaving fluid temperature, 95 °F ambient temperature, 0.0005 fouling.
2 Pressure drops may vary with individual glycol manufacturer's products. The information provided for pressure drop is typical but installing contractor / project engineer is responsible for verification of pressure drop correction based on specifications of glycol used.

3.7 SYSTEM WATER QUALITY

Responsibility of the user/operator/installer

The installer, operator and user must assure system water quality (Table 3.2 *p. 23*). Failure to comply with the manufacturer's guidelines may affect operation, integrity and life of the appliance, voiding the warranty.
For any further detail, please contact directly Robur Corporation Evansville, IN, Phone (812) 424-1800; Fax (812) 422-5117.

System water characteristics

Free chlorine or water hardness may damage the appliance.
Adhere to the chemical-physical parameters in Table 3.2 *p. 23* and the regulations on water treatment for residential and industrial heating systems.

Robur is not liable for ensuring that water quality is always compliant with what reported in Table 3.2 *p. 23* or is not.

Table 3.2 *Chemical and physical parameters of water*

Chemical and physical parameters of water in heating/cooling systems		
Parameter	**Measurement unit**	**Required value**
pH	/	> 7 (1)
Chlorides	ppm	< 125 (2)
Total hardness ($CaCO_3$)	°f	< 15
	°d	< 8.4
Iron	ppm	< 0.5 (3)
Copper	ppm	< 0.1 (3)
Aluminium	ppm	< 1
Langelier's index	/	0-0.4
Harmful substances		
Free chlorine	ppm	< 0.2 (3)
Fluorides	ppm	< 1

Sulphides	ABSENT

1 With aluminium or light alloys radiators, pH must also be lower than 8 (in compliance with applicable rules)
2 Value referred to the maximum water temperature of 176 °F
3 In compliance with applicable rules

Water topping up

The chemical-physical properties of the system's water may alter over time, resulting in poor operation or excessive topping up. Reintegration should not exceed 5% per year of the total amount of water.

► Ensure there are no leaks in the installation.
► Periodically check the chemical-physical parameters of the water, particularly in case of automatic topping up.

Chemical conditioning and washing

Water treatment/conditioning or system washing carried out carelessly may result in risks for the appliance, the system, the environment and health.

- Contact specialised firms or professionals for water treatment or system washing.
- Check compatibility of treatment or washing products with operating conditions.
- Do not use aggressive substances for stainless steel or copper.
- Do not leave washing residues.

3.8 SYSTEM FILLING

How to fill up the system

After completing all water, electrical and gas connections:

1. Pressurise (at least 20 psig) and vent the hydraulic circuit.
2. Let water flow (with appliance off).
3. Check and clean the filter on the inlet pipe.
4. Repeat items 1, 2 and 3 until the pressure has stabilised (at least 20 psig).

3.9 FUEL GAS SUPPLY

All gas piping must conform to the latest edition of **National Fuel Gas Code ANSI Z223.1** and all local gas piping codes. In Canada, the gas piping must conform to the **CGA Standard CAN1 B149.1 e .2**, "*Installation Code for Gas Burning Appliances & Equipment*" and local codes. Your gas utility must be contacted regarding local requirements, type and size of gas lines. Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the appliance, when it underwent the tests specified in the standards shown on the rating plate.
Adequate combustion and ventilation air have to be provided, in accordance with section 5.3 "Air for combustion and ventilation" of the National Fuel Gas Code, ANSI Z223.1, appropriate sections of the Natural Gas Installation Code, CAN/CGA B149.1, or the Propane Installation Code, CAN/CGA B149.2, or applicable provisions of the local building codes.

Gas connection

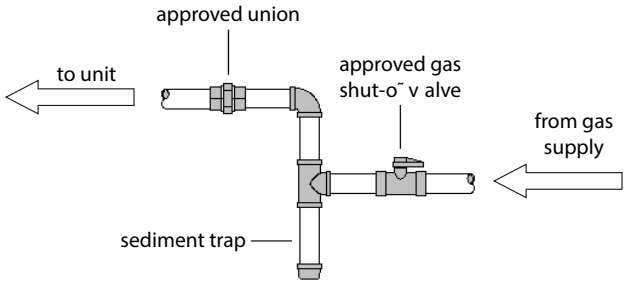
► 1/2" F

on the right, at the bottom, connection plate (Figures 1.2 *p. 8* and 1.3 *p. 8*).

► Install an anti-vibration connection between the appliance and the gas piping.
► An approved union should be installed in the gas line near the unit and downstream of any external shut-off valve that may be required by local codes (Figure 3.4 *p. 24*).
► Be sure to use materials resistant to the LPG corrosive action when making pipe connections. Use an approved sealing compound resistant to propane gas on all male pipe threads.

The appliance and its gas connections must be leaked tested before placing it in operation.

Figure 3.4 *Typical gas connection*



Mandatory shut-off valve

► Provide a gas shut-off valve (manual) on the gas supply line, next to the appliance, to isolate it when required.
► Perform connection in compliance with applicable regulations.
► The appliance and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of the gas piping system at test pressures **in excess of 1/2 psig**.
► The appliance must be isolated from the gas supply piping system by closing its individual shut-off valve during any pressure testing of the gas piping system at test pressures **equal to or less than 1/2 psig**.

Gas pipes sizing

The gas pipes must not cause excessive pressure drops and, consequently, insufficient gas pressure for the appliance.

Supply gas pressure

Inlet gas pressure to the appliance must not exceed 14.0 inch WC.

The appliance gas supply pressure, both static and dynamic, must comply with the manufacturer's specifications (Table 5.1 *p. 32*), with tolerance ± 15%. Inlet gas pressure to the unit must not exceed 14.0 inch WC on natural gas or propane gas. The minimum inlet gas pressure at the unit is 5.0 inch WC on natural gas and 11.0 inch WC on propane gas.

Non compliant gas pressure may damage the appliance and be hazardous.

Vertical pipes and condensate

► Vertical gas pipes must be fitted with siphon and discharge of the condensate that may form inside the pipe.
► If necessary, insulate the piping.

LPG pressure reducers

With LPG the following must be installed:

► A first stage pressure reducer, close to the liquid gas tank.
► A second stage pressure reducer, close to the appliance.

4 ELECTRICAL INSTALLER

In the following Section please refer to "L" as "L1" and to "N" as "L2".

4.1 WARNINGS

General warnings

Read the warnings in Chapter III.1 *p. 4*, providing important information on regulations and on safety.

Compliance with installation standards

The appliance's electrical connections and grounding must be in accordance with the latest edition of the **National Electrical Codes, ANSI/NFPA No. 70 (CSA Standard C22.1 when installed in Canada)** and with any local codes. To ensure the electrical safety of this appliance, it must be correctly connected to an efficient grounding system. The manufacturer is not responsible for any damages caused by the failure of the grounding system.
Installation must comply with applicable regulations in force, based on the installation Country and site, in matters of safety, design, implementation and maintenance of electrical systems.

Installation must also comply with the manufacturer's provisions.

Live components

- After placing the appliance in the final position, and prior to making electrical connections, ensure not to work on live components.

Grounding

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

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 blackouts are tolerated).
- To turn the appliance on and off, exclusively use the suitably provided control device (DDC or external request).

Control of water circulation pump

The water circulation pump of the water/primary circuit must mandatorily be controlled by the appliance's electronic board (S61). It is not admissible to start/stop the circulating pump with no request from the appliance.

Isolation relay

An isolation relay **must** be used to separate the appliance's transformer from any additional equipment having a transformer or damage to the S61 board will occur. Isolation relays must have a 24 V AC coil, which does not present more than 0.25 A load to the control circuit.

The manufacturer cannot be held responsible for any damages to persons, animals or goods due to improper, erroneous or irrational installation of these appliances.

4.2 ELECTRICAL SYSTEMS

Electrical connections must provide:
- ► power supply (Paragraph 4.3 *p. 25*)
- ► control system (Paragraph 4.4 *p. 26*)

How to make connections

All electrical connections must be performed in the electrical panel of the appliance:
1. Ensure the appliance's electrical panel is not live.
2. Remove the front panel of the appliance and the cover of the electrical panel.
3. Run the cables through the suitable holes in the connection plate.
4. Run the cables through the suitable cable glands in the electrical panel.
5. Identify the appropriate connection terminals.
6. Make the connections.
7. Close the electrical panel and fit the front panel back on.

4.3 ELECTRICAL POWER SUPPLY

Power supply line

The appliance electrical system is wired for single-phase, 208-230 V and 60 Hz operation. The electrical control box includes a 208-230 - 24 V transformer to supply low voltage to the control system. The high voltage line connections to be made at the time of installation consists of connecting 208-230 V, 60 Hz to the high voltage terminal board of the control panel. A fused disconnect switch should be installed in the 208-230 V supply line within sight of and not over 50 feet from the unit.
Provide (by the installer) a protected single phase line (208-230 V 1-N 60 Hz) with:
- ► 1 three-pole cable type FG7(O)R 3Gx1.5
- ► 1 two-pole switch with two 5 A type T fuses, (GS) or one 10 A magnetothermic breaker.

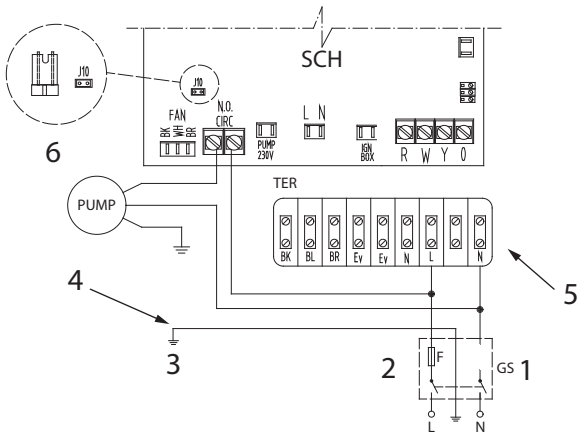
The switches must also provide disconnector capability, with min contact opening 4 mm.

How to connect the power supply

To connect the three-pole power supply cable (Figure 4.1 *p. 26*):
1. Access the electrical board of the appliance according to the Procedure 4.2 *p. 25*.

2. Connect the three lead-in wires to the terminal block (TER) in the electrical panel on the machine.
3. Provide the earth ground lead-in wire longer than live ones (last to be torn in the event of accidental pulling).

Figure 4.1 *Wiring for a single unit with pump absorbed current less than 4 A*



1 General switch
2 Use a 15 A time lag fuse on L wire
3 Ground pin
4 Ground cable has to be connected by a suitable eyelet to the ground pin into the electrical panel, and fixed to it by the proper preset nut.
5 L, N wiring to the terminal board must be done respecting the correct polarity
6 Jumper closed

Do not operate the appliance unless the water system is filled with water and antifreeze.

4.4 SET-UP AND CONTROL

Control systems, options (1) or (2)

Two separate control systems are provided, each with specific features, components and diagrams (Figures 4.3 *p. 27*, 4.6 *p. 29*):

- ► System (1), with **DDC control** (with CAN bus connection).
- ► System (2), 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 control device.
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, ...), 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 controller is connected to the appliance through the CAN bus signal cable, shielded, compliant to Table 4.1 *p. 26* (admissible types and maximum distances).
For lengths ≤650 ft and max 4 nodes (e.g. 1 DDC + 3 GAHP), a simple 3 x 18 AWG shielded cable may even be used.

Table 4.1 *CAN bus cables type*

CABLE NAME	SIGNALS / COLOR			MAX LENGTH	Note
Robur					Ordering Code MCVO008
ROBUR NETBUS	H= BLACK	L= WHITE	GND= BROWN	1475 ft	
Honeywell SDS 1620					In all cases the fourth conductor should not be used
BELDEN 3086A	H= BLACK	L= WHITE	GND= BROWN	1475 ft	
TURCK type 530					
DeviceNet Mid Cable					
TURCK type 5711	H= BLUE	L= WHITE	GND= BLACK	1475 ft	
Honeywell SDS 2022					
TURCK type 531	H= BLACK	L= WHITE	GND= BROWN	656 ft	

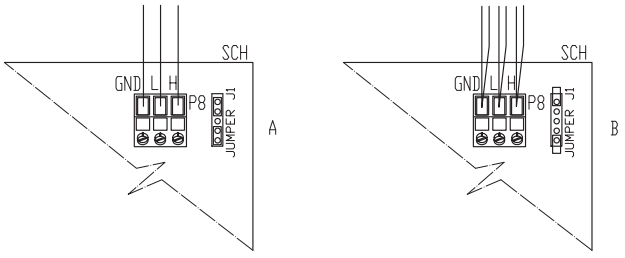
GND is the common signal wire, and not a ground connection.

How to connect the CAN bus cable to the appliance

To connect the CAN bus cable to the S61 electronic board (Paragraph 1.5 *p. 12*), located in the electrical panel inside the unit, (Figure 4.2 *p. 26* and 4.3 *p. 27*):

1. Access the electrical board of the appliance according to the Procedure 4.2 *p. 25*.
2. Connect the CAN bus cable to the GND (shielding/grounding) + L and H terminals (two signal wires).
3. Place the CLOSED J1 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 to the CAN bus cable according to the instructions of the following Paragraphs and DDC Manual.

Figure 4.2 *Connection of the CAN bus cable to the electronic board*

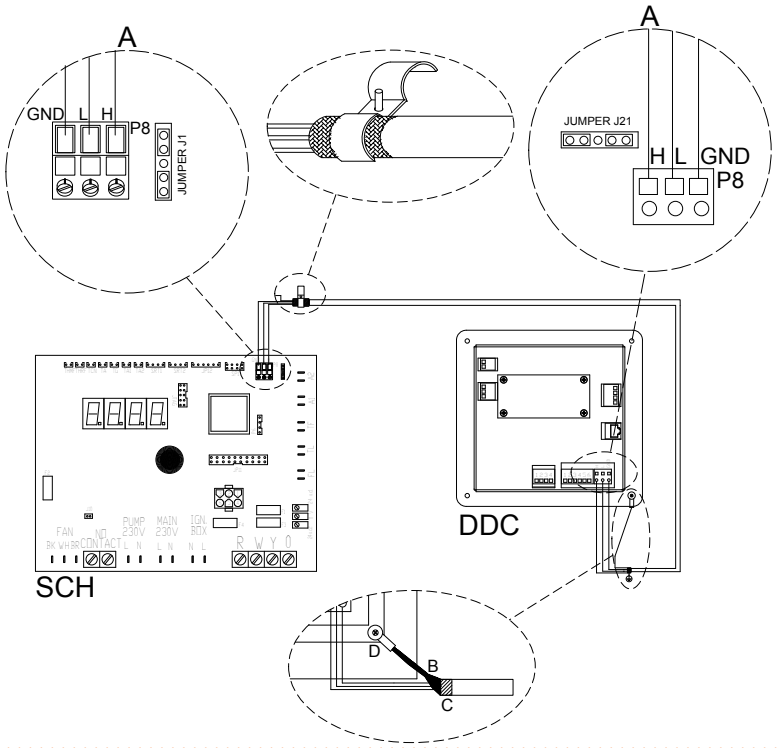


SCH Electronic board
GND Common data
L Data signal LOW
H Data signal HIGH
J1 Jumper CAN bus in board
A detail of "terminal node" case (3 wires; J1 = jumper "closed")
B Detail of "intermediate node" case (6 wires; J1 = jumper "open")
P8 CAN port/connector

GA Configuration (S61) + DDC

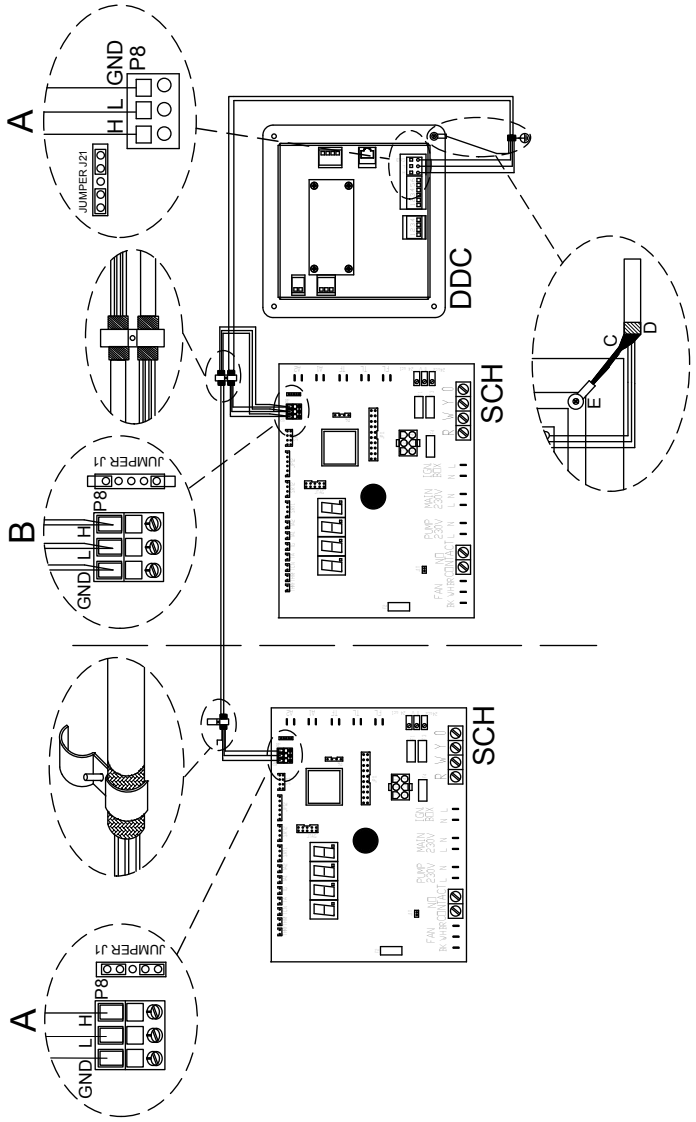
System (1) see also Paragraph 1.6 *p. 13*.

Figure 4.3 *CAN bus connection for systems with one unit*



DDC Direct Digital Control
SCH S61 controller
J1 Jumper CAN bus in board
J21 Jumpers CAN bus on DDC board
H,L,GND Data signal wires (ref. cables table)
A Terminal node connection (3 wires; J1 and J21 = "closed")
B CAN bus cable shield
C Insulating tape to protect the shield of the CAN bus cable
D Eyelet terminal and fixing screw

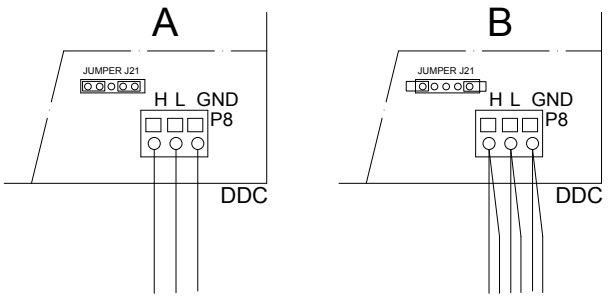
Figure 4.4 *CAN bus connection for systems with multiple single units*



DDC Direct Digital Control
SCH S61 controller
J1 Jumper CAN bus in board
J21 Jumpers CAN bus on DDC board
H,L,GND Data signal wires (ref. cables table)
A Terminal node connection (3 wires; J1 and J21 = "closed")
B Intermediate node connection - (6 wires; J1 and J21 jumpers = "open")
C CAN bus cable shield
D Insulating tape to protect the shield of the CAN bus cable
E Eyelet terminal and fixing screw

Place the CLOSED J21 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).

Figure 4.5 *Connection of the CAN bus cable to the control panel*



DDC Direct Digital Control
GND Common data
L Data signal LOW
H Data signal HIGH
J21 Jumpers CAN bus on DDC board
A Detail of "terminal node" case (3 wires; J21 = jumper "closed")
B Detail of "intermediate node" case (3 wires; J21 = jumper "closed")
P8 CAN port/connector

External request

System (2) see also Paragraph 1.6 *p. 13*.
It is required to arrange:

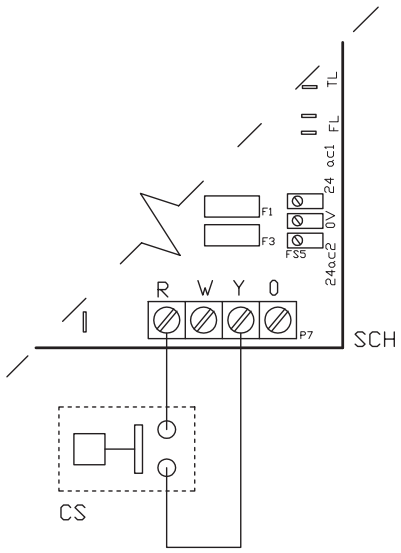
► Enable device (e.g. thermostat, timer, switch, ...) fitted with a voltage-free NO contact.

How to connect the external request

Connection of external request is effected on the S61 board located in the electrical panel inside the unit (Figure 4.6 *p. 29*):

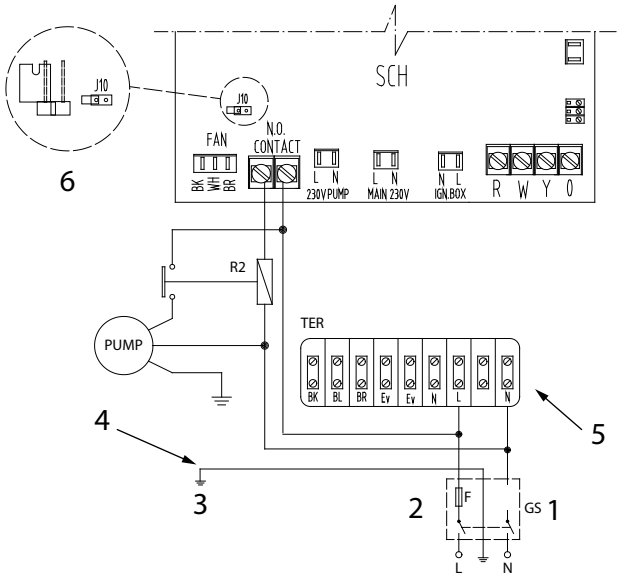
1. Access the electrical board of the appliance according to the Procedure 4.2 *p. 25*.
2. Connect the voltage free contact of the external device (Detail CS), through two wires, to **terminals R and Y** (respectively: common 24 V AC and cooling request) of electronic board S61. It is recommended to use a cable with the correct number of color-coded 18 AWG wires.

Figure 4.6 *External cooling request connection*



SCH Electronic board
R Common
Y Cooling request terminal
Components NOT SUPPLIED
CS External request

Figure 4.7 *Wiring for a single unit with pump absorbed current more than 4 A*



1 General switch
2 Use a 15 A time lag fuse on L wire
3 Ground pin
4 Ground cable has to be connected by a suitable eyelet to the ground pin into the electrical panel, and fixed to it by the proper preset nut.
5 L, N wiring to the terminal board must be done respecting the correct polarity
6 Jumper open

Thermostat location

If the external request is a thermostat, it should be located on an inside wall about 54 inches above the floor. It should be located so that it will no be affected by any of the following items:

- ► discharge air from a supply grille
- ► drafts
- ► direct sunlight through a window or glass door
- ► electrical appliances such as television, radio or lamps

The thermostat should be located so that it senses the average temperature of the climatized space. The thermostat should be mounted according to the manufacturer's instructions (packaged with the thermostat). Thermostats using a mercury bulb switch must be level. If the thermostat has a built-in heating anticipator, this must be set as required by the heating unit load.

4.5 WATER CIRCULATION PUMP

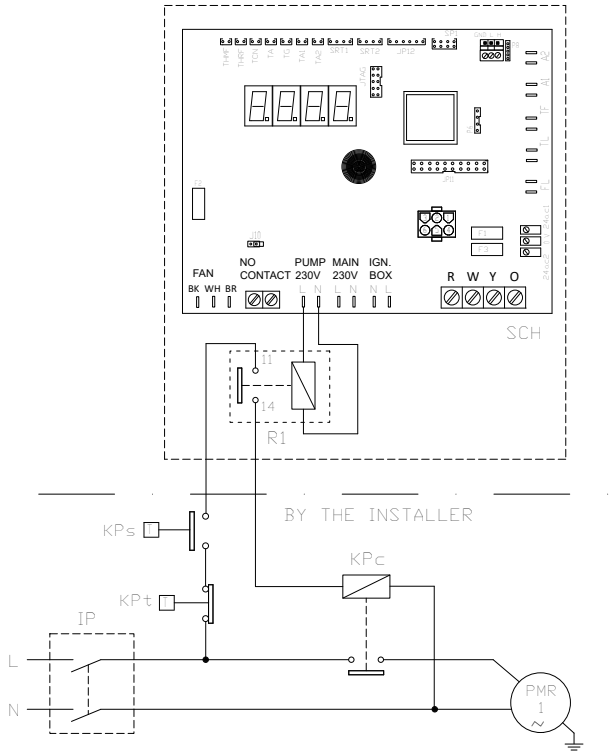
4.5.1 Constant flow circulation pump

It must be mandatorily controlled from the S61 electronic board. If power for the water pump is taken from the high voltage terminal block located in the electrical control panel, as shown in Figure 4.1 *p. 26*, the minimum circuit ampacity for the unit must be increased above that listed in the technical data (Table 1.1 *p. 14*) to accommodate the additional current draw of the water pump installed. **The maximum current carrying capacity of the N.O. contact is 4 A**. If the current is above 4 A, use an additional relay controlled by N.O. contact on the S61 board (Figure 4.7 *p. 29*).
Jumper J10 must be opened if the pump is > 700 W, otherwise it must be closed.

4.5.2 Heat recovery exchanger circulating pump

To be controlled through a relay available in the electrical board of the appliance (Figure 4.8 *p. 30*).

Figure 4.8 *Recovery exchanger pump connection*

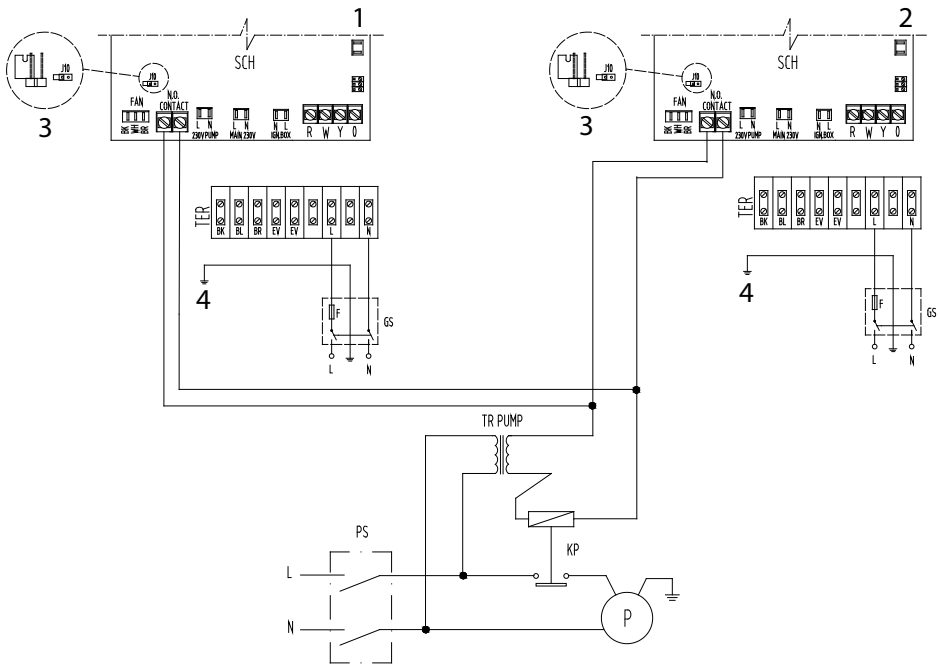


R1 Relay on the unit for recovery exchanger pump request
KPt Thermostat with setpoint calibration of DHW tank (not supplied)
KPs Thermostat calibrated at 95 °F with capillary tube in the lower part of the DHW tank (not supplied) [to be provided in the event the water flow rate on the recovery circuit exceeds the nominal value of 9.6 GPM]
KPc Two-pole relay for recovery exchanger pump request (not supplied)
IP Two-pole isolation switch for recovery exchanger pump power supply (not supplied)
PMR Recovery exchanger pump (not supplied)

4.6 WITH MORE THAN ONE GA ACF UNIT

Figure 4.9 *p. 30* shows typical wiring for 2 or more GA ACF units.
It is always necessary to provide a safety transformer (secondary SELV) and a respective control relay.
The transformer is required to feed N.O. contacts with low voltage current, for safety reasons: when doing maintenance and a unit is shut off, these contacts could still remain fed.
In this case, no matter if pump current absorption is more or less than 4 A.

Figure 4.9 *Wiring for 2 units with low voltage transformer*



1 Unit 1
2 Unit 2
3 Jumper open
4 Ground pin

5 FIRST START-UP

First start-up entails checking/setting up the combustion parameters and may exclusively be carried out by a Robur AT. NEITHER the user NOR the installation technician is authorised to perform such operations, under penalty of voiding the warranty.

5.1 PRELIMINARY CHECKS

Preliminary checks for first start-up

Upon completing installation, before contacting the AT the installer must check:

- Water, electrical and gas systems suitable for the required capacities and equipped with all safety and control devices required by the regulations in force.
- Absence of leaks in the water and gas systems.
- Type of gas for which the appliance is designed (natural gas or LPG).
- Supply gas pressure complying with the values of Table 5.1 *p. 32*, with max tolerance ±15%.
- Power supply mains complying with the appliance's rating plate data.
- Appliance correctly installed, according to the manufacturer's instructions.
- System installed in a workmanlike manner, according to national and local regulations.

Before performing the first start-up, the AT is required to:

- Check that the whole system has been set up in accordance with its design, following the instructions supplied by the manufacturer and respecting current regulation. The project must have been carried out by a skilled professional.
- Check personally that all of the connections (hydraulic, gas and electrical) of the appliance (and of the DDC, if any) have been made correctly.
- Check that the necessary conditions for system compliance effectively exist (as per the declaration consigned to the user by the qualified firm that has carried out the installation of the appliance).
- Check that the water pressure and flow in the hydraulic circuit and the static supply network pressure are correct, as indicated by the manufacturer.

The declaration of compliance certifies that the system conforms to current regulations. This declaration is a compulsory document, and as such must be issued by law to the owner by the qualified firm that has carried out the installation of the appliance.

Abnormal or hazardous installation situations

Should any hazardous installation situations be found, the AT shall not perform first start-up and the appliance shall not be commissioned.

These situations may be:

- Appliance installed inside a room.
- Failed compliance with minimum clearances.
- Insufficient distance from combustible or flammable materials.
- Conditions that do not warrant access and maintenance in safety.
- Appliance switched on/off with the main switch, instead of the control device provided (DDC, or external request).
- Appliance defects or faults caused during transport or installation.
- Gas smell.
- Non-compliant mains gas pressure.
- Antifreeze monoethylene glycol not added to the system water (Paragraph 3.6 *p. 23*).
- All situations that are potentially hazardous.

Should any abnormal installation situations be found, the AT can carry out the first start-up, but the appliance will be kept switched off until the user/installer fully follows the manufacturer's directions/instructions.

These situations may be:

- Installations which show situations in contradiction to the directions/instructions of the manufacturer in part or fully.
- All situations that may involve operation abnormalities.

Non-compliant system and corrective actions

Should the AT find any non-conformities, he must:

- Inform the user/installer of any installation anomaly.
- Inform the user/installer of any situation that is judged to be hazardous for the appliance and for people.
- Inform the user/installer of any missing documentation relating to the system.
- Indicate, in relation to the reports made, any corrective measure to be taken on the plant, which the installer will have to carry out in order to proceed with the first start-up.

Should the AT find any non-conformities, the user/installer is bound to perform any corrective procedures required by the AT. After performing the remedial actions (the installer's responsibility), if the AT deems that safety and conformity conditions are in place, first start-up may be effected.

The positive result of the first start-up (in site) is only reflecting the good operation of the appliance and DDC (if used) but doesn't involve any responsibility concerning the correct execution of the system.

The length of the warranty is dependent upon the installation and start-up of the unit by Authorized Technicians (AT). See warranty card for complete details.

5.2 FIRST START-UP OPERATIONS

To carry out the first start-up of the appliance, it is necessary to perform the operations described below, proceeding according to the following sequential order.

First start-up operations

- Open the gas supply tap to the system and check that there is no smell of gas (indicating possible leaks).
- Close the gas tap and check the static gas mains pressure (Paragraph 5.3 *p. 32*).
- Prepare the appliance for the gas pressure adjustment (Paragraph 5.4 *p. 32*).
- Power up the appliance, after:
  - check one final time that there is no smell of gas
  - activating the external mains switch (GS), provided by the electrical system installer on a suitable panel, moving it to the ON position
- Power up the DDC, if provided.

- ► Switch on the appliance by means of the provided control device (DDC or external request).
- ► Adjust the gas pressure to the appliance (Paragraph 5.4 *p. 32*).
- ► Check the dynamic gas mains pressure (if possible on the appliance that is furthest from the point where the system is connected to the gas mains), by performing the following points in order:
  - ■ stop the appliance
  - ■ connect the manometer (Paragraph 5.4 *p. 32*)
  - ■ reactivate the appliance
  - ■ read the dynamic mains pressure on the manometer and check that this value satisfies the requiments of Table 5.1 *p. 32*
- ► Carry out the regulation of the operating parameters of the system.

In the first activation stage, on the display of the electronic board of the appliance (and/or on the display of the DDC, if any), an operating code may be displayed (Table 8.1 *p. 40*).

5.3 CHECK THE STATIC GAS MAINS PRESSURE

Procedure for checking the static gas mains pressure (Figure 5.1 *p. 32*)

1. Turn main gas valve knob to the "OFF" position.
2. Remove the plug on the gas pressure intake of gas valve and attach pressure tap and manometer.
3. Turn main gas valve knob to the "ON" position.
4. Read the value of the static gas mains pressure on the manometer and compare it with the required value:
   – 5 inch WC for natural gas
   – 11 inch WC for LPG
5. Turn main gas valve knob to the "OFF" position.
6. Remove manometer and pressure tap. Replace plug in gas valve.

5.4 GAS PRESSURE ADJUSTMENT

The manufacturer supplies the appliances already adjusted for a particular type of gas. The type of gas can be checked and easily identified by looking at the marking label inside the appliance. Nevertheless, before starting the appliance it is necessary to check and adjust if necessary the gas input (HHV) to the burner. Using the Table 5.1 *p. 32* below, arrange the proper manifold pressure according to the local gas heating value (BTU content per cubic foot) and specific gravity. Table 5.1 *p. 32* is based on the correct natural gas input (HHV) for the model by manifold pressure in inches of water column (inch WC).

Table 5.1 *Manifold pressure [inch WC] based on gas input (HHV) of 94.900 Btu/hr using a 0.21" nozzle*

MJ/m³	Btu/CU.FT.	Specific gravity of natural gas			
		0.55	0.60	0.65	0.70
35.40	950	2.81	3.07	3.33	3.58
36.33	975	2.67	2.91	3.16	3.40
37.26	1000	2.54	2.77	3.00	3.23
38.19	1025	2.42	2.64	2.86	3.08
39.12	1050	2.30	2.51	2.72	2.93
40.05	1075	2.20	2.40	2.60	2.80
40.98	1100	2.10	2.29	2.48	2.67
41.92	1125	2.01	2.19	2.37	2.55
Our reference:					
MJ/m³	**Btu/CU.FT.**	**Specific gravity of natural gas**			
		0.555			
37.78	1014	2.50			

The conditions referred to by the Table 5.1 *p. 32* above are for the guidance of the installer and the CSA design certification does not cover the conditions described therein.

For propane gas appliances, follow the same instructions as given for natural gas. The manifold pressure for propane gas should be 4.8 inch WC and adjustment is made at the gas valve regulator. Manifold pressure at 94.900 Btu/hr. input using 0.14" nozzle.

The following Table 5.2 *p. 32* summarizes nozzles and manifold pressures for different types of gases.

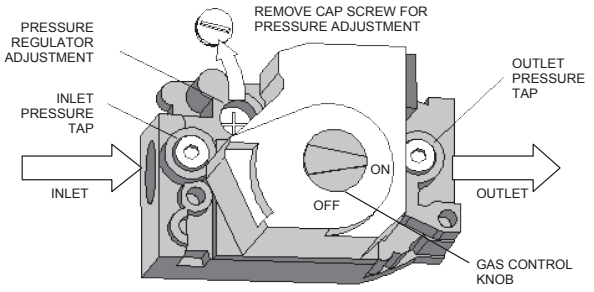
Table 5.2 *Manifold pressure and nozzle diameter*

Gas type	natural gas	LPG
Manifold pressure	2.5 inch WC	4.8 inch WC
Nozzle diameter	0.21"	0.14"

Gas pressure adjustment procedure (Figure 5.1 *p. 32*)

1. Turn main gas valve knob to the "OFF" position.
2. Remove the plug on outlet end of gas valve and attach pressure tap and manometer.
3. Switch on the appliance and close control switch.
4. Wait for the burner to start up. Due to the presence of air inside the piping, it may be that the burner does not start at the first three attempts and, failing to do so, the ignition system is locked out. If this happens reset the ignition system (Paragraph *p. 38*). Repeat until all the air is purged from the piping and the burner ignites.
5. When the burner ignites read the manometer and compare the value to the required pressure (Table 5.1 *p. 32*).
6. If necessary change the manifold pressure using the gas valve regulator. The regulator is built into the gas valve. Remove the seal screw and turn adjusting screw clockwise to increase pressure or counterclockwise to reduce pressure. Replace seal screw after adjustment.
7. Open control switch and make sure that the appliance is off.
8. Remove manometer and pressure tap. Replace plug in gas valve.
9. Turn on the appliance by closing control switch. Check all gas connections with soap for leaks.

Figure 5.1 *Gas valve*



5.5 GAS CHANGEOVER

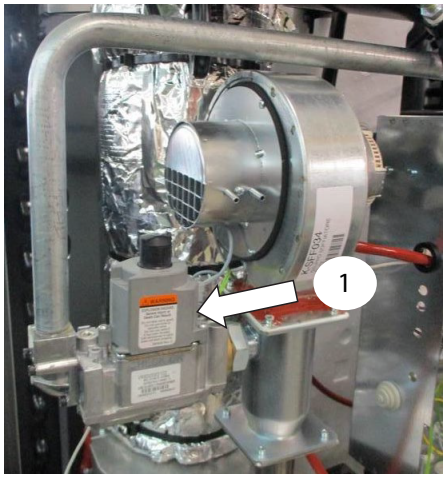
Only an authorised technician can perform the gas change operation.

If the type of gas indicated does not correspond to the type to be used (natural or propane gas) by the appliance, it must be converted and adapted to the type of gas to be used.
The gas nozzle must be changed (Table 5.2 *p. 32*) and the gas valve must be converted.

Gas change procedure (Figure 5.3 *p. 33*)

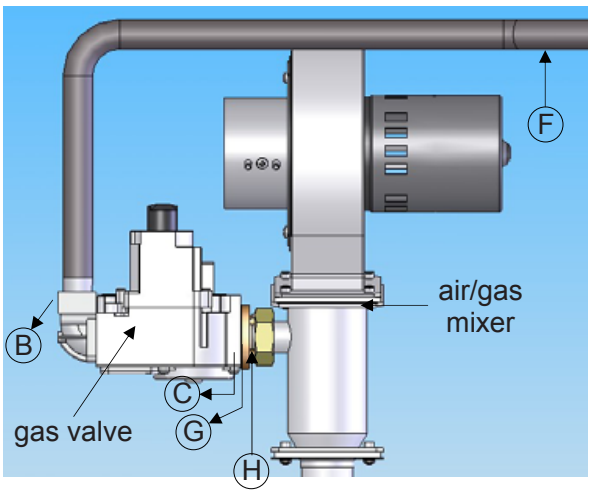
1. Cut off electric power and gas supply.
2. Remove front and left panel.
3. Remove the wires from the gas valve.
4. Remove the ring nut (H) from the threaded gas nozzle (C).
5. Remove the gas nozzle (C) from the gas valve (A) by removing the 4 screws (G) from the valve flange (use 9/64" hex key wrench). Put the o-ring (D) in a safe place, to be re-used with the new nozzle.
6. Attach the new gas nozzle to the gas valve using the 4 screws to secure valve flange: be sure to put the o-ring in the proper site.
7. Tighten the ring nut and re-attach wires to the valve.
8. Restore the gas and electrical supply.
9. Adjust the gas pressure for the gas to be used following the instructions reported in Paragraph 5.4 *p. 32*.
10. Replace the sticker indicating the type of gas for which the unit is preset with the new one, which indicates the type actually being used.

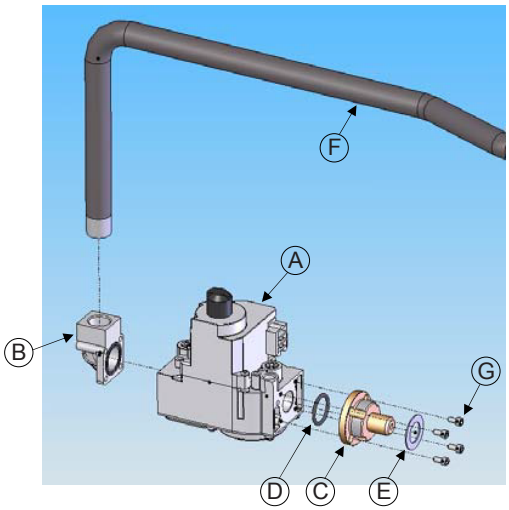
Figure 5.2 *Gas valve*



1 gas valve

Figure 5.3 *Gas change operations*





A 24 V AC gas valve
B Gas valve flange
C Nozzle
D O-ring
E Gasket
F Gas supply pipe
G Burnished screw (4)
H Hexagonal nut

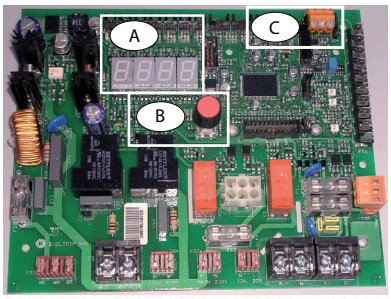
5.6 ELECTRONIC ADJUSTMENT ON THE MACHINE – MENUS AND PARAMETERS OF THE S61 BOARD

Firmware

The instructions on the use of the S61 electronic board concern the **firmware version 3.035**.

The appliance's electronic board (S61)

Figure 5.4 *Electronic board S61*



The S61 electronic control board has three fuses for circuit protection. If the electronic control board does not start up or the finned coil fan does not run, remove power from the unit and check the condition of the fuses.

The S61 board requires a 10 A (condenser fan) and two 2 A fuses (electrical board). The size of the fuse is labeled on the electronic control board next to the respective fuse holder.

The **maximum current carrying capacity** of the N.O. Contact is **4 A**. (Paragraph 4.5 *p. 29*).

Isolation relay

An isolation relay **must** be used to separate the appliance's transformer from any additional equipment having a transformer or damage to the S61 board will occur. Isolation relays must have a 24 V AC coil, which does not present more than 0.25 A load to the control circuit.

Display

The 4-digit display of the S61 board (Detail A Figure 5.4 *p. 34*) is as follows:

- The **first digit** (on the left, green) indicates the menu number (e.g. "0.", "1.", "2.", ... "8.").
- The **last three digits** (on the right, red) indicate a **code** or a **value** for a parameter, among those included in the selected menu (e.g. "__6" "_20", "161").

(e.g. menu+parameter "1.__6", "2._20", "3.161").

Knob

One of the following actions may be done with the S61 board knob (Detail B in Figure 5.4 *p. 34*):

- Enter the menu list (by pressing the first time).
- Scroll the menu list, or a series of parameters in a menu (by turning).
- Select a menu or a parameter (by pressing).
- Modify and confirm the setting of a parameter (turning and pressing).
- Execute a command (by pressing).
- Exit a menu and go back to the higher level by selecting the letter "E" which is displayed at the end of the menu list or of a series of parameters in a menu.

The letter "E" is displayed at the end of the menu list or of a series of parameters in a menu, and indicates the exit to go back to the higher level by pressing the knob.

Menus and Parameters

The menus may be display only (functional data or parameters), display and setting (parameters) or control (reset).
The menu entries will be identified on the display of the electronic control board through a number, where its maximum value is 3 digits (lined up at right).
The visualization is characterized by the presence (on the 1st digit of display) of the menu identification number (example: 0.__0 indicates entry 0, menu 0; 0.__2 indicates entry 2, menu 0).

Menu for the user (but for the installer and AT as well)

- The menu "0.", display only, for functional data detected in real time.
- The menu "1.", display only, for current values of appliance parameters.
- Menu "2.", control, to execute flame control unit reset operations, reset errors (Paragraph 7.5 *p. 38*).
- Menu "3.", display and setting, to set the value of some system parameters (e.g. water setpoint temperature); the values are initialized by the AT at first start-up.

It is accessed without password.

Menu for the installer or AT (not accessible to the user)

- Menu "4.", "5.", "6." and "9." are password-protected. These are specific sections, exclusively intended for qualified personnel (installer or AT).
- Menu "7." is display only and intended for the manufacturer.
- Menu "8." is empty, it may be selected but not used.

Special key for the knob

- To access the menus and parameters of the S61 board, use the special standard supplied key. The key allows the knob to be operated through the suitable hole in the electrical panel cover, operating safely away from live components.
- Always keep the key for future uses.

How to access the menus and parameters

Before Starting:
(1) Power supply switch on.
(2) Display of the S61 board showing in sequence the detected water temperature data (if the appliance is in normal operation), or the flashing malfunction and failure codes (if the appliance is in failure).
To access the menus and parameters of the S61 board, proceed as follows (see also Figure 5.4 *p. 34*):

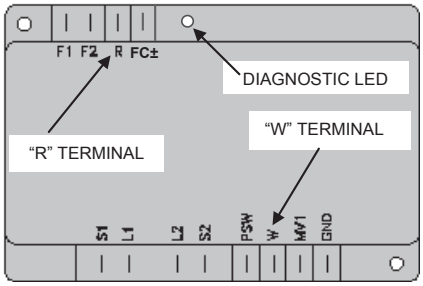
1. Remove the front panel by removing the fixing screws.
2. Remove the cover of the electrical board to access the S61 board knob.
3. Act on the knob by means of the special key through the suitable hole.
4. Press the knob once to display the menus: the first menu is displayed, "0." (= menu 0).
5. Turn the knob clockwise to scroll down and display the other/subsequent menus; the menu numbers will be displayed in order, "1.", "2.", ... , "6." ... or "E" (= exit).
6. Select the menu of interest (e.g. display "2.___" = menu 2) by pressing the knob; the first parameter code will be displayed, in menu order (e.g. display "2._20" = parameter 20 in menu 2).
7. Turn the knob clockwise to scroll down the other parameters in the menu; the codes will be displayed in order (e.g. display "2._20", "2._21", ... "2._25" = parameters 20, 21, ... 25 in menu 2), or letter "E" (= exit) at the end of the list.
8. Select the parameter of interest (e.g. with code 075 in menu 3) by pressing the knob; the figure previously assigned to the parameter will be displayed, read only or to

be set (e.g. the figure "44" for parameter 075 in menu 3 = water temperature setpoint at 44 °F); if instead of a figure/setting it is a command, a blinking code is displayed (e.g. "reS1" for the flame lockout reset command).

9. Press the knob to reconfirm the figure; or rotate the knob to modify the figure, and press at the end to confirm or set the new figure; if however, it is a matter of controlling an appliance operation, press the knob to execute it.
10. To exit a parameter menu or the menu list and go back to the higher level, turn the knob to display the letter "E" for exit, then press the knob again.
11. Place the cover back on the electrical panel opening and fit the appliance's front panel back on.

5.6.1 Flame controller

Figure 5.5 *Flame controller*



When power is supplied to the appliance (to the "R" terminal on the ignition control box), ignition control will reset, perform a self-check routine, flash the diagnostic LED, and enter thermostat scan state.
When the control switch is closed, the electronic control board will energize the ignition control box starting the ignition sequence (24 V applied to the "W" terminal on the ignition box).
The ignition control box will check the differential air pressure switch for open contacts. If the differential air pressure switch contacts are closed and stay closed for 30 seconds, an airflow fault will show. The diagnostic LED on the ignition control box indicates this fault. In this mode, the ignition control box pre-mixer blower will not start.
If the pressure switch contacts are open, the ignition control box pre-mixer blower will instead start. An airflow fault will occur if the air pressure switch contacts remain open for 30 seconds after the pre-mixer blower start. The diagnostic LED on the ignition control box indicates this fault. In this mode, the ignition control box will keep the pre-mixer blower energized.
If the air pressure switch contacts close after the pre-mixer blower starts (normal operation), a pre-purge delay begins and the ignition sequence continues.
Next, the ignition control box energizes an ignition transformer that generates a high-intensity spark at the igniter to ignite the gas/air mixture. Simultaneously, the gas valve is energized, allowing the flow of gas to the burner.
The ignition control box continuously monitors the flame sensor for ignition. If the flame sensor detects flame, the ignition transformer is de-energized immediately and the gas valve and pre-mixer blower remain energized.
Should the burner fail to light, or flame is not detected during the first trial for ignition, the gas valve and ignition transformer are de-energized and the ignition control box begins an inter-purge delay before another ignition attempt. The control will attempt two additional ignition trials (total of 3 ignition trials) before going into lockout. Upon lockout, the gas valve will de-energize immediately and the pre-mixer blower will turn off.
The thermostat ("W" terminal), air pressure switch and burner flame are constantly monitored to assure proper system operation. When the call for flame has ended (24 V removed from "W" terminal on ignition control), the gas valve is de-energized immediately. The ignition control then senses loss of flame and de-energizes the pre-mixer blower.
To reset the flame controller lockout, refer to the procedure given in Paragraph *p. 38*.

5.7 MODIFYING SETTINGS

Modify settings via the DDC

If the device is connected to the DDC control, refer to the relevant manual to modify settings.

If any information (menu, menu entries, parameters and/or values, etc.) is visualized on the display in flashing mode, it means that this information couldn't be entered.

When information is not available, the display visualizes -.-.-.-.

How to raise/lower the water temperature setpoint

The water temperature setpoint establishes the outlet temperature to the system (water output from the appliance), or inlet from the system (water input in the appliance). The temperature is pre-set by the AT upon first start-up.

If the appliance is not connected to a DDC control, to raise/lower the water temperature setpoint with the S61 board, proceed as follows:

1. Access menu 3 under parameter 75 (= water temperature setpoint) by rotating and pressing the knob; "3._75" must be displayed (procedure Paragraph 5.6 *p. 33*).
2. Display the parameter value by pressing the knob; the previously set value is displayed (from 37.4 to 77 °F); to reconfirm the pre-existing value press the knob again, otherwise go to step 3.
3. Turn the knob to modify the value, increasing or decreasing it, and press it to set the new value.
4. Exit menu 3, and from the menu list, by selecting and pressing letter "E" twice, and go back to the normal display of detected temperature data.

Do not modify complex settings

Specific technical and system knowledge is required for complex settings. Contact an AT.

6 NORMAL OPERATION

This section is for the end user.

6.1 WARNINGS

General warnings

Prior to using the appliance carefully read the warnings in Chapter III.1 *p. 4*, providing important information on regulations and on safety.

First start-up by AT

First start-up may exclusively be carried out by a Robur AT (Chapter 5 *p. 31*).

Never power the appliance off while it is running

NEVER power the appliance off while it is running (except in the event of danger, Chapter III.1 *p. 4*), since the appliance or system might be damaged.

6.2 SWITCH ON AND OFF

Routine switching on/off

The appliance may exclusively be switched on/off by means of the suitably provided control device (DDC or external request).

Do not switch on/off with the power supply switch

Do not switch the appliance on/off with the power supply switch. This may be harmful and dangerous for the appliance and for the system.

Checks before switching on

Before switching on the appliance, ensue that:
- gas valve open
- appliance electrical power supply (main switch (GS) ON)
- DDC power supply (if any)
- water circuit ready

How to switch on/off

The appliance may be turned on/off in cooling mode, to produce chilled water, according to climate control needs.
- ► If the appliance is controlled by a DDC, refer to the relevant manual.
- ► If the appliance is controlled by external request (e.g. thermostat, timer, switch, ... with voltage-free NO contact), the appliance is switched on/off by the ON/OFF positions of the external control device.

Switch on

Switch on the appliance using the on/off command (placing it in the "ON" position).
After switching on with the control, in normal operating conditions, the appliance starts/stops automatically according to the user's cooling needs, supplying chilled water at the programmed temperature.

Although the external request is in the "ON" position, this does not mean the appliance will start immediately, but it will only start when there are actual service demands.

Switch off

Switch off the appliance using the on/off command (placing it in the "OFF" position).
The shutdown cycle takes approximately 10 minutes to complete.

6.3 MODIFYING SETTINGS

Modify settings via the DDC

If the device is connected to the DDC control, refer to the relevant manual to modify settings.

Do not modify complex settings

Specific technical and system knowledge is required for complex settings. Contact an AT.

6.4 EFFICIENCY

For increased appliance efficiency:
- ► Keep the finned coil clean.
- ► Set minimum water temperature to the actual system requirement.
- ► Reduce repeated switch-ons to the minimum (low loads).
- ► Program appliance activation for actual periods of use.
- ► Keep water and air filters on plumbing and ventilation systems clean.

7 MAINTENANCE

7.1 WARNINGS

Correct maintenance prevents problems, assures efficiency and keeps running costs low.

Maintenance operations described herein may exclusively be performed by the AT or skilled maintenance technician, excluding finned coild cleaning, which can also be done by the user.

Any operation on internal components may exclusively be performed by the AT.

Before performing any operation, switch off the

appliance by means of the control device (DDC or external request) and wait for the end of the shutdown cycle, then disconnect power and gas supply, by acting on the electrical disconnector and gas valve.

Lubrication of condenser fan, hydraulic pump, and premixer motor is not recommended.

The efficiency checks and every other "check and maintenance operation" must be performed **once a year**.

Responsibility for efficiency checks, to be carried out for the aims of restricting energy consumption, lies with the system manager.

Environmental or operational heavy conditions

In environmental or operational conditions particularly heavy (for example: heavy-duty use of the appliance, salty environment, etc.), maintenance and cleaning operations must be more frequent.

7.2 SCHEDULED ROUTINE MAINTENANCE

The maintenance operations to be carried out on the appliance, at least once a year, which can also be done by the user, are:

► Clean the finned coil.

The maintenance operations to be carried out on the appliance, at least once a year, that may exclusively be performed by the AT or skilled maintenance technician, are:

► Check the condenser fan height
► Checking that the combustion circuit is fully functional:
  ■ inspect and clean flue gas passage
  ■ clean the burner
  ■ check the ignition and flame sensor electrodes
► Check that the oil pump is operating correctly:
  ■ check the oil level
  ■ replace the belts after 6 years or 12000 hours of operation
► Check the cleanliness of the water filters and efficiency of the internal flow switch

7.2.1 Clean the finned coil

Finned coil cleaning can also be done by the user.

Avoid excessively aggressive cleaning of the finned coil (e.g. high-pressure washer).

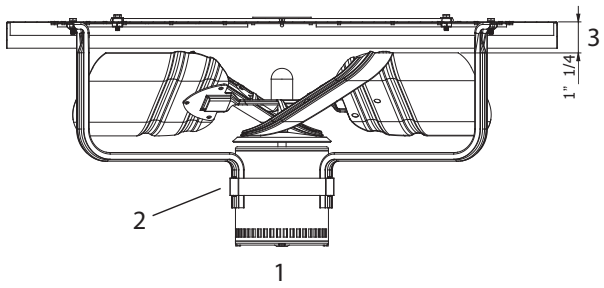
Do not use solvents for cleaning the finned coil. This could cause damage to the aluminium fins.

During the cleaning of the finned coil, always wear safety googles.

7.2.2 Condenser fan height check

For proper airflow, the distance between the top edge of the fan blade and the top panel must be 1" 1/4.
If the fan is at an improper height, adjust the location of the mounting strap around the fan motor.

Figure 7.1 *Section view showing proper fan height*



1 Section view
2 Mounting strap
3 Fan blade edge - top panel
Note: some details have been removed for clarity

7.2.3 Inspection and cleaning of the flue gas passage

Procedure for inspecting and cleaning the flue gas passage

1. Switch off the appliance by means of the suitably provided control device (DDC or external request) and wait for the end of the shutdown cycle.
2. Cut off electric power and gas supply.
3. Remove the front panel.
4. Clean the base pan around the generator housing of any debris.
5. Look at the flue opening to the right of the generator housing and clear any debris that may be ostructing the opening.
6. Look at the air intake chute for combustion air and clear any debris that may be obstructing the opening.
7. Replace the front panel.
8. Restore the gas and electrical supply.
9. Start the appliance to check for correct operation.

7.2.4 Inspection and cleaning of the burner

Tools needed

► Fiber bristle brush
► Dust mask (3M #8710 or equal)
► Safety googles
► Hand tools

Procedure for inspecting and cleaning the burner

1. Switch off the appliance by means of the suitably provided control device (DDC or external request) and wait for the end of the shutdown cycle.
2. Cut off electric power and gas supply.
3. Remove the front panel.
4. Remove bolts and nuts securing the pre-mix blower housing to the burner tube flange.
5. Remove screws holding the burner and insulation retaining straps.

Wear a dust mask (3M #8710 or equal NOISH/MSHA TC-21C mask) during burner removal, cleaning and assembly operations.

6. Pry bottom of burner tube out to clear bottom of generator housing. Pull burner down and out to remove it from generator housing.

Be careful not to distort or damage the burner tube or the flame sensor / ignition electrodes assemblies in the

generator housing.

7. Position the burner tube with open end down.
8. Clean burner tube ports with fiber bristle brush and shake any debris out of the tube.
9. Inspect burner tube gasket that seals the burner tube to the generator housing and the burner flange gasket that seals the burner to the pre-mix blower housing. Replace either gasket if damaged during the burner removal process.
10. Replace the burner tube in reverse order of removal.

Make sure the two gaskets are positioned correctly and that the generator housing is properly sealed.

11. Replace the front panel.
12. Restore the gas and electrical supply.
13. Start the appliance to check for correct operation.

7.3 EXTRAORDINARY MAINTENANCE

The operations described in this paragraph must be carried out as and when necessary.

► Adding water and antifreeze to the system water

If it should be necessary to add water to the system, add a suitable quantity, making sure that the minimum pressure is the required one (Paragraph 3.8 *p. 24*).
Always add the correct amount of antifreeze glycol, depending on the minimum external temperature of the installation area (Paragraph 3.6 *p. 23*).

7.4 MESSAGES ON THE DISPLAY

4 digit display

The S61 board of the appliance (Paragraph 1.5 *p. 12*, Figure 5.4 *p. 34*) is fitted with a 4-digit display, visible through the sight glass of the front panel.

► When the appliance is powered on, all the LEDs switch on for 3 sec, then the board name is displayed.
► After another 15 sec, the appliance is ready to operate.

Signals in normal operation

► During normal operation, water temperature values alternate on the display: output, input and the difference between the two.

Signals in the event of fault

In the event of fault the display blinks indicating an operational code (first letter on the display: "E" = error, or "U" = warning).
The display rotates after the values of the outlet water temperature, the inlet and the difference between them.
If multiple events are active, they are shown in sequence, ordered by increasing code number.
If warning or error events are active, the left green symbol, shown together with water temperature data, blinks.
If it is a permanent error or warning the appliance stops.
(Table 8.1 *p. 40*).

7.5 RESTARTING A LOCKED-OUT UNIT

Fault signals on the display

In the event of locked-out appliance, an operational code flashes on the display (first green figure on the left, letter "U" = warning or "E" = error).

► To restart the appliance you must know and perform the procedure concerning the issue signalled and identified by the code (Paragraph 8.1 *p. 40*).
► Only act if you are familiar with the issue and with the procedure (technical expertise and professional qualifications might be required).
► If you do not know the code, the problem, or the procedure, or you do not have sufficient skills, and in any case of doubt, contact the AT.

Locked-out appliance

An external intervention (reset or repair) is required due to an appliance fault or problem with the system.

► A reset may be enough for a temporary and provisional fault.
► For a fault or breakdown, alert the maintenance technician or AT.

Reset

There are two options for resetting a fault:

1. If the appliance is connected to a DDC you may act through the control device, as described in the relevant manual.
2. You may act directly from the S61 board as described below (if the appliance is controlled with external request, this is the only option).

How to perform reset from the S61 board

To perform the reset directly from the S61 board:

1. Access Menu 2 under Parameter "__0", to reset flame lockout (Error E12), or Parameter "__1" for any other generic reset, turning and pressing the knob; "2.__0"/"2.__1" must be displayed (procedure Paragraph 5.6 *p. 33*).
2. Press the knob to display the flashing reset request (e.g. "reS1" to reset flame block).
3. Press the knob again (the second time) to perform the reset; the reset request stops blinking, then "2._XX" is displayed again (e.g. "2.__0"). The reset operation has been performed.
4. Exit menu 2 and the menu list, by selecting and pressing letter "E" twice, and go back to the normal display of detected temperature data.

If, after these operations have been carried out, the appliance does not start, first perform the following simple checks:

► Check that any external CS request (Paragraph *p. 28*) or that the DDC (if connected and in controller mode) is in a position that requires the operation of the appliance.
► Make sure that the main power supply switch (GS) fitted by the electrical installation technician on a suitable panel (Figure 4.1 *p. 26*) is in the ON position.
► Check that the gas supply valve is open.
► Check that there are no further messages on the display.

At this point, if the appliance still fails to start:

► Refrain from proceeding by trials and errors. Instead, ask an AT to intervene, communicating the operating code reported by the appliance.
► Disconnect the appliance from the gas and electric mains, interrupting the gas supply by means of the tap and the power supply by means of the main switch/disconnector switch (Detail GS in Figure 4.1 *p. 26*).
► Wait for the contacted AT to arrive.

7.6 PERIODS OF INACTIVITY

Avoid emptying the installation

Emptying the system may cause damage due to corrosion of the water pipes. Assure at least one of the two following conditions:

1. sufficient antifreeze glycol (Paragraph 3.6 *p. 23*)
2. empty the system, however taking care to fill it again following the instructions in Paragraph 3.8 *p. 24*

Prolonged periods of inactivity

► Should you foresee to leave the appliance inactive for a long period of time, disconnect it from the electrical and gas mains. These operations must be performed by qualified personnel.

How to deactivate the appliance for long periods of time

1. Switch the appliance off (Paragraph 6.2 *p. 36*).
2. Only when the appliance is completely off, power it off with the main switch/disconnector switch (Detail GS in Figure 4.1 *p. 26*).
3. Close the gas valve.
4. If necessary, add water with glycol (if the appliance is disconnected from the power and gas mains, the active antifreeze protection is missing, Paragraph 3.5 *p. 23*).

How to reactivate the appliance after long periods of inactivity

Before reactivating the appliance, the operator/maintenance technician of the system must first of all:

- Check whether any maintenance operations are required (contact the AT; see Paragraph 7.2 *p. 37*).
- Check content and quality of the water in the system, and if necessary top it up (Paragraphs 3.8 *p. 24*, 3.7 *p. 23* and 3.6 *p. 23*).
- Ensure the flue gas exhaust duct is not obstructed, and that the condensate drain is clean.

After completing the above checks:

1. Open the gas valve and ensure there are no leaks; should gas smell be noticed, close the gas valve again, do not switch any electrical devices on and request intervention by qualified personnel.
2. Power on with the main power supply switch (GS, Figure 4.1 *p. 26*).
3. Switch on the appliance by means of the provided control device (DDC or external request, Paragraph 4.4 *p. 26*).

8 DIAGNOSTICS

8.1 OPERATIVE CODES

Table 8.1 *Operative codes*

Code	Description	Warning	Error	Possible causes / Checks
1	Generator sidewall limit switch open on absorption units - or - hot water limit open on GAHP and AY-119 models	Warning will reset automatically but generator sidewall limit must be manually reset	Error can be reset via S61, DDC or power off but generator sidewall limit must be manually reset	Hydraulic Pump malfunction or hydraulic pump low on oil Faulty limit switch If the problem persists, contact AT
2	Exhaust limit open	Warning will reset automatically when temperature drops by 14 °F	Error can be reset via S61, DDC or power off	Hydraulic Pump malfunction or hydraulic pump low on oil Faulty limit switch If the problem persists, contact AT
3	Cold water safety limit warning	Warning will reset automatically when temperature increases by 3.6 °F above limit	NA	Light load conditions Low water flow If the problem persists, contact AT
4	Condenser / absorber coil overheating	Warning will reset automatically after 20 minutes	Error can be reset via S61, DDC or power off	Dirty condenser / absorber coil Condenser temperature sensor (TCN) or ambient temperature sensor (TA) not sensing correct temperatures Fan motor - Capacitor If the problem persists, contact AT
5	High ambient temperature	Warning will automatically reset after condition is corrected	NA	Check location of the unit and probe
6	Low ambient temperature	Warning will automatically reset after condition is corrected	NA	Check location of the unit and probe
7	High condenser inlet temperature	Warning will reset automatically when temperature drops to 149 °F	Error can be reset via S61, DDC or power off	Hydraulic Pump malfunction or hydraulic pump low on oil Check generator (TG) temp probe connection to pipe If the problem persists, contact AT
8	Flame controller error	NA	Error can be reset via S61, DDC or power off	Check generator (TG) temp probe connection to pipe Check wire connections to S61 from Fenwal
10	Inadequate water circulation Water flow switch open during expected operation	Warning will automatically reset when water flow switch closes for 5 seconds and outlet water temp is greater than cold water safety limit or if no water flow is required by unit	Error can be reset via S61, DDC or power off	No or low water flow 3-way diverting valve on AYF/2 units not properly diverting water flow - bad actuator or valve body stuck Water flow switch bad or possibly stuck open Check Δp - Flow switch operation
11	Reed sensor not detecting rotation of hydraulic pump pulley	Warning will reset automatically after 20 minutes	Error can be reset via S61, DDC or power off	Pump motor malfunction Broken, stretched or worn belt(s) Worn pulleys Magnet on back of bottom pulley possibly ejected If the problem persists, contact AT
12	Ignition malfunction / ignition lockout	Warning will automatically reset upon new ignition attempt	Error can be reset via S61, DDC or power off	Bad ignitor or flame sensor Bad ignition transformer Fenwal malfunction Incorrect gas pressure to burner Blockage of gas orifice Bad 3.15 amp fuse on main control board If the problem persists, contact AT

Code	Description	Warning	Error	Possible causes / Checks
16	Outlet chilled water temperature sensor faulty (THM)	NA	Error can be reset via S61, DDC or power off	Broken or short in sensor wire Possible bad connection at control board If the problem persists, contact AT
17	Inlet chilled water temperature sensor faulty (THR)	NA	Error can be reset via S61, DDC or power off	Broken or short in sensor wire Possible bad connection at control board If the problem persists, contact AT
18	Condenser outlet temperature sensor faulty (TCN)	NA	Error can be reset via S61, DDC or power off	Broken or short in sensor wire Possible bad connection at control board If the problem persists, contact AT
20	Condenser inlet temperature sensor faulty (TG)	NA	Error can be reset via S61, DDC or power off	Broken or short in sensor wire Possible bad connection at control board If the problem persists, contact AT
28	Gas valve energized with ignition malfunction code (E 12) active	NA	Error can be reset via S61, DDC or power off	If the problem persists, contact AT
29	Ignition malfunction No voltage supplied to gas valve from Fenwal after 120 seconds from call for flame by the S61 board	Warning will automatically reset if gas valve is powered within 10 minutes from call for flame or, if after 5 min of operation the warning is generated, then it will reset if there is no longer call for operation	Error can be reset via S61, DDC or power off	Possible blocked flue passage Bad or faulty air pressure differential switch - possibly stuck closed or stuck open Bad or faulty pre-mix blower assy motor Debris on blower wheel preventing full air flow Cracked or clogged air tubes connecting blower assy to pressure differential switch Possible loss of flame sensing after 5 minutes of operation Possible gas valve issue after 5 minutes of operation If the problem persists, contact AT
32	Water temperature below operational limits in cooling mode FW ver. 3.026 or later	Warning will reset automatically when temperature increases by 3.6 °F above limit	NA	Light load conditions Low water flow If the problem persists, contact AT
51	Activation of antifreeze function - cold module	Warning automatically resets once the function ceases and starts the standard 10 minute cycle down period	NA	Low outdoor ambient conditions Possible operation in conjunction with other chillers causing water temps flowing through unit to drop below antifreeze set point If the problem persists, contact AT
61	Oil pump priming cycle activated Double piston model only	#15 ON/OFF cycles with 10 seconds ON and 30 seconds OFF	NA	-
77	Passive cooling module water flow detected	Warning automatically resets once the condition ceases, if a transition to cooling from heating is requested, or if cooling plant operation is required	NA	Possible bad/stuck closed flow switch Possible 3-way diverting valve malfunction internal of unit on AYF/2 models or in water loop causing flow through chiller when there should be none If the problem persists, contact AT
80	Incomplete board parameters	NA	New parameter setting is required	New parameter setting is required If the problem persists, contact AT
81	Invalid bank 1 parameters	NA	Error can be reset via power off	If the problem persists, contact AT
82	Invalid bank 2 parameters	NA	Error can be reset via power off	If the problem persists, contact AT
84	Faulty low voltage	NA	Error can be reset via S61, DDC or power off	Bad 2 amp fuse Bad connection between transformer and low voltage connection to board Faulty transformer If the problem persists, contact AT
85	Incorrect unit types	NA	Error can be reset via power off	New parameter setting is required If the problem persists, contact AT

Code	Description	Warning	Error	Possible causes / Checks
86	Electronic board fault	NA	Error can be reset via power off	If the problem persists, contact AT
87				
88				
89				
90	Ambient temperature sensor fault (TA)	NA	Error can be reset via S61, DDC or power off	Broken or short in sensor wire Possible bad connection at control board If the problem persists, contact AT
91	Electronic board fault	NA	Error can be reset via power off	If the problem persists, contact AT

NA: Not Applicable

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