ROBUR

caring for the environment

Installation, use and maintenance manual

GA Line ACF 60-00 Model

Gas fired absorption chiller
for cooling medium-large areas

Natural gas/LPG fired

INDEX

NOTE

Carefully read the information contained in this manual. It contains important instructions regarding installation, use and maintenance safety. Save this manual for any future needs. The manufacturer cannot be held responsible for any damages from improper, erroneous or irrational use.

With the aim of continuously improving the quality of our products, manufacturer reserves the right to change reported instructions and drawings without any prior notice.

1. GENERAL WARNINGS

This manual is an integral and essential part of the product and must be given to the owner.

Only qualified technicians, strictly complying with the manufacturer's instructions and the local standards, should install this product. The manufacturer will not accept responsibility for personal injuries or property damage resulting from improper installation.

Qualified technicians are those having specific technical competence in air conditioning and gas appliances according to international and national standards.

This appliance must be used exclusively for its intended purpose. All chilling applications must be in accordance with the operating specifications of the unit. Any other use is considered improper and, therefore, dangerous. Steps must be taken to avoid improper use and potential dangers.

The fluids used in the sealed refrigerant circuit may cause health problems if inhaled, ingested or when allowed to come into contact with the skin. It is recommended that no work be performed on the sealed refrigerant circuit except by a qualified service technician or engineer. Care should also be taken not to disturb or handle the valves of the chiller's sealed refrigerant circuit.

The manufacturer will not accept contractual or non-contractual liability for damages resulting from improper installation or misuse of the unit or intentional disregard of any of the manufacturer's instructions.

After unpacking the unit, check the unit for integrity. Due to the potential danger, keep all packaging materials (plastic bags, polystyrene foam, nails, etc.) away from children.

Before installation, it is recommended that all chilled water and gas supply piping be flushed. If not flushed prior to installation, residual materials may be left in the piping that could cause improper functioning of the chiller.

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 chiller'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.

In the case of failure and/or poor unit performance, shut the unit down in the proper manner, disconnect the UNIT power supply and close the gas valve. Do not attempt any repair and call a qualified technician for service. The chiller should also be disconnected when not in use for a prolonged period of time.

The manufacturer's authorized service technicians, using only original replacement parts, must perform repairs to the product. Failure to adhere to this guideline may compromise the safety of the unit. To ensure the correct operation and efficiency of the unit, it is essential that qualified service technicians perform annual maintenance in accordance with the manufacturer's instructions.

If the unit is sold or transferred to another owner, this manual will be provided for use to the new owner and/or installer.

Under no circumstances should the unit be operated with any safety or electrical component by-passed or defective.

Do not use this appliance if any part has been under water. 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 under water.

Before starting the appliance:

A qualified service technician must verify that:

- The electric and gas supplies are the same as indicated on the rating plate
- The fuel supply and water distribution systems are water tight
- The appliance is supplied with the type of fuel for which it is preset
- The gas supply pressure conforms to the pressure indicated on the rating plate
- The gas supply system is appropriately designed for the gas rate needed by the unit, and equipped with all safety and control devices prescribed by standards in force.

WARNING

To guarantee the correct operation of the unit and avoid possible failures, **ALWAYS** turn off the unit by means of the thermostat or any switch that controls the operation of the unit.

NEVER turn off the unit by shutting off the power supply.

2. OVERVIEW AND TECHNICAL DATA

2.1 OVERVIEW

The High Efficiency Chillers ACF60-00 series are water chillers, equipped with an air-cooled condenser and designed for outdoor installation. The absorption cooling cycle is based upon a solution of water and ammonia for the production of chilled water (temperature of chilled water is given by Technical Tables).
The chilling system is fed by thermal energy provided by a gas burner, therefore the required electric energy is limited to driving the fan and pump motors (the only mechanical moving components of the unit). The evacuation of combustion gases occurs by mixing them with condenser air using an axial fan of the appliance. The combustion fuel is Natural Gas or LPG.

The **STANDARD** and **HT** versions are designed for the commercial and industrial air-conditioning applications in the hot climate areas.
The **TK** versions are designed for the air-conditioning and refrigeration of technological applications (for example, in the industrial process, that could require chilled water up to 24h a day).
The **LB** versions are designed for the low temperature refrigeration applications (for example cold rooms for food conservation).

For further information see next paragraph, technical data.

ACF60-00 units are Natural Gas or LPG fired and supplied with 208 - 230V 60Hz single-phase electrical power.

ACF60-00 units could be controlled by DDC - Direct Digital Controller (available as Optional). DDC can control up to 16 single chillers.

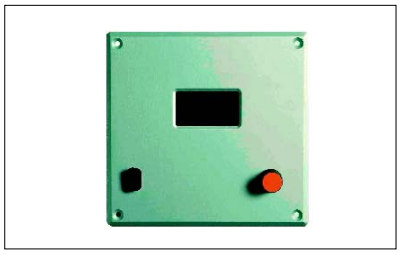


Figure 1 – Direct Digital Controller

CHILLER'S CONTROL AND SAFETY DEVICES

Electronic Control Board with integrated microprocessor controls the operation of the chiller.

High Temperature Limit Switch (manual reset) is located at the generator wall above the combustion chamber; the switch opens if the generator's sidewall temperature exceeds 330°F; the switch is manual reset. The switch can be reset when the generator sidewall temperature drops below 280°F.

Safety Relief Valve on the sealed circuit is set to release ammonia vapor if internal pressure exceeds 450 psig; the valve closes automatically when pressure is under 450 PSI_g

Differential Air Pressure Switch on the combustion circuit stops the burner ignition due to insufficient combustion air flow.

Ignition Control Box controls the burner ignition. Checks the differential air pressure switch and starts the pre-mixer blower. After 30 seconds of purging, the ignition control box opens the gas valve and starts the ignition transformer sparking at the burner for 8 seconds. If no flame is detected, the ignition control box will close the gas valve and retry lighting after an inter-purge period of 30 seconds. The ignition control box will try a total of three times to light. The unit will stop if no flame has been established or detected after the 3 tries.

Dual Gas Valve: two gas valves in the same housing, electrically controlled, which positively stops gas flow when either closes.

Flow Switch monitors the chilled water flow and shuts down the unit when the water flow stops or drops to an insufficient level.

2.2 GAS FIRED CHILLER OPERATION CYCLE

The fluid used in the cooling cycle is a solution of water and ammonia (see Figure 2). Ammonia is the **refrigerant** and water is the absorbing fluid. In the chiller's generator, the ammonia-water solution is heated to boiling by a burner producing both a vapor with a strong concentration of ammonia and a liquid solution with a low concentration of ammonia. Liquid solution with a low concentration of ammonia is called a "weak solution".

The ammonia vapor passes into the rectifier, which separates the water from the vapor. The hot and pressurized ammonia vapor exiting the rectifier enters the condenser where it is cooled and changed to a liquid.

The liquid ammonia is then brought to a lower pressure by means of a restrictor and further cooled in a "tube-in-tube" refrigerant heat exchanger. Finally, the liquid ammonia is reduced to a pressure of 39 to 60 psig and a temperature lower than 37°F by a second restrictor.

Under this low pressure and temperature condition, liquid ammonia enters the evaporator where the ammonia evaporates due to heat being removed from water returning from the user's required cooling application (thermal blowers, fan-coils, etc.) within the chilled water system.

The cold, low-pressure ammonia vapor exiting the evaporator exchanges heat with the liquid ammonia coming from the condenser in the refrigerant heat exchanger. The ammonia vapor then enters the "solution cooled absorber" where it comes into contact with "weak solution" from the generator that has been brought to a low pressure by means of a restrictor.

Inside the "solution cooled absorber" the absorption process starts, i.e. the dilution of ammonia vapor into the "weak solution". The absorption of ammonia vapor is an exothermic process. (i.e. heat is produced) To have the vapor completely absorbed by the solution, the solution exiting the "solution cooled absorber" must be further cooled in a portion of the condenser/absorber coils.

Once the absorption process is complete, the liquid solution contains a high concentration of ammonia, also called "strong solution". A hydraulically driven, diaphragm solution pump pumps the "strong solution" to the generator at high pressure.

As the "strong solution" is pumped to the generator, it passes through the coil of the rectifier and the solution cooled absorber (the GAX section) where it is preheated before entering the generator. The cycle then starts over.

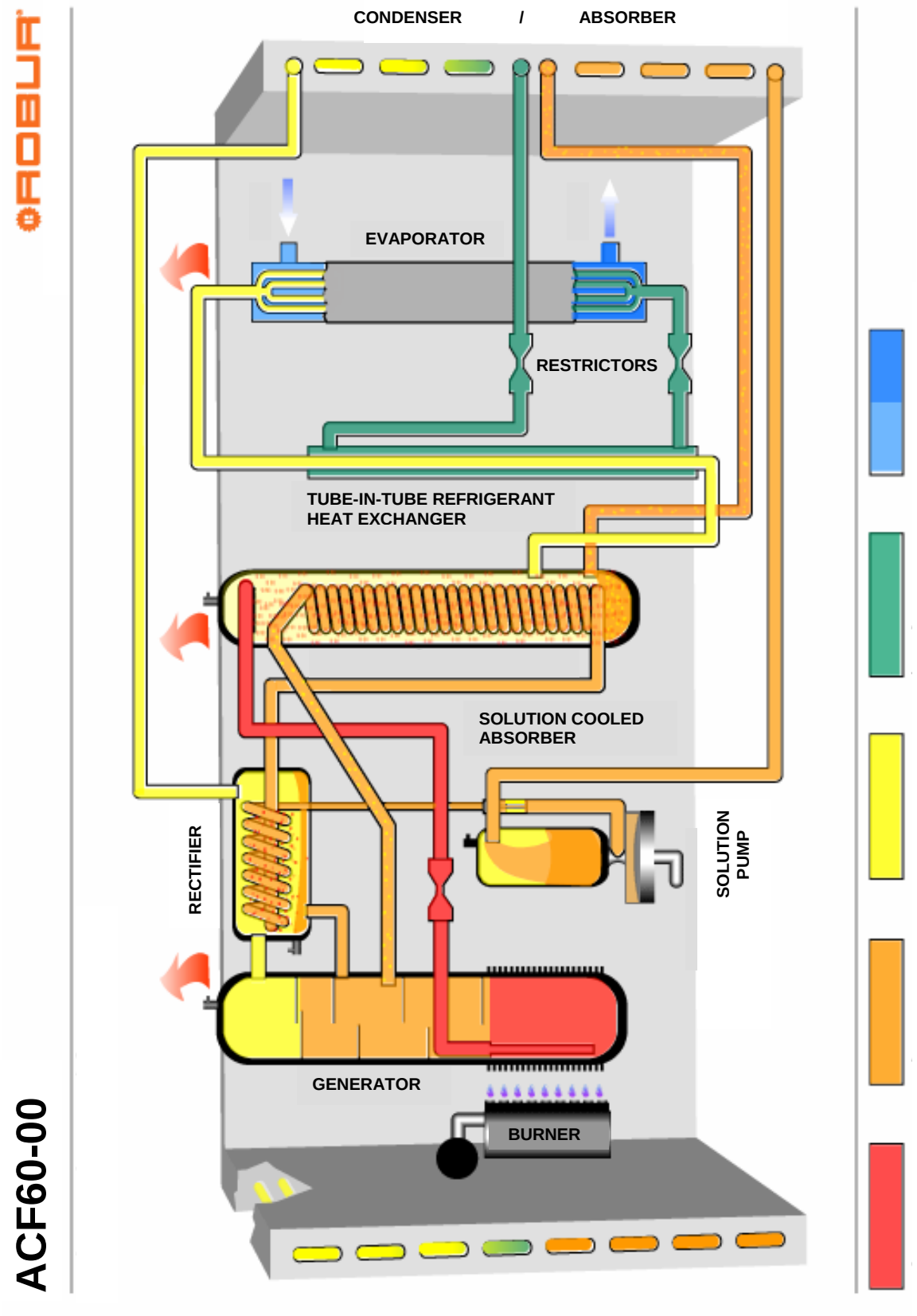


Figure 2– ABSORPTION REFRIGERANT CYCLE

2.3 TECHNICAL DATA: ACF60-00, HT, TK, LB

STANDARD VERSION

PERFORMANCE RATINGS[1]		UNITS	ACF60-00
Cooling Capacity[2]	Nominal	Btu/hr	60,500
Gas Input (HHV)	Nominal	Btu/hr	94,900
Ambient Operating Temperature	Maximum	°F	120
	Minimum	°F	32
Condenser Air Flow[3]	Nominal	CFM	6,000
	Minimum	CFM	2,000
Inlet (to the unit) Chilled Water Temperature	Maximum	°F	113
Outlet (to plant) Chilled Water Temperature	Minimum	°F	37.4
Chilled Water Flow	Nominal	GPM	12.2
	Maximum		14.1
	Minimum		11.0
Internal Pressure Drop		Feet of Head	9.7
		psi_g	4.2
ELECTRICAL RATINGS			
Required Voltage, 60 Hz, Single Phase[4]		V	208 - 230
Condenser Fan Motor HP (Variable Speed)	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 6.2
Hydraulic Pump Motor HP	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 24.2
Premix Blower Motor HP	Nominal	-	1/50
Full Load / Locked Rotor		A	.55 / .75
Total Electrical Operating Consumption[5] (Unit only)		kW	.75
Minimum Circuit Ampacity (MCA) (Unit only)		A	9.88
Maximum Over Current Protection (MOCP) Qty (2) - Field Supplied		A	15
PHYSICAL DATA			
Refrigerant Type		-	R717
Unit Chilled Water Volume[6]		Gallons	0.79
Chilled Water Entering and Leaving Connections[7]		FPT	1
Gas Inlet Connection		FPT	1/2
Electrical Entrance Knockouts, Diameter		Inches	7/8
Shipping Weight		Pounds	795
Operating Weight		Pounds	750
Dimensions	Width	Inches	$33^1/_2$
	Length		$48^1/_2$
	Height		$50^3/_4$

Table 1 – ACF60-00 TECHNICAL DATA

Notes:
1. All illustrations and specifications contained herein are based on the latest information available at the time of publication approval. Robur reserves the right to make changes at any time without notice, in materials, specifications, and models or to discontinue models.
2. Capacity at standard conditions of 95°F ambient temperature. Chilled water Outlet temperature 45°F, chilled water Inlet temperature 55°F. Actual capacity will vary with ambient (condenser) air temperature and leaving water temperature. Capacity characteristics are shown in the table below. Interpolations between tabled values are permissible, but do not extrapolate. For capacities at ambient temperatures higher than in table, contact Robur or your authorized distributor.
3. Fan speed is reduced when external temperature is less than 91.4°F.
4. Units are factory-wired for 208-230 volts operation.
5. May vary by ±10% as a function of both power supply and electrical motor input tolerance.
6. "Chilled Water" refers to a solution of quality tap water and 10% by volume of inhibited permanent antifreeze. Higher antifreeze concentrations may be required in certain applications.
7. Mono-ethylene glycol causes corrosion phenomenon in galvanized metal pipes.

COOLING CAPACITY in Btu/hr

AMBIENT AIR TEMPERATURE (°F)	OUTLET CHILLED WATER (°F)			
	37.4	41.0	44.6	48.2
32	59,307	59,912	61,123	62,323
41	59,307	59,912	61,123	62,333
50	59,307	59,912	61,123	62,323
59	59,307	59,912	61,123	62,333
68	59,307	59,912	61,123	62,323
77	58,701	59,912	61,123	62,333
86	54,465	59,307	61,123	62,333
95	40,546	52,650	60,517	61,727
104	-	-	53,255	56,281
113	-	-	40,546	47,203
120	-	-	-	39,336

Table 2 – ACF60-00 COOLING CAPACITY

HT VERSION

PERFORMANCE RATINGS[1]		**UNITS**	**ACF60-00 HT**
Cooling Capacity[2]	Nominal	Btu/hr	58,400
Gas Input (HHV)	Nominal	Btu/hr	94,900
Ambient Operating Temperature	Maximum	°F	122
	Minimum	°F	32
Condenser Air Flow[3]	Nominal Minimum	CFM CFM	6,000 2,000
Inlet (to the unit) Chilled Water Temperature	Maximum	°F	113
Outlet (to plant) Chilled Water Temperature	Minimum	°F	41
Chilled Water Flow	Nominal Maximum Minimum	GPM	11.8 14.1 11.0
Internal Pressure Drop		Feet of Head psi_g	9.1 3.9
ELECTRICAL RATINGS			
Required Voltage, 60 Hz, Single Phase[4]		V	208 - 230
Condenser Fan Motor HP (Variable Speed) Full Load / Locked Rotor	Nominal	- A	1/2 3.1 / 6.2
Hydraulic Pump Motor HP Full Load / Locked Rotor	Nominal	- A	1/2 3.1 / 24.2
Premix Blower Motor HP Full Load / Locked Rotor	Nominal	- A	1/50 .55 / .75
Total Electrical Operating Consumption[5] (Unit only)		kW	.75
Minimum Circuit Ampacity (MCA) (Unit only)		A	9.88
Maximum Over Current Protection (MOCP) Qty (2) - Field Supplied		A	15
PHYSICAL DATA			
Refrigerant Type		-	R717
Unit Chilled Water Volume[6]		Gallons	0.79
Chilled Water Entering and Leaving Connections[7]		FPT	1
Gas Inlet Connection		FPT	1/2
Electrical Entrance Knockouts, Diameter		Inches	7/8
Shipping Weight		Pounds	860
Operating Weight		Pounds	816
Dimensions	Width Length Height	Inches	$33^1/_2$ $48^1/_2$ $50^3/_4$

Table 3 – ACF60-00 HT TECHNICAL DATA

Notes:

1. All illustrations and specifications contained herein are based on the latest information available at the time of publication approval. Robur reserves the right to make changes at any time without notice, in materials, specifications, and models or to discontinue models.
2. Capacity at standard conditions of 95°F ambient temperature. Chilled water Outlet temperature 45°F, chilled water Inlet temperature 55°F. Actual capacity will vary with ambient (condenser) air temperature and leaving water temperature. Capacity characteristics are shown in the table below. Interpolations between tabled values are permissible, but do not extrapolate. For capacities at ambient temperatures higher than in table, contact Robur or your authorized distributor.
3. Fan speed is reduced when external temperature is less than 91.4°F.
4. Units are factory-wired for 208-230 volts operation.
5. May vary by ±10% as a function of both power supply and electrical motor input tolerance.
6. "Chilled Water" refers to a solution of quality tap water and 10% by volume of inhibited permanent antifreeze. Higher antifreeze concentrations may be required in certain applications.
7. Mono-ethylene glycol causes corrosion phenomenon in galvanized metal pipes.

COOLING CAPACITY in Btu/hr

AMBIENT AIR TEMPERATURE (°F)	OUTLET CHILLED WATER (°F)				
	41.0	**44.6**	**50.0**	**54.5**	**57.2**
32.0	59,637	59,637	59,637	59,637	60,222
35.6	59,637	59,637	59,637	59,637	60,222
39.2	59,637	59,637	59,637	59,637	60,222
42.8	59,637	59,637	59,637	59,637	60,222
46.4	59,637	59,637	59,637	59,637	60,222
50.0	59,637	59,637	59,637	59,637	60,222
53.6	59,637	59,637	59,637	59,637	60,222
57.2	59,637	59,637	59,637	59,637	60,222
60.8	59,637	59,637	59,637	59,637	60,222
64.4	59,637	59,637	59,637	59,637	60,222
68.0	59,637	59,637	59,637	59,637	60,222
71.6	59,637	59,637	59,637	59,637	60,222
75.2	59,637	59,637	59,637	59,637	60,222
78.8	59,053	59,637	59,637	59,637	60,222
82.4	59,053	59,637	59,637	59,637	60,222
86.0	59,053	59,637	59,637	59,637	60,222
89.6	57,883	59,637	59,637	59,637	60,222
93.2	56,129	59,053	59,053	59,053	59,637
95.0	54,960	58,368	58,468	59,053	59,637
96.8	53,791	57,883	58,468	58,468	59,637
100.4	50,867	56,714	57,883	57,883	59,053
104.0	47,944	54,375	56,714	57,299	58,468
107.6	-	51,452	54,960	56,714	57,883
111.2	-	47,944	53,206	55,545	56,714
114.8	-	-	50,282	53,791	55,545
118.4	-	-	46,774	50,867	53,206
122.0	-	-	-	47,359	50,282

Table 4 – ACF60-00 HT COOLING CAPACITY

TK VERSION

PERFORMANCE RATINGS[1]		**UNITS**	**ACF60-00 TK**
Cooling Capacity[2]	Nominal	Btu/hr	60,500
Gas Input (HHV)	Nominal	Btu/hr	94,900
Ambient Operating Temperature	Maximum	°F	120
	Minimum	°F	10.4
Condenser Air Flow[3]	Nominal	CFM	6,000
	Minimum	CFM	2,000
Inlet (to the unit) Chilled Water Temperature	Maximum	°F	113
Outlet (to plant) Chilled Water Temperature	Minimum	°F	37.4
Chilled Water Flow	Nominal	GPM	12.2
	Maximum		14.1
	Minimum		11.0
Internal Pressure Drop		Feet of Head	9.7
		psi_g	4.2
ELECTRICAL RATINGS			
Required Voltage, 60 Hz, Single Phase[4]		V	208 - 230
Condenser Fan Motor HP (Variable Speed)	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 6.2
Hydraulic Pump Motor HP	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 24.2
Premix Blower Motor HP	Nominal	-	1/50
Full Load / Locked Rotor		A	.55 / .75
Total Electrical Operating Consumption[5] (Unit only)		kW	.75
Minimum Circuit Ampacity (MCA) (Unit only)		A	9.88
Maximum Over Current Protection (MOCP) Qty (2) - Field Supplied		A	15
PHYSICAL DATA			
Refrigerant Type		-	R717
Unit Chilled Water Volume[6]		Gallons	0.79
Chilled Water Entering and Leaving Connections[7]		FPT	1
Gas Inlet Connection		FPT	1/2
Electrical Entrance Knockouts, Diameter		Inches	7/8
Shipping Weight		Pounds	860
Operating Weight		Pounds	816
Dimensions	Width	Inches	$33^1/_2$
	Length		$48^1/_2$
	Height		$50^3/_4$

Table 5 – ACF60-00 TK TECHNICAL DATA

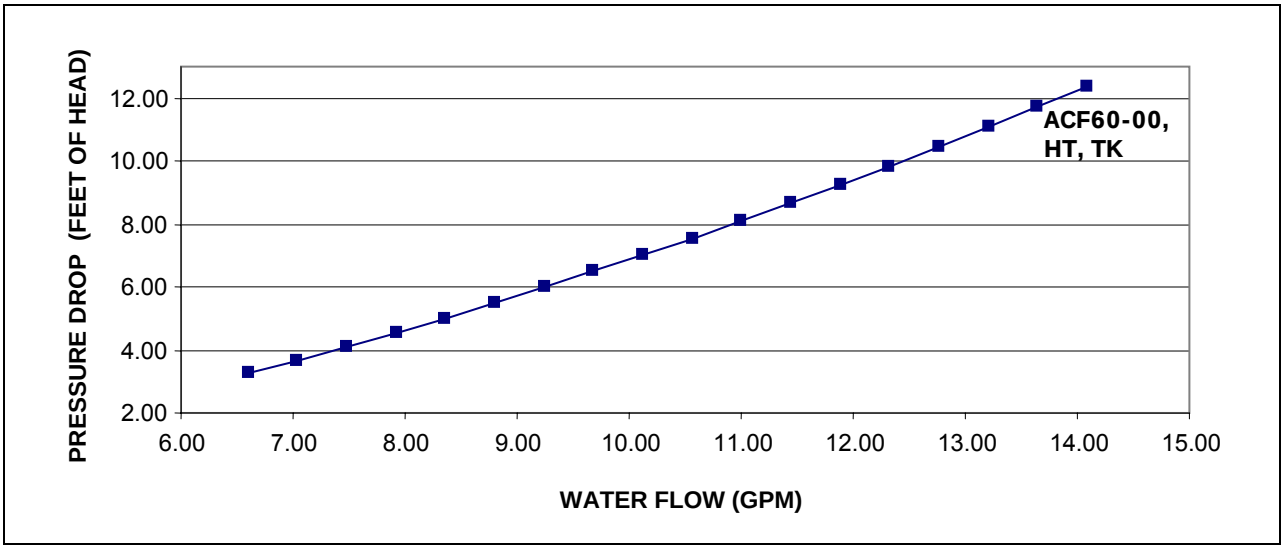
Notes:
1. All illustrations and specifications contained herein are based on the latest information available at the time of publication approval. Robur reserves the right to make changes at any time without notice, in materials, specifications, and models or to discontinue models.
2. Capacity at standard conditions of 95°F ambient temperature. Chilled water Outlet temperature 45°F, chilled water Inlet temperature 55°F. Actual capacity will vary with ambient (condenser) air temperature and leaving water temperature. Capacity characteristics are shown in the table below. Interpolations between tabled values are permissible, but do not extrapolate. For capacities at ambient temperatures higher than in table, contact Robur or your authorized distributor.
3. Fan speed is reduced when external temperature is less than 91.4°F.
4. Units are factory-wired for 208-230 volts operation.
5. May vary by ±10% as a function of both power supply and electrical motor input tolerance.
6. "Chilled Water" refers to a solution of quality tap water and 10% by volume of inhibited permanent antifreeze. Higher antifreeze concentrations may be required in certain applications.
7. Mono-ethylene glycol causes corrosion phenomenon in galvanized metal pipes.

COOLING CAPACITY in Btu/hr

AMBIENT AIR TEMPERATURE (°F)	OUTLET CHILLED WATER (°F)			
	37.4	**41.0**	**44.6**	**48.2**
10.4	71,410	71,410	72,015	72,620
17.6	70,805	70,805	71,410	72,015
24.8	70,200	70,200	70,200	71,410
32.0	69,595	69,595	69,595	70,200
39.2	68,989	68,989	68,989	69,595
46.4	67,779	68,384	68,384	68,989
53.6	67,779	67,779	67,779	68,384
60.8	67,174	67,174	67,779	67,779
68.0	65,964	65,964	67,174	67,174
75.2	64,148	64,148	66,569	66,569
82.4	59,307	61,727	65,358	65,358
89.6	51,439	57,491	62,938	64,148
95.0	41,757	52,650	60,517	62,333
100.4	-	-	56,886	59,912
107.6	-	-	50,229	55,070
113.0	-	-	-	49,624
120.0	-	-	-	42,057

Table 6 – ACF60-00 TK COOLING CAPACITY

ACF60-00, HT, TK UNIT INTERNAL PRESSURE DROP



Graph 1- UNIT PRESSURE DROP AS A FUNCTION OF WATER FLOW, OUTLET WATER TEMPERATURE 44.6 °F

LB VERSIONS

PERFORMANCE RATINGS[1]		**UNITS**	**ACF60-00 LB**
Cooling Capacity[2]	Nominal	Btu/hr	45,400
Gas Input (HHV)	Nominal	Btu/hr	94,900
Ambient Operating Temperature	Maximum	°F	120
	Minimum	°F	10.4
Condenser Air Flow[3]	Nominal	CFM	6,000
	Minimum	CFM	2,000
Inlet (to the unit) Chilled Water Temperature	Maximum	°F	113
Outlet (to plant) Chilled Water Temperature	Minimum	°F	14
Chilled Water Flow	Nominal	GPM	11.4
	Maximum		12.8
	Minimum		10.1
Internal Pressure Drop		Feet of Head	14.1
		psi_g	6.1
ELECTRICAL RATINGS			
Required Voltage, 60 Hz, Single Phase[4]		V	208 - 230
Condenser Fan Motor HP (Variable Speed)	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 6.2
Hydraulic Pump Motor HP	Nominal	-	1/2
Full Load / Locked Rotor		A	3.1 / 24.2
Premix Blower Motor HP	Nominal	-	1/50
Full Load / Locked Rotor		A	.55 / .75
Total Electrical Operating Consumption[5] (Unit only)		kW	.75
Minimum Circuit Ampacity (MCA) (Unit only)		A	9.88
Maximum Over Current Protection (MOCP) Qty (2) - Field Supplied		A	15
PHYSICAL DATA			
Refrigerant Type		-	R717
Unit Chilled Water Volume		Gallons	0.79
Chilled Water Entering and Leaving Connections[6]		FPT	1
Gas Inlet Connection		FPT	1/2
Electrical Entrance Knockouts, Diameter		Inches	7/8
Shipping Weight		Pounds	860
Operating Weight		Pounds	816
Dimensions	Width	Inches	$33^1/_2$
	Length		$48^1/_2$
	Height		$50^3/_4$

Table 7 – ACF60-00 LB TECHNICAL DATA

Notes:
1. All illustrations and specifications contained herein are based on the latest information available at the time of publication approval. Robur reserves the right to make changes at any time without notice, in materials, specifications, and models or to discontinue models.
2. Capacity at standard conditions of 95°F ambient temperature. Chilled water Outlet temperature (40% mono-ethylene glycol) 23°F, chilled water Inlet temperature 32°F. Actual capacity will vary with ambient (condenser) air temperature and leaving water temperature. Capacity characteristics are shown in the table below. Interpolations between tabled values are permissible, but do not extrapolate. For capacities at ambient temperatures higher than in table, contact Robur or your authorized distributor.
3. Fan speed is reduced when external temperature is less than 91.4°F.
4. Units are factory-wired for 208-230 volts operation.
5. May vary by ±10% as a function of both power supply and electrical motor input tolerance.
6. Mono-ethylene glycol causes corrosion phenomenon in galvanized metal pipes.

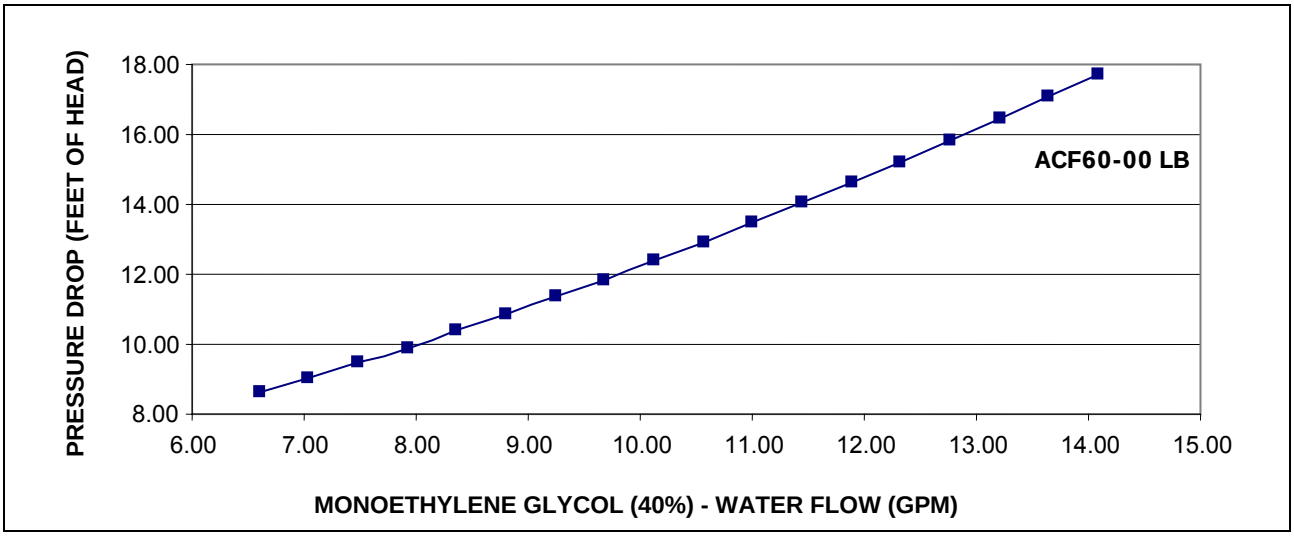
COOLING CAPACITY in Btu/hr

AMBIENT AIR TEMPERATURE (°F)	OUTLET CHILLED WATER (°F)				
	14.0	19.4	23.0	28.4	32.0
23.0	52,007	52,217	52,426	52,801	53,176
24.8	52,007	52,217	52,426	52,801	53,176
26.6	52,007	52,217	52,426	52,801	53,176
28.4	52,007	52,217	52,426	52,801	53,176
30.2	52,007	52,217	52,426	52,801	53,176
32.0	52,007	52,217	52,426	52,801	53,176
33.8	52,007	52,217	52,426	52,801	53,176
35.6	52,007	52,217	52,426	52,801	53,176
37.4	52,007	52,217	52,426	52,801	53,176
39.2	52,007	52,217	52,426	52,801	53,176
41.0	52,007	52,217	52,426	52,801	53,176
42.8	52,007	52,217	52,426	52,801	53,176
44.6	52,007	52,217	52,426	52,801	53,176
46.4	52,007	52,200	52,392	52,784	53,176
48.2	52,007	52,183	52,358	52,767	53,176
50.0	52,007	52,166	52,324	52,750	53,176
51.8	51,965	52,127	52,290	52,733	53,176
53.6	51,904	52,080	52,256	52,716	53,176
55.4	51,822	52,022	52,221	52,699	53,176
57.2	51,718	51,952	52,187	52,681	53,176
59.0	51,588	51,884	52,181	52,678	53,176
60.8	51,430	51,793	52,157	52,666	53,176
62.6	51,241	51,677	52,113	52,644	53,176
64.4	51,020	51,533	52,047	52,610	53,172
66.2	50,763	51,360	51,957	52,563	53,169
68.0	50,469	51,155	51,841	52,503	53,166
69.8	50,134	50,915	51,696	52,423	53,149
71.6	49,757	50,638	51,520	52,314	53,107
73.4	49,334	50,322	51,311	52,174	53,038
75.2	48,864	49,965	51,067	52,002	52,937
77.0	48,343	49,564	50,785	51,795	52,805

AMBIENT AIR TEMPERATURE (°F)	OUTLET CHILLED WATER (°F)				
	14.0	19.4	23.0	28.4	32.0
78.8	47,771	49,117	50,464	51,551	52,637
80.6	47,143	48,622	50,101	51,267	52,432
82.4	46,458	48,076	49,694	50,941	52,188
84.2	45,713	47,476	49,240	50,571	51,901
86.0	44,905	46,822	48,738	50,155	51,571
87.8	44,033	46,109	48,186	49,690	51,194
89.6	43,093	45,337	47,580	49,174	50,768
91.4	42,084	44,502	46,919	48,605	50,291
93.2	41,003	43,602	46,201	47,981	49,760
95.0	39,847	42,635	45,400	47,299	49,174
96.8	38,614	41,599	44,584	46,557	48,530
98.6	37,302	40,491	43,681	45,753	47,825
100.4	35,907	39,309	42,711	44,884	47,057
102.2	34,428	38,051	41,673	43,949	46,225
104.0	32,863	36,713	40,564	42,945	45,325
105.8	31,208	35,295	39,383	41,869	44,356
107.6	29,461	33,794	38,126	40,720	43,314
109.4	27,620	32,206	36,793	39,496	42,198
111.2	25,682	30,531	35,379	38,193	41,006
113.0	23,645	28,765	33,885	36,810	39,735
120.0	-	-	28,004	31,587	35,176

Table 8 – ACF60-00 LB COOLING CAPACITY

ACF60-00 LB UNIT INTERNAL PRESSURE DROP



Graph 2 - ACF60-00 LB PRESSURE DROP

2.4 DIMENSIONS

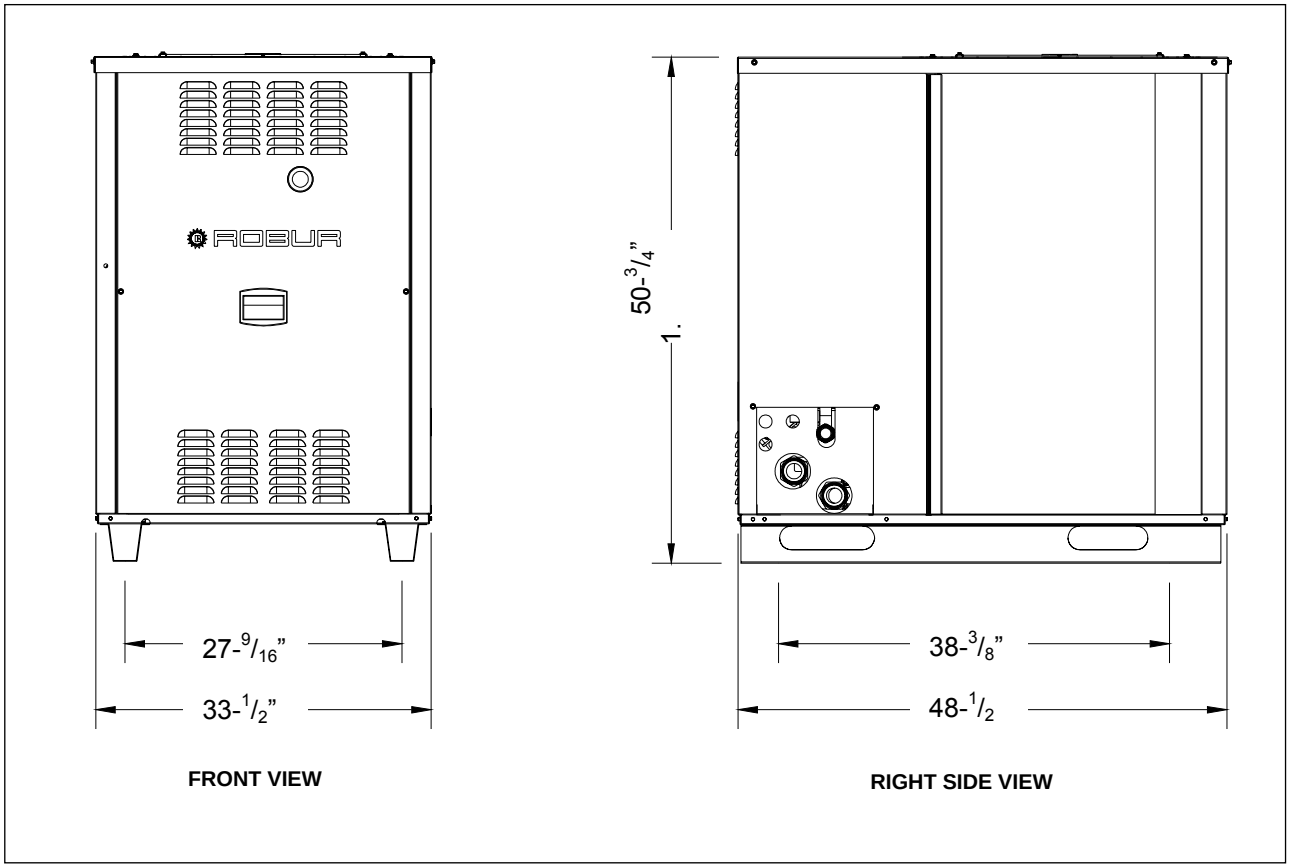


Figure 3 - ACF60-00, HT, TK, LB DIMENSIONS.

3. INSTALLATION

3.1 GENERAL RULES

Only qualified technicians, in compliance with the manufacturer's instructions, should carry out the installation and maintenance of the ACF60-00 unit. 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**.

All wiring should be installed 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.

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

To ensure that a correct installation and maximum unit performances are obtained, the following rules have to be followed:

- Unpack the unit carefully, checking that it has not suffered damage during transport. Each unit is factory tested before shipping, if damage is found report this immediately to the haulage contractor.
- **Each unit must be installed outdoors in an area of free natural air circulation** and does not require particular weather protection.
  In no case must the unit be installed in a room.
- No overhead obstructions should block the outlet of air from the unit top.
- **The unit should not be installed so that the fan discharge is in close proximity to the fresh air intakes of a building or in such a manner that hot or contaminated air from flues, dryer vents, chimney, etc., could be drawn into the unit by the condenser fan.**
- The front and rear sides of the unit must have a **minimum clearance of 31-$^1/_2$" inches and 24 inches, respectively, (for safety, maintenance and servicing) from any combustible surface, walls or other stationary constructions. The left and right sides require a minimum distance of 18 inches for proper airflow toward the condenser.**
- Be sure that gas supply provided from the gas main meets the manufacturer's specifications. Inlet gas pressure to the unit must not exceed 14.0" W.C. on natural gas or propane gas. The minimum Inlet gas pressure at the unit is 5.0" W.C. on natural gas and 11.0" W.C. on propane gas.

WARNING

The electrical safety of the unit is obtained only when it is correctly connected to an efficient grounding system, which meets existing applicable safety standards. Never use gas supply piping to ground the appliances. The ground wire should be longer than power supply wires for safety reasons. If the power supply wires are accidentally stretched, the ground wire will be the last to break. By following this rule, good ground continuity will be assured.

3.2 INSTALLATION OF THE UNIT

HANDLING OF THE UNIT ON SITE

When arriving at the installation site, visually inspect the unit for any signs of damage to the package, which may indicate possible unit damage.

Once on site, the units must remain in the factory packaging and only be unpacked at the moment before installation.

Before locating and unpacking the unit, make a hole in the package to check for ammonia odor. If ammonia odor is present, contact the factory.

LOCATION

The chillers **must be installed outdoors** in an area of free natural air circulation.

The installation inside a room or a building is not allowed.

There must be a minimum clearance of 4 feet horizontally from electric meters, gas meters, regulators, and relief equipment and in no case located above or below these items unless a 4 feet horizontal distance is maintained.

The unit can be installed at ground level, on a platform or on the roof (if it can withstand the weight).

The noise generated by the condenser fan during unit operation is not excessive. However, avoid locating the unit in an area adjacent to bedrooms or neighboring buildings (see Figure 4).

Also, avoid installing the unit in building corners, where air turbulence can take place or the unit noise (reverberation) can be amplified.

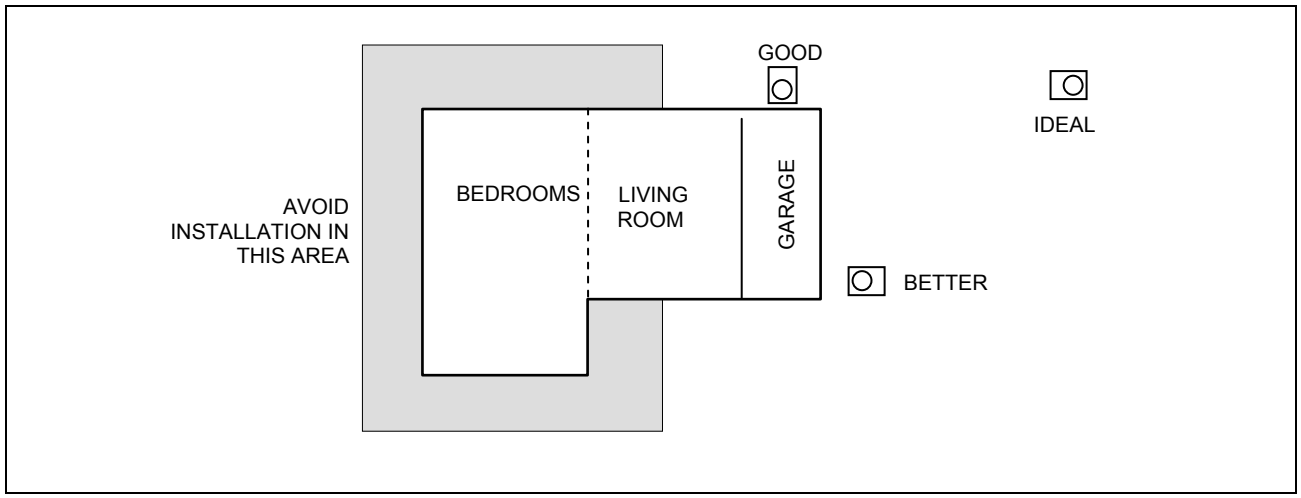


Figure 4 - LOCATION OF THE UNIT

CLEARANCES

A free space is to be provided around the unit to allow for proper unit operation and for servicing. The minimum clearance from walls, obstructions and other units should be as follows (see Figure 5):

- right / left side: 18 inches
- rear side: 24 inches
- front side: 31-$^1/_2$ inches

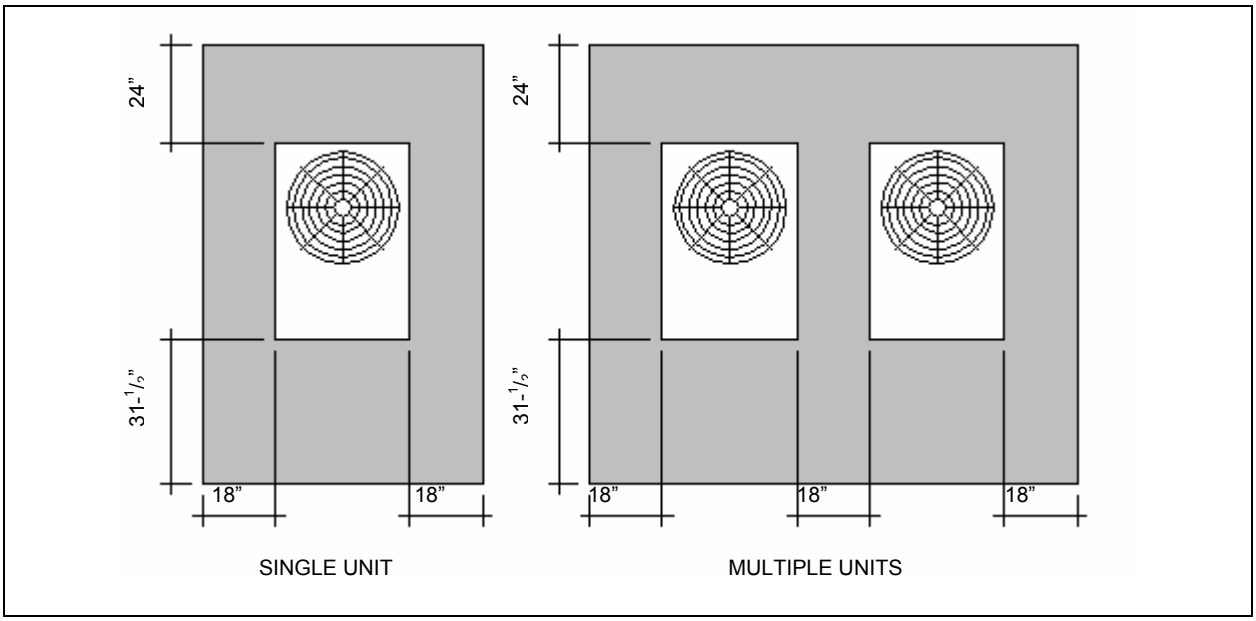


Figure 5 – CLEARANCES FOR CORRECT INSTALLATION OF THE UNIT

There **MUST NOT** be any obstructions or structural overhangs (roof edges, balconies) over the top of the unit. The re-circulation of the air discharged from the condenser results in a poor unit performance.

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

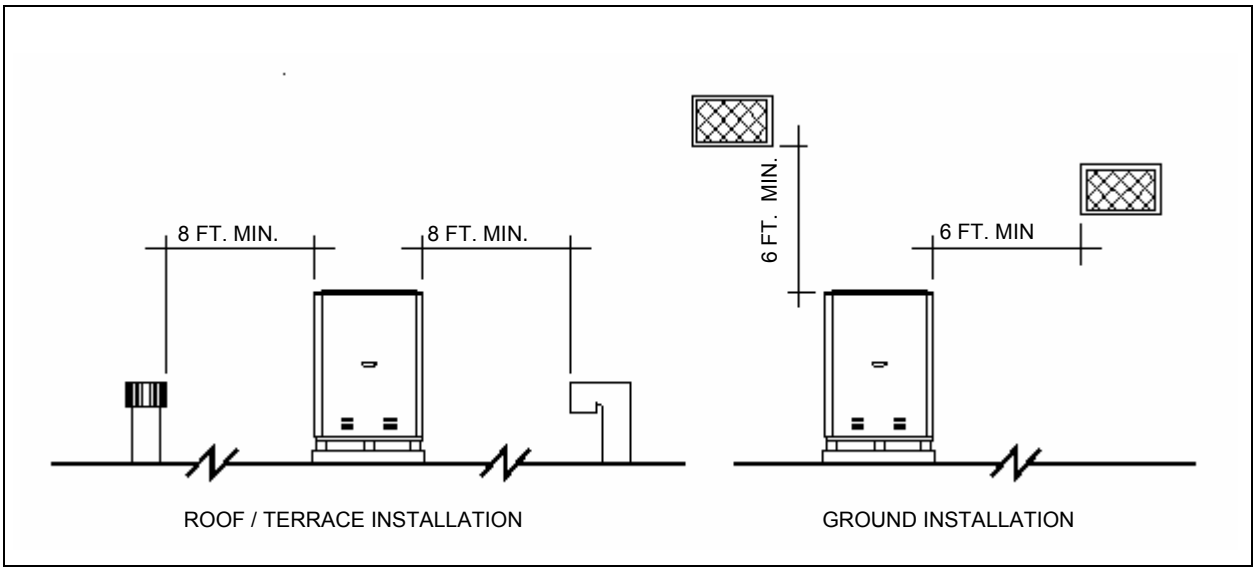


Figure 6 – CLEARANCES FROM VENT OUTLETS, CHIMNEY FLUES AND AIR INTAKE OPENINGS

GROUND INSTALLATION

Ground level units should be supported on a LEVEL concrete pad with a minimum thickness of 4" and slightly larger than the unit base (see Figure 7 for typical slab dimensions). Local soil conditions will actually dictate the slab thickness required to prevent shifting.

Do not allow the concrete slab touch the foundation of a structure. Unit operational noises can be transmitted inside the structure if they are connected.

Ground level installations should use vibration-damping base supports, available from the factory. Another option is to use 4" thick concrete blocks positioned under the unit, instead of the factory base supports.

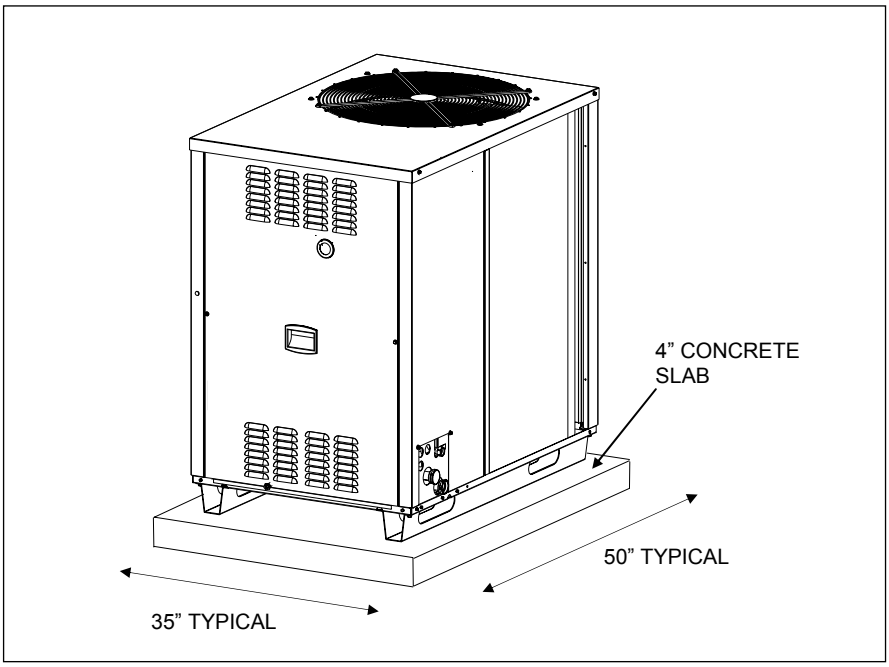


Figure 7 – DIMENSIONS OF THE UNIT BED

ROOF / TERRACE INSTALLATION

If the unit must be lifted by a hoist for installation, leave it on the crate base. Attach hoist lines to the crate base and use spreader bars to prevent the hoist lines from damaging UNIT cabinet panels.

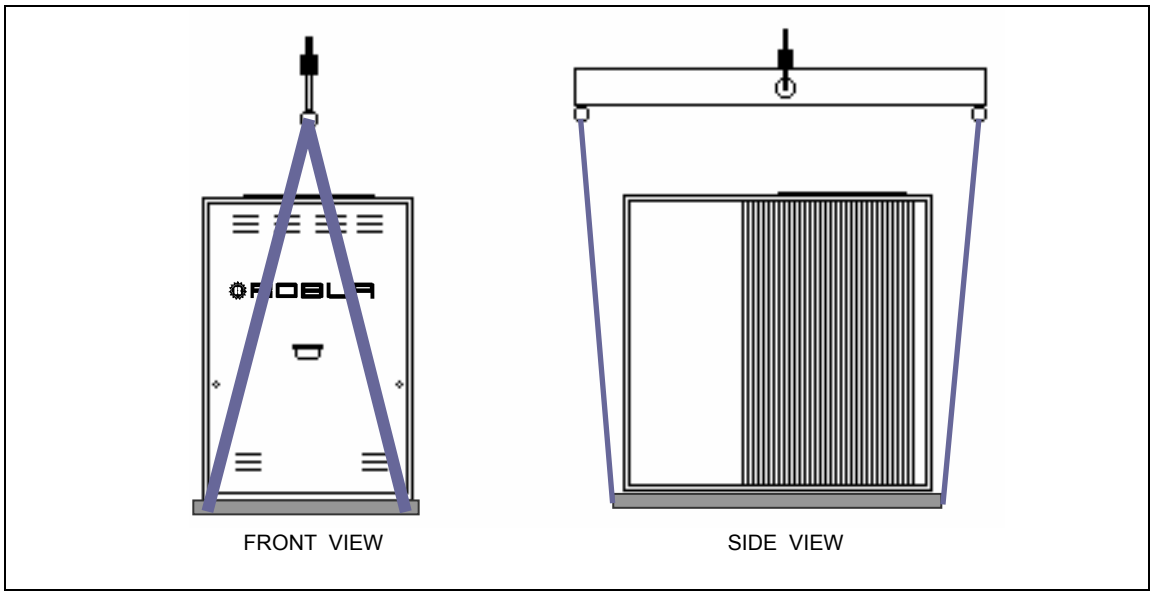


Figure 8 – HANDLING OF THE ACF60-00 UNIT

Although approved for installation on a combustible base, the unit must not be installed directly on the roof surface. Use base supports for the installation (see Figure 7).

Both the unit and the supporting base weight should be sufficiently supported by the roof joists.

Provide for a gangway all around the unit for maintenance purposes.

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.

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.

4. HYDRONIC AND GAS INSTALLATION

4.1 WATER PIPING DESIGN AND INSTALLATION

Piping for the chiller is to be designed and installed as a closed hydronic circuit.
The following items (not supplied) must be installed close to the unit (see Figure 9):

- FLEXIBLE CONNECTIONS to avoid vibration transmission to the chiller water lines.
- MANOMETERS to measure Inlet and Outlet pressure.
- CHILLED WATER FILTER mounted in the water Inlet line to remove debris from the chiller water lines.
- WATER FLOW RATE VALVE for adjusting proper water flow rate.
- WATER PUMP properly sized for system.
- EXPANSION TANK must be properly sized based on the hydronic system size, maximum thermal expansion, and maximum water pressure.
- FILL VALVE for filling, draining or flushing the hydronic system.
- AIR BLEED set at the highest point in the hydronic system for removal of air.

WARNING

To ensure the correct operation of the unit and to avoid the water freezing, add 10% by volume of mono-ethylene glycol (antifreeze) to the circulation water. Add more mono-ethylene glycol as needed for the minimum external temperature of the installation zone (see Table 10, page 47).

When using an automatic water charge system, the mono-ethylene glycol percentage must be checked once a year.

There must be correct chilled water flow when the unit is operating and during the shut down period (600 seconds, between turning the burner off and complete shutdown of the appliance).

Piping (diameters of tubes etc.) must be sized appropriately in order to ensure the correct chilled water flow necessary for the proper operation of the unit. The water lines should also be sized so the maximum velocity of the water/mono-ethylene glycol solution in the lines does not exceed 6 feet per second to avoid excessive noise.

Absorption cooling unit does not require obligatory installation of cold-water storages (because there is no compressor in the system).
The use of the cold-water storage is anyhow suggested, in order to absorb frequent variations of thermal load, that reduces the working time of the unit, reduces the energy consumption and consequently saving money. It is recommended specially when water quantity in the system is lower than 18.5 gallons for each installed ACF60-00 unit.

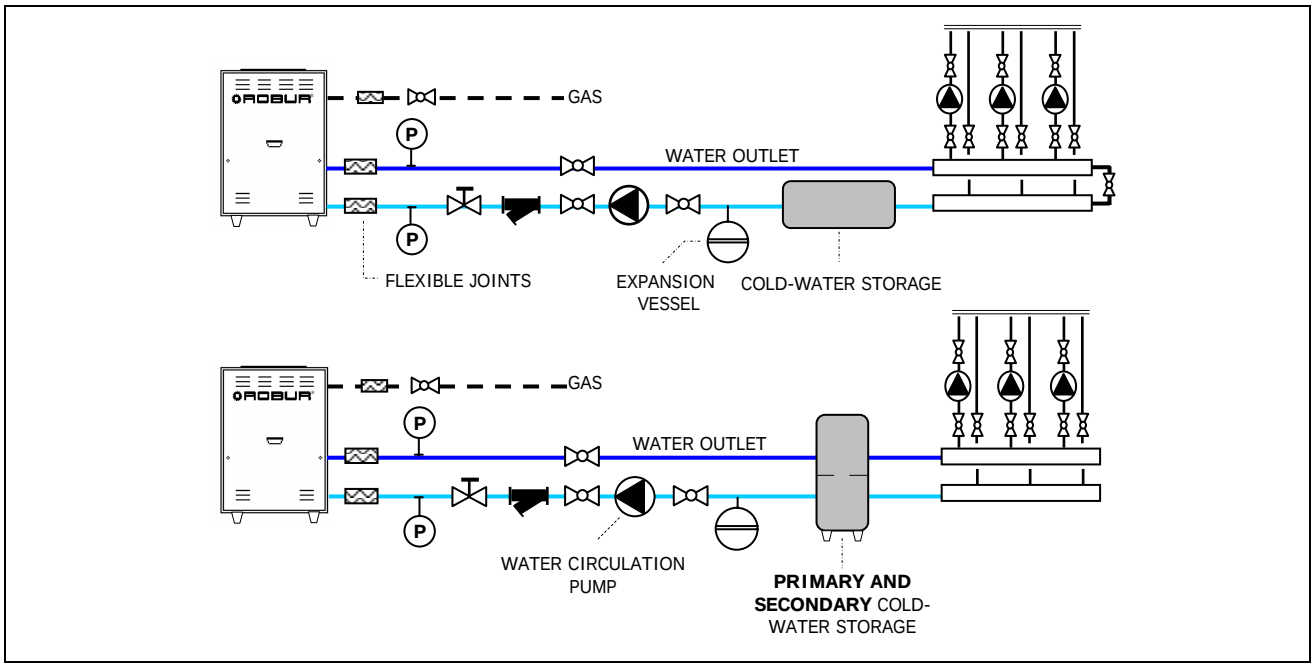


Figure 9 – EXAMPLE OF HYDRONIC SYSTEMS WITH SINGLE COLD-WATER STORAGE (TOP) and PRIMARY-SECONDARY WATER STORAGE (BOTTOM)

When rigid pipes are used, it is recommended to use flexible connections between the unit and piping to avoid vibration transmission.

All piping must be properly insulated according to federal and local codes to avoid thermal losses and condensate on the water lines. All seams and joints should be carefully made so as to be air and watertight.

For size of water connections on the unit, refer to TECHNICAL DATA sheet (2.3)

Connections at the coil or heat exchanger must be performed in accordance with the recommendations of the coil or heat exchanger manufacturer. For best performance, the supply-chilled water line must attach to the side of the coil or heat exchanger nearest the exit of the leaving cooled medium.

If the heat exchanger is an air coil, the air coil must be installed downstream from the furnace to avoid condensation in the furnace. Additionally if the heat exchanger is an air coil, a “P” trap must be provided to drain condensate. The height of the “P” trap must be sufficient to ensure drainage of condensate. Any horizontal run of the condensate drain line must slope ¼” for each running foot and not be smaller than ¾” I.P.S. to assure the condensate will drain by gravity. The condensate drain line must be insulated and ran to a suitable drain.

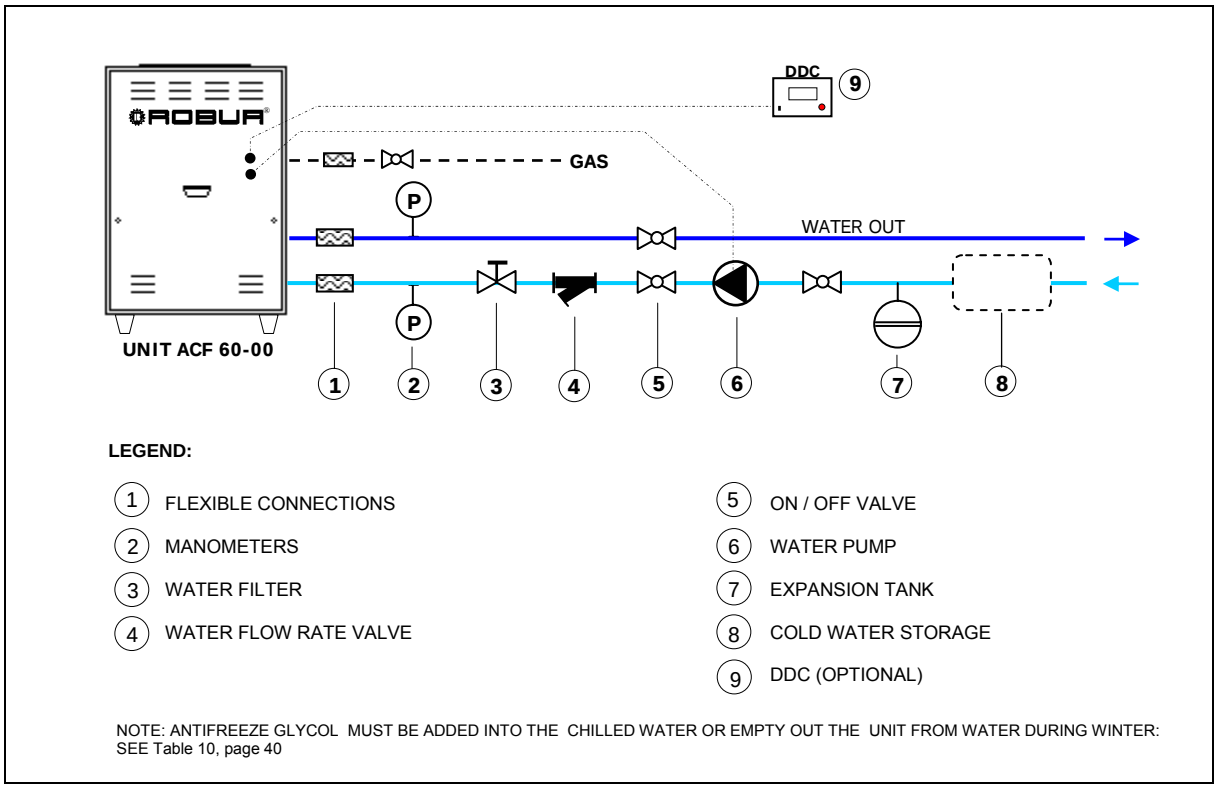


Figure 10 – WATER PIPING DIAGRAM FOR A SINGLE UNIT

The connections for water and gas piping are located at the service plate on the right-side of the chiller (see Figure 3).

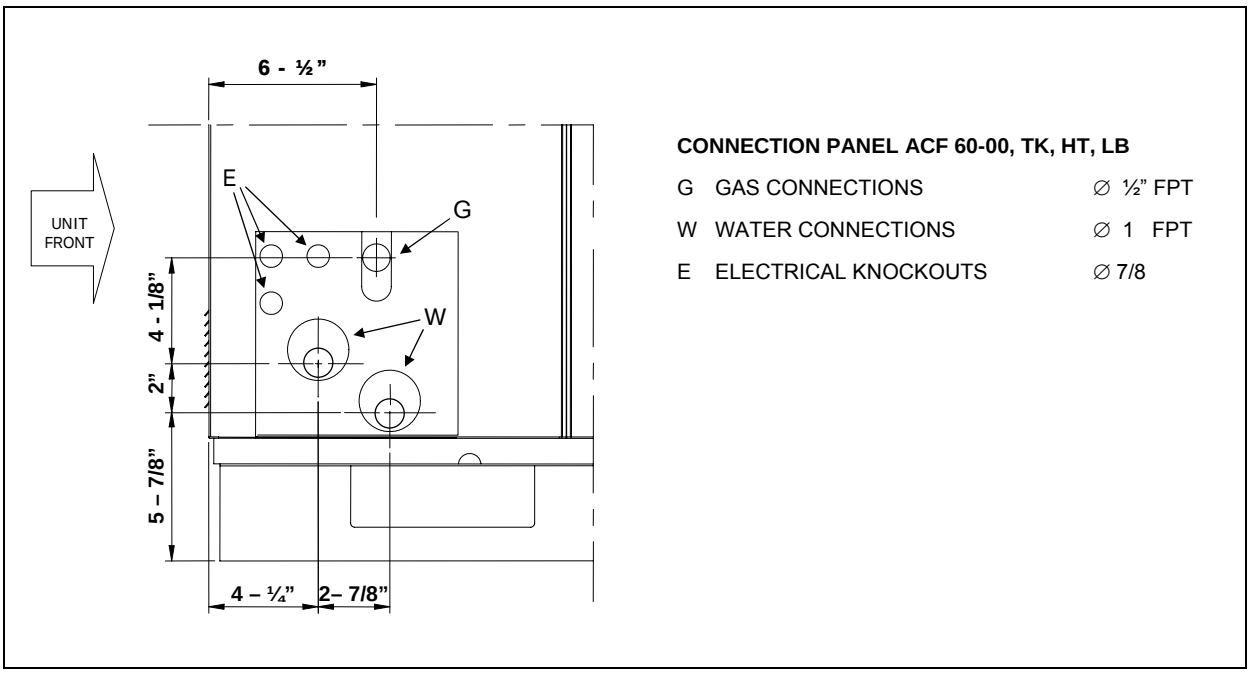


Figure 11 – ACF 60-00, TK, HT, LB SERVICE PLATE DIMENSIONS

4.2 GAS SUPPLY PIPING

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** and **.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 chiller, when it underwent the tests specified in the standards shown on the rating plate.

For Natural Gas the minimum Inlet gas pressure to the chiller is 5" W.C. and the maximum is 14" W.C. For Propane Gas the minimum Inlet gas pressure to the chiller is 11" W.C. and the maximum is 14" W.C.

For size of gas connection to the unit, see Figure 11.

WARNING

Gas supply pressures higher than those stated above could damage the gas valve, resulting in a fire hazard.

Vertical gas piping must be trapped and a means provided to drain condensate that may accumulate in the piping during the cold season. Insulation may also be necessary for the gas piping to prevent excessive accumulations of condensate.

An approved union should be installed in the gas line near the unit and down stream of any external shut-off valve that may be required by local codes.

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 chiller and its gas connections must be leaked tested before placing the chiller in operation.

The chiller 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 chiller 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.**

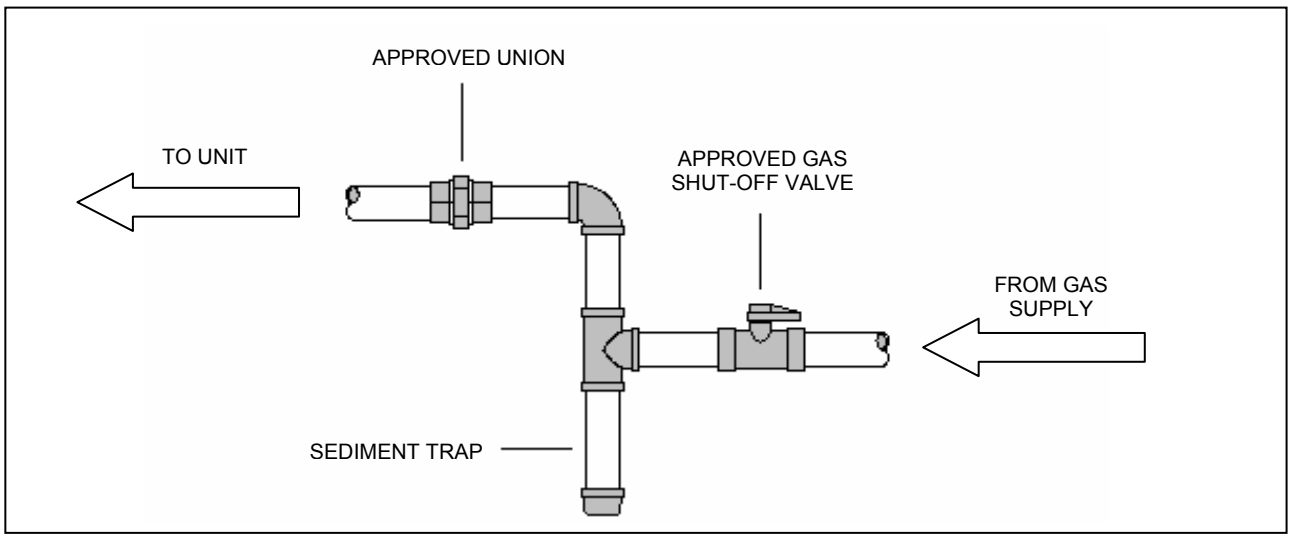


Figure 12 – TYPICAL GAS CONNECTION

5. ELECTRICAL CONNECTION

5.1 POWER SUPPLY AND PUMP WIRING FOR A SINGLE ACF60-00 UNIT

All wiring should be installed 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.

The UNIT electrical system is wired for single-phase, 208-230 volt and 60Hz operation. The electrical control box includes a 208 – 230 - 24 volt 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 volt, 60 Hz to the high voltage terminal board of the control panel. A fused disconnect switch should be installed in the 208-230 volt supply line within sight of and not over 50 feet from the unit.

NOTE

- An error in wiring installation could cause problems during the UNIT operation and could damage the electrical components of the appliance.
- The unit must be electrically grounded in accordance with national requirements.
- The power supply line must not be used to turn the unit “ON” or “OFF”. The dedicated control switch in the R-Y line is for this purpose.
- Disconnect the power supply lines only when assured that unit is completely shut off.

WARNING

DO NOT OPERATE the unit unless the chilled water system is filled with water and antifreeze.

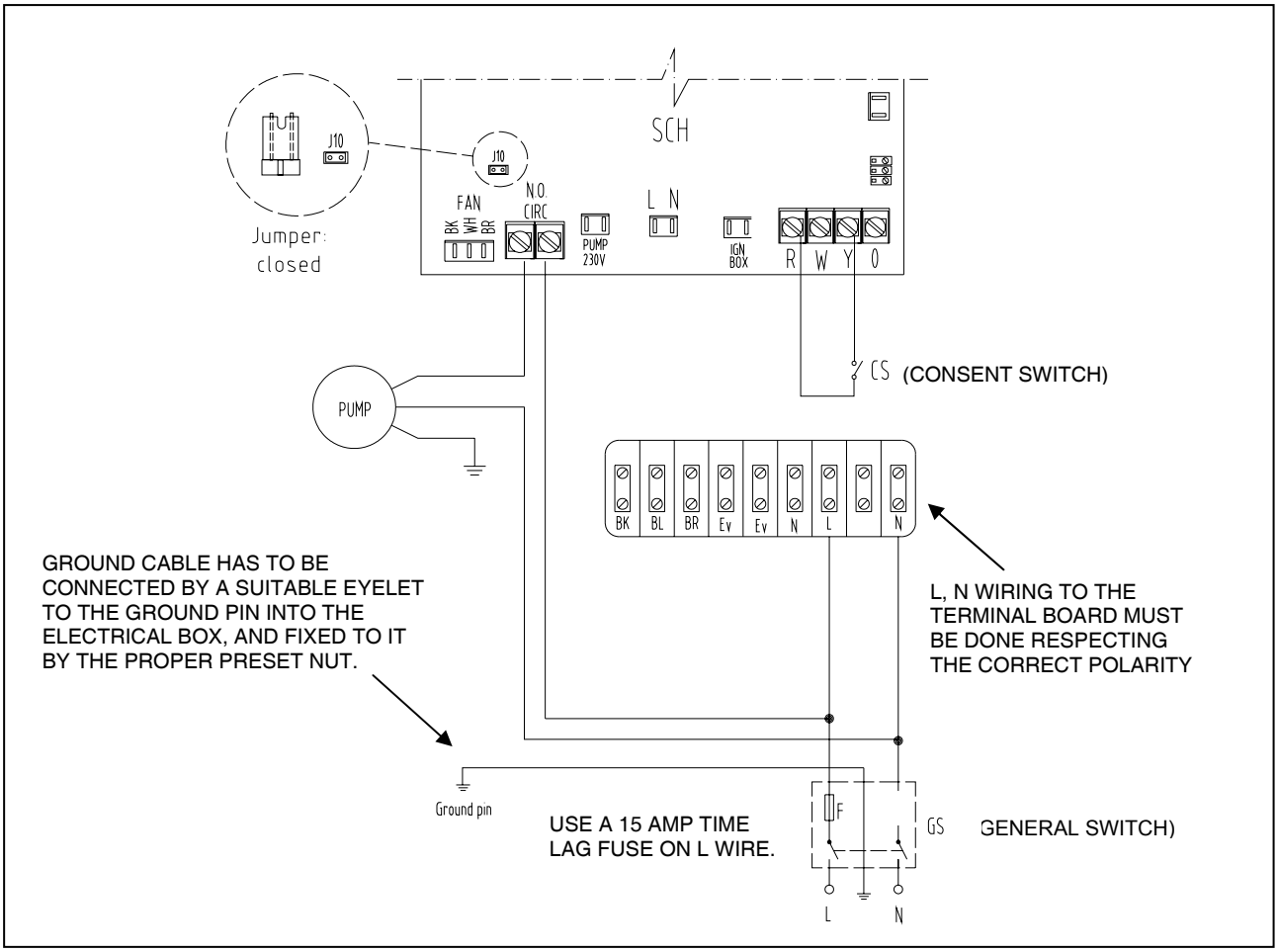


Figure 13 – WIRING FOR A SINGLE ACF60-00 UNIT WITH PUMP ABSORBED CURRENT LESS THAN 4 AMP.

WARNING

If power for the water pump is taken from the high voltage terminal block located in the electrical control box, as shown in Figure 13, the minimum circuit ampacity for the unit must be increased above that listed in the TECHNICAL DATA sheet in SECTION 2 to accommodate the additional current draw of the water pump installed. **The maximum current carrying capacity of the N.O. Contact is 4A.** If the current is above 4A, use an additional relay controlled by N.O. Contact on the S60 board.

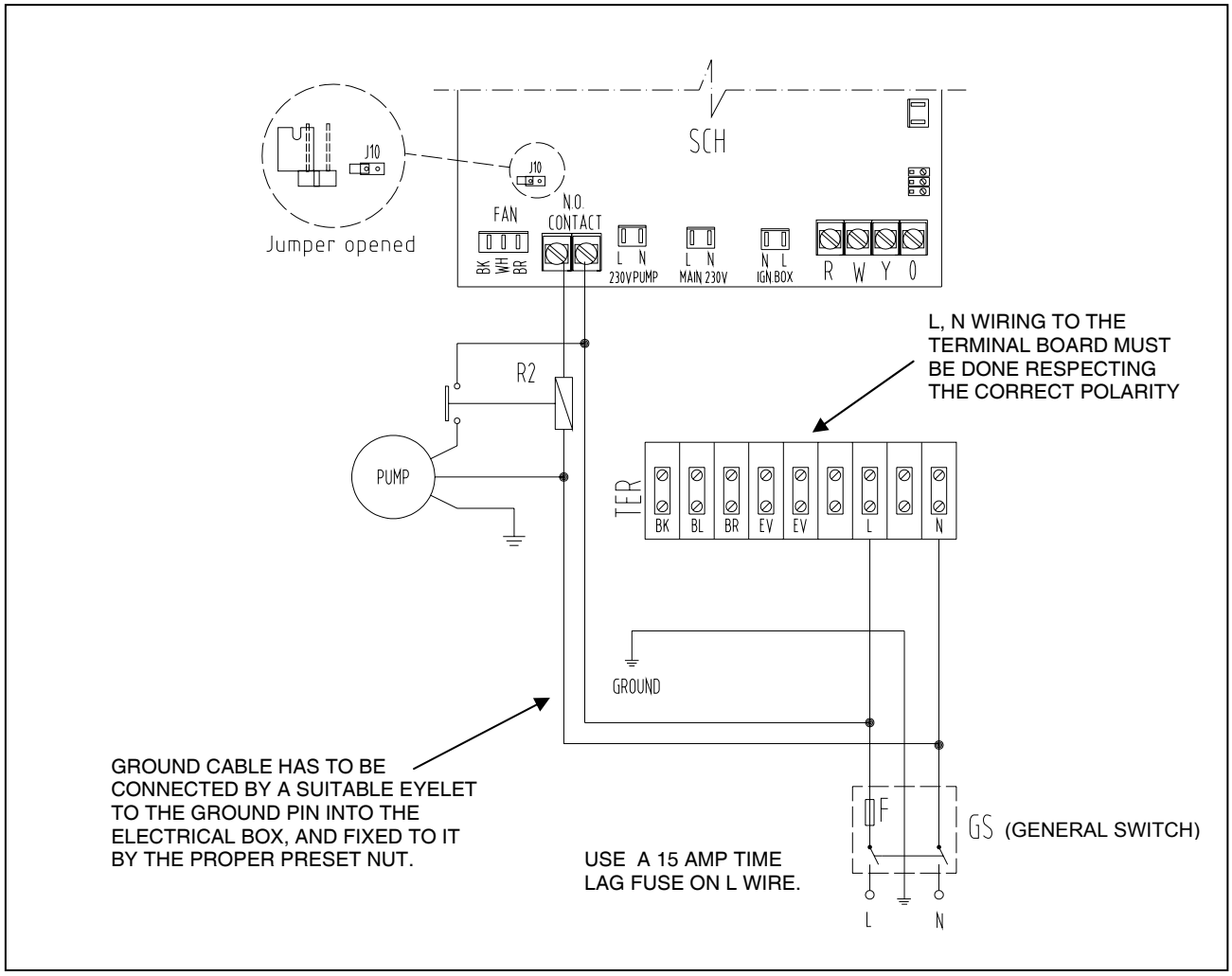


Figure 14 – WIRING FOR A SINGLE ACF60-00 UNIT WITH PUMP ABSORBED CURRENT MORE THAN 4 AMP

5.2 POWER SUPPLY AND PUMP WIRING FOR 2 OR MORE ACF60-00 UNITS

The figure shows typical wiring for 2 or more ACF60-00 units. The transformer is required to feed N.O. contacts with low voltage current; this is done for safety reasons: when doing maintenance and a unit is shut off, these contracts could still remain fed. In this case, no matter if pump current absorption is more or less than 4 amp.

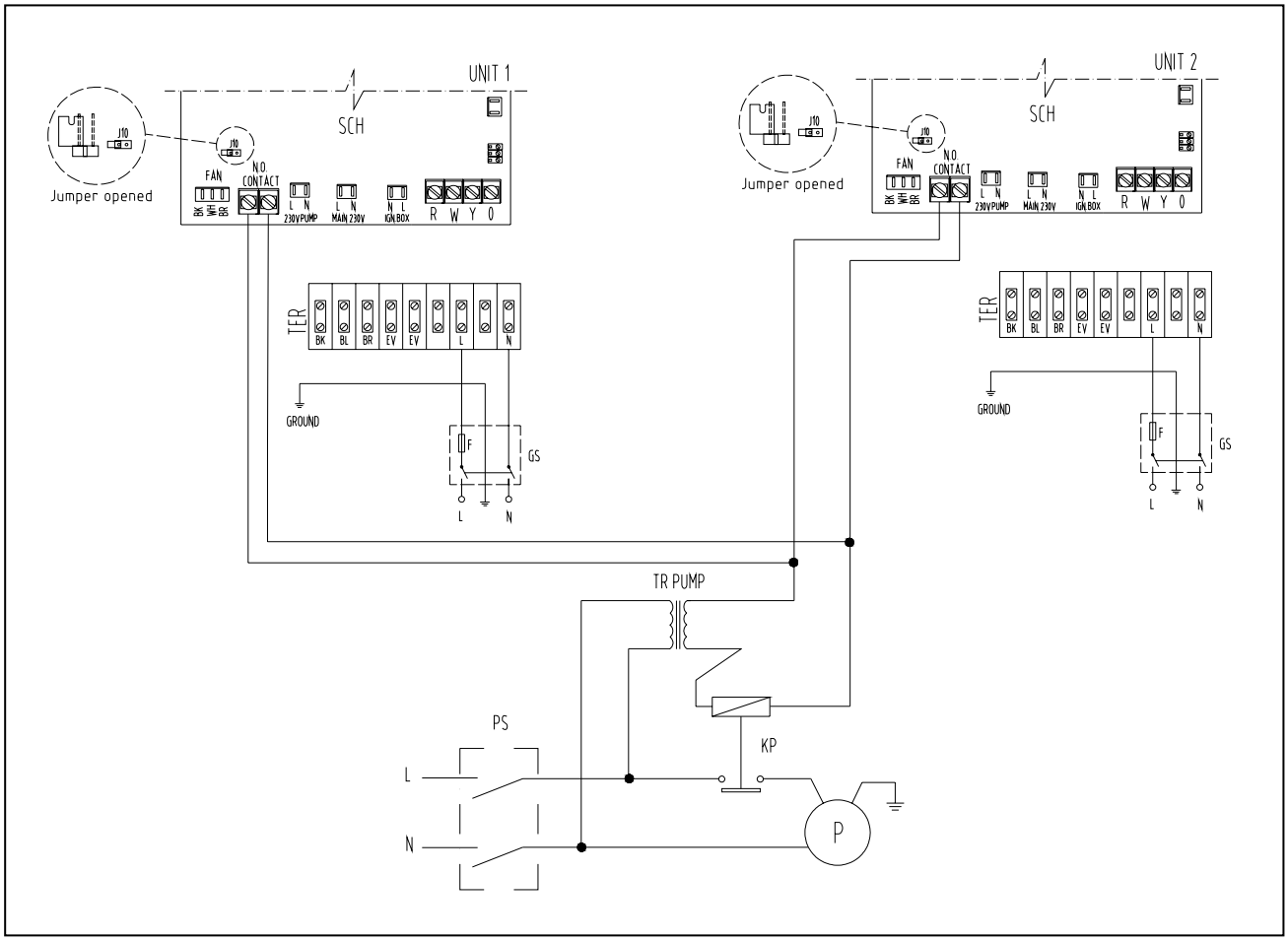


Figure 15 - WIRING FOR 2 ACF60-00 UNITS WITH LOW VOLTAGE TRANSFORMER

5.3 CONTROL SWITCH WIRING AND THERMOSTAT LOCATION

CONSENT SWITCH WIRING

If DDC is not used, a consent switch that provides an ON/OFF function is to be connected to the R and Y on the S60 board. This wiring will carry 24-volt current and it is recommended to use a cable with the correct number of color-coded 18 AWG wires.

An isolation relay MUST be used to separate the chiller's transformer from any additional equipment having a transformer or damage to the S60 board will occur. Isolation relays must have a 24-volt AC coil, which does not present more than 0.25 amp load to the control circuit.

THERMOSTAT LOCATION

If the control switch is a thermostat, the thermostat 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 conditioned 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.

5.4 ACF60-00 WIRING

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 392°F or equivalent.
Igniter and flame sensor wire have to be replaced with Robur spare parts. See, SPARE PARTS, page 55.
Label all wires prior to disconnection when servicing the controls. Wiring errors can cause improper and dangerous operation.

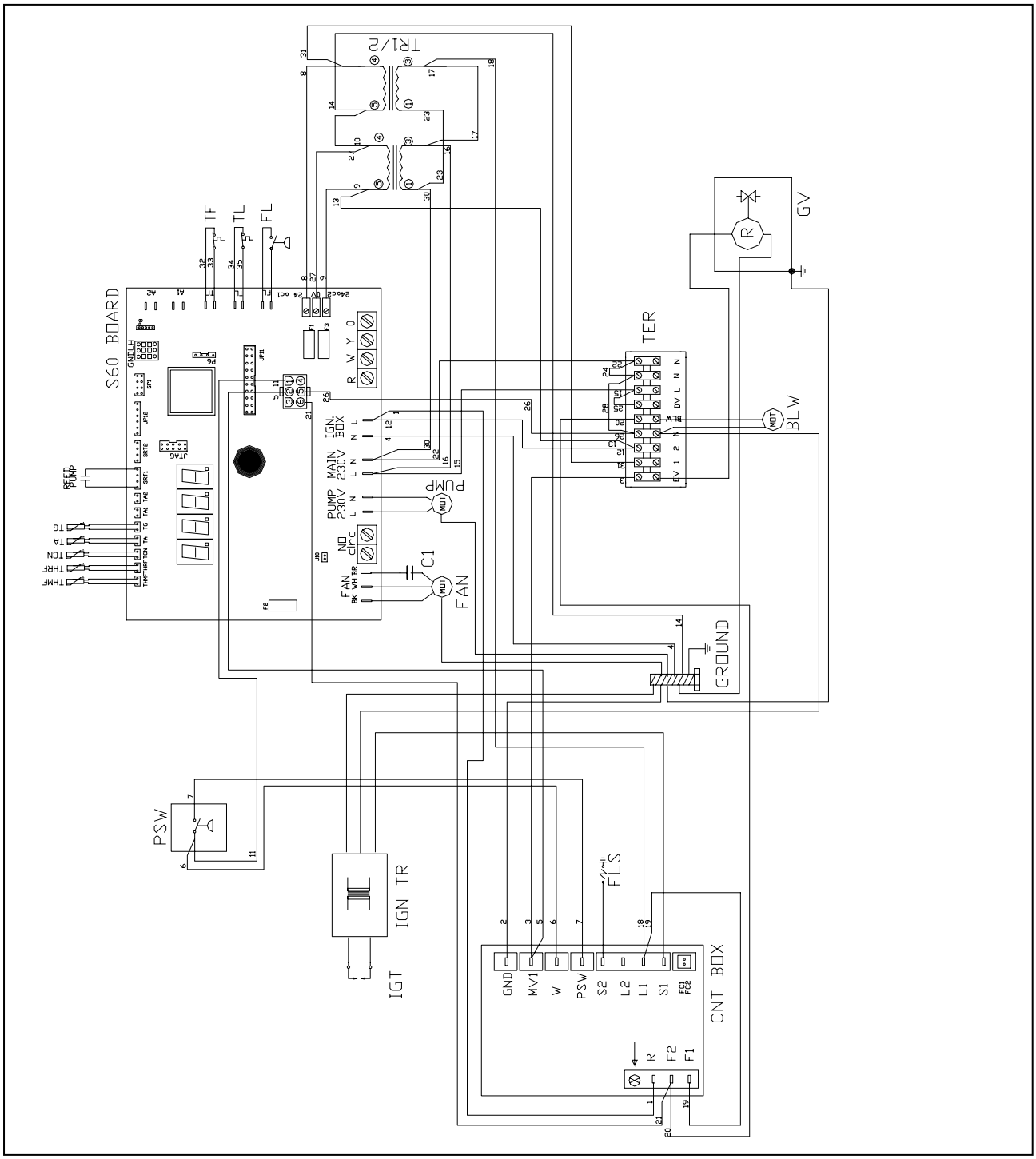


Figure 16 – WIRING DIAGRAM FOR ACF60-00

5.5 DDC CONNECTION

Connection with ACF60-00 UNIT

WARNING

For the connection of DDC (available as accessory) with ACF60-00 units, consult the instructions, figures and diagrams only contained in this subparagraph. For further details and/or information refer to the specific "DDC installation, programming and use manual".

To well manage one or more units connected to the same hydronic system, it is important to use the DDC, available as accessory. In such a case, it is necessary to:
- Connect the DDC to the power supply (see "DDC: Electric supply wire connection")
- Use a CAN-BUS wire to connect the units and the DDC (see "Connection of DDC to the unit")

DDC: Electric supply wire connection

The DDC should be electrically supplied through a safety transformer 230 /24 V.a.c. – 60 Hz. With minimum power equal to 20 VA.

Use an electric supply wire (min. 2 x 18 AWG) and the 4 terminals connector of the DDC (placed at bottom left, back side) to make the connection as in Figure 17, respecting the following polarity:
- terminal 1 = 24 V;
- terminal 2 = 0 V;
- terminal 3 = ground

Warning: in all cases terminal 3 of the DDC terminals connector should be connected to one safety ground (≤ 0,1Ω).

The DDC is also equipped with a plug battery which, in case of black out, stores in its memory the programmed values; **the plug battery lasts approximately 7 years**, then it should be changed by **Authorized Service Engineer**.

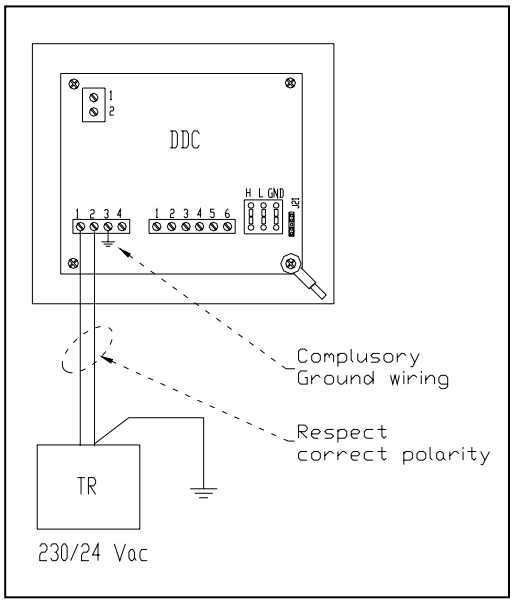


Figure 17– ELECTRICAL SUPPLY WIRE CONNECTION

Connection of DDC to the unit

The connection between DDC and the unit (or more units) is made through a CAN-BUS wire, in a way to create a parameters communication network, characterized by one series of "n" nodes (see Figure 18 and Figure 19, pag. 37). The parameters communication network can connect max 3 DDC.

NOTE

Every single object (ACF60-00 unit or DDC) at its connection to the communication network is intended to be a *node*. Every network is composed by 2 *terminal nodes* and of a certain number of *intermediate nodes*.

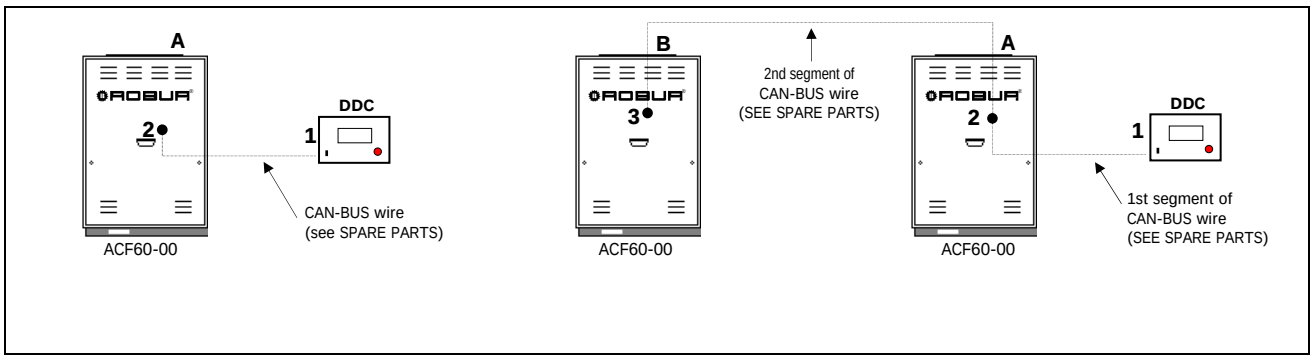


Figure 18 – EXAMPLE CONNECTION OF DDC TO SINGLE ACF60-00 UNIT (2 nodes network) AND TO N.2 ACF60-00 UNITS CONNECTED ON THE SAME HYDRONIC SYSTEM (3 nodes network).

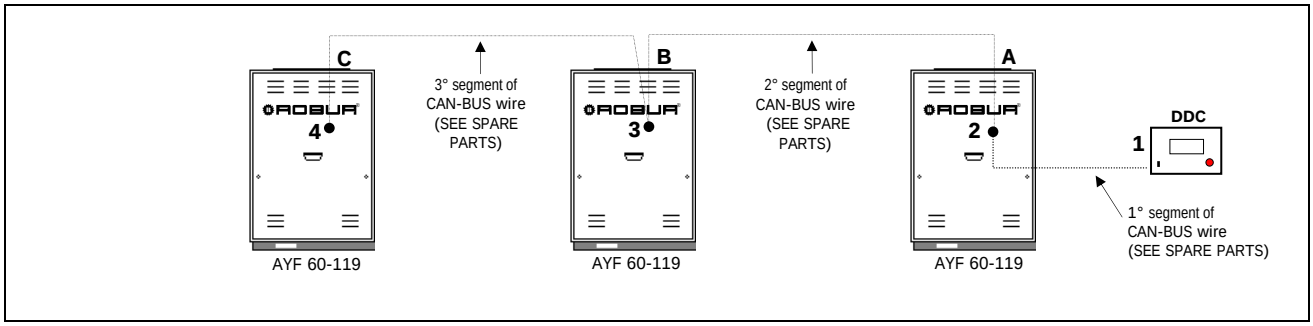


Figure 19 – EXAMPLE CONNECTION OF DDC TO N.3 ACF60-00 UNITS CONNECTED ON THE SAME HYDRONIC SYSTEM (4 nodes network).

CAN-BUS wire connection

If the network connection is max 650 ft cable long and has max 6 nodes (e.g.: 5 ACF60-00 + 1 DDC) a simple shielded wire 3 x 18 AWG is required.
For major lengths, the CAN-BUS wire should be compatible with **Standards Honeywell SDS**.
The next Table shows some examples of these wires, according to the total length of the wire itself:

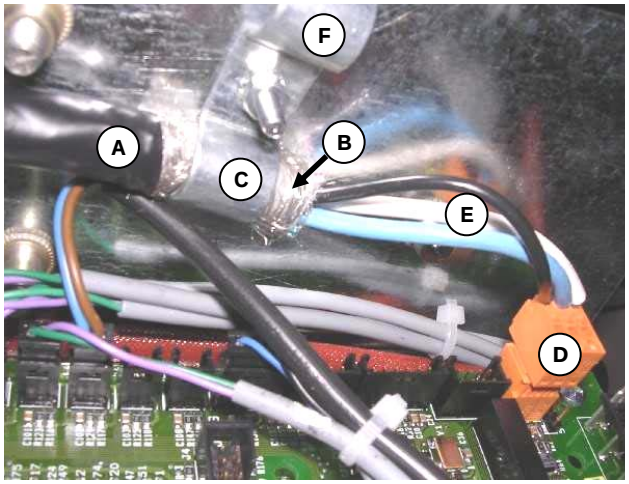
CABLE TYPE AND MODEL	COLOR AND SIGNAL			MAX DISTANCE COVERED ft
ROBUR NETBUS	BLACK = H	WHITE = L	BROWN = GND	1475
Honeywell SDS 1620				
BELDEN 3086A	BLACK = H	WHITE = L	BROWN = GND	1475
TURCK type 530				
DeviceNet Mid Cable				
TURCK type 5711	BLUE = H	WHITE = L	BLACK = GND	1475
Honeywell SDS 2022				
TURCK type 531	BLACK = H	WHITE = L	BROWN = GND	656

Table 9 – EXAMPLE OF TYPES OF WIRES USED FOR CAN-BUS

NOTE: "GND" is the common signal wire, and NOT a ground connection.

Take the CAN-BUS wire of suitable length for the connection between DDC and the unit and, for every network or CAN-BUS wire segments (from a node to another) cut sheath of the wire from both terminal for about 3" length and connect them to the proper nodes, on the electronic control board (S60) or on DDC.

- **CAN-BUS wire connection to Electronic Control board**



LEGEND

NB: Situation with only one CAN-BUS wire
(The figure at left, is an example of *terminal node* connection to electronic control board).

A Isolated adhesive tape

B CAN-BUS wire shield

C Fixing clamp (1 CAN-BUS wire is fixed)

D Connector for CAN-BUS wire conductors (to be removed to ease the conductors connection)

E Internal conductors (n. 3) of CAN-BUS wire

F Fixing point for eventual 2° segments CAN-BUS wire (*intermediate node*)

Figure 20 – EXAMPLE OF CAN-BUS CONNECTION TO ELECTRONIC CONTROL BOARD (EXAMPLE WITH ONLY ONE CAN-BUS WIRE)

1. Turn over the whole CAN-BUS shield (the aluminum part and the metal braiding) of the cut sheath part and fix it to the clamp (details B and C, Figure 20)

WARNING

Isolate the whole shielded part of CAN-BUS wire after fixing clamp to avoid any contact between the shield and the electronic control board (Particular A, Figure 20).

2. Extract from the electronic control board the orange color connector from its CAN Port (placed in right top angle of ECB: particular D Figure 20) and proceed with the following instructions of point 3.

3. If one INTERMEDIATE node of PARAMETERS COMMUNICATION NETWORK is under connection, follow all the next instructions (points **3a, 3b, 3c, 4** and **5**); but if one TERMINAL node of PARAMENTERS COMMUNICATION NETWORK is under connection, follow the instruction of points **3a, 4** and **5** only.

3a Connect 3 conductors of CAN-BUS wire (particular E, Figure 20) respecting the signal/color indications as in Table 9, page 37 with 3 inlets H, L, GND of the same connector as in Figure 20 (see also details of Figure 21, page 39).

3b Repeat the same procedure of point 1 when connecting the 2nd CAN-BUS wire segment by fixing the 2nd wire to the same clamp (particular F, Figure 20).

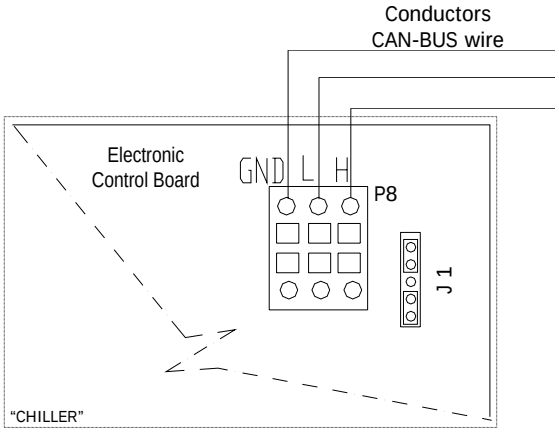
3c Connect 3 conductors of the 2nd CAN-BUS wire, respecting the signal/color indications as in Table 9, page 37 with the other 3 inlets H, L, GND of the other connector as in Figure 22, pag 39.

4. Engage the connector to the electronic control board.

5. Adjust the Jumpers according to the following cases:

- 1st CASE: on the orange connector of CAN port, there are three conductors (terminal nodes): in this case, the 2 jumpers existing beside the orange connector of CAN Port should be adjusted as indicated in Figure 21, page 39 (detail J1).
- 2nd CASE: on the orange connector of CAN Port, there are 6 conductors (terminal nodes): in this case, the 2 Jumpers existing beside the orange connector of CAN Port should be adjusted as indicated in Figure 22, page 39 (details J1).

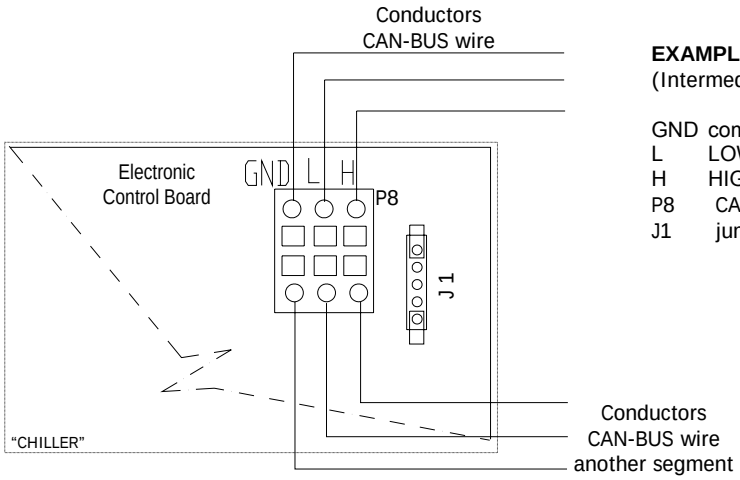
The Jumpers are pre-adjusted (in the factory) as in 1st CASE, that is closed.



EXAMPLE OF CLOSED JUMPERS
(terminal node with only 1 CAN-BUS wire)

GND common cable
L LOW signal parameters
H HIGH signal parameters
P8 CAN PORT / CONNECTOR
J1 jumpers (closed position)

Figure 21 – DETAILED EXAMPLE OF THE CONNECTION OF ONLY ONE CAN-BUS WIRE WITH THE ELECTRONIC CONTROL BOARD



EXAMPLE OF OPENED JUMPERS
(Intermediate node with 2 CAN-BUS wires)

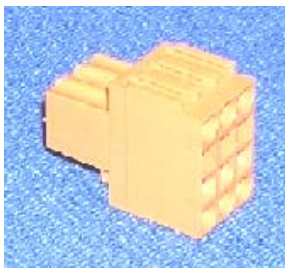
GND common cable
L LOW signal parameters
H HIGH signal parameters
P8 CAN PORT / CONNECTOR
J1 jumpers (opened position)

Figure 22– DETAILED EXAMPLE OF THE CONNECTION OF TWO CAN-BUS WIRES WITH THE ELECTRONIC CONTROL BOARD

- **CAN-BUS wire connection to Digital Display Control (DDC)**

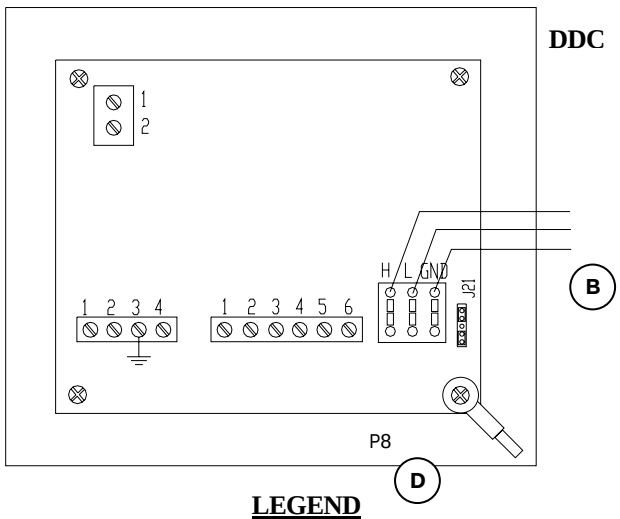
WARNING

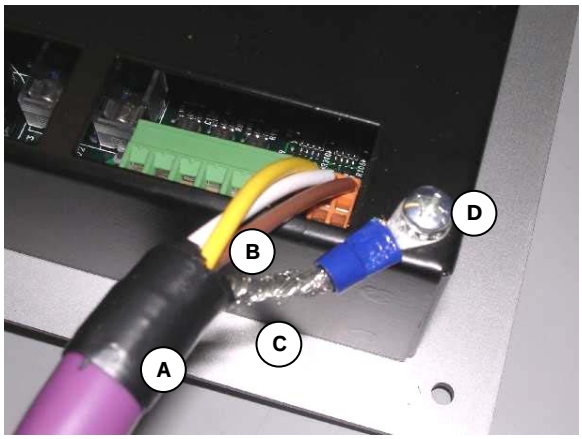
Like the orange connector of the electronic control board, the DDC connector, too, has two different situations of connection (see Figure 24, Figure 25 page 41). The Jumpers (J21) are closed in the factory as in 1st CASE.



ORANGE CONNECTOR OF CAN PORT

1. Take from the supplied bag the orange connector of CAN Port.
2. Connect 3 conductors of CAN-BUS wire (Particular B, Figure 23) respecting the signal/color indications as in Table 9, page 37 with three inlets H, L, GND of the connector as in Figure 23; see also Figure 24, page 41.
3. **If one intermediate node** of parameters communication network is under connection, follow the instructions of points **3a, 3b, 3c, 3d;** but **if one terminal node** of parameters communication network is under connection, go directly to point **4**.
   3a Connect 3 internal conductors of the other segment of CAN-BUS wire (after cutting the sheath from terminals) with 3 inlets H, L, GND of the DDC connector as in Figure 25, page 41.
   3b Remove the back cover of the DDC unscrewing the 4 fixing screws.
   3c In the electronic control board of DDC, ad just the Jumpers (J21) placed beside the orange connector of CAN Port (P8) as in Figure 25, page 41.
   3d Fix the back cover of the DDC using 4 screws
4. Engage – from the back cover hole of DDC – the orange connector of CAN Port to the DDC electronic control board.
5a Roll up the cut shield of the above mentioned CAN-BUS wire and connect it with an eyelet terminal of 0.16" (particular C&D, Figure 23).
5b (only for intermediate node) roll up the cut shield of the other CAN-BUS wire and connect it with eyelet terminal of 0.16" (particular C&D, Figure 23).
6. Unscrew the right bottom screw of the DDC back cover (particular D, Figure 23) and inset it to the eyelet terminal (s) and screw it down again.
7 Isolate – with suitable adhesive tape – the shield part of the wire (particular A, Figure 23).

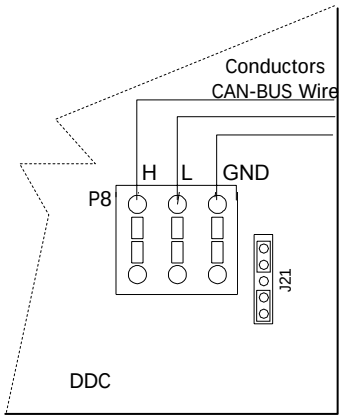




LEGEND

GND	Common cable	A	Isolated adhesive tape
L	LOW signal parameters	B	Conductors CAN wire
H	HIGH signal parameters	C	CAN –BUS wire shield
J21	Jumpers	D	Eyelet terminal fixed with screw at back cover DDC

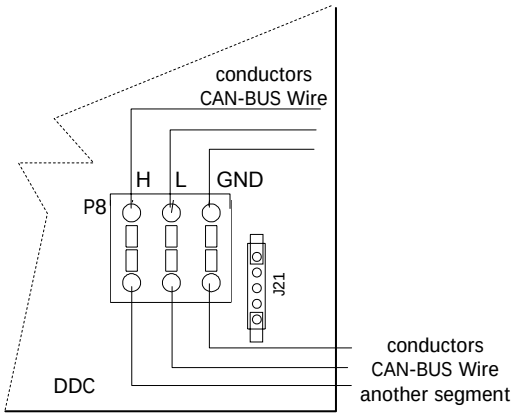
Figure 23 – EXAMPLE OF CAN-BUS WIRE CONNECTION TO DDC (only one entry CAN-BUS wire)



EXAMPLE OF CLOSED JUMPERS
(Terminal node with N. 1 CAN-BUS wire)

GND common cable
L LOW parameters signals
H High parameters signals
P8 CAN PORT / CONNECTOR
J21 jumpers (closed position)

Figure 24 – DETAILED EXAMPLE OF ONE CAN-BUS WIRE CONNECTION TO DDC



EXAMPLE OF OPENED JUMPERS
(Intermediate node with N. 2 CAN-BUS wires)

GND common cable
L LOW parameters signals
H High parameters signals
P8 CAN PORT / CONNECTOR
J21 jumpers (opened position)

Figure 25 – DETAILED EXAMPLE OF TWO CAN-BUS WIRES CONNECTION TO DDC

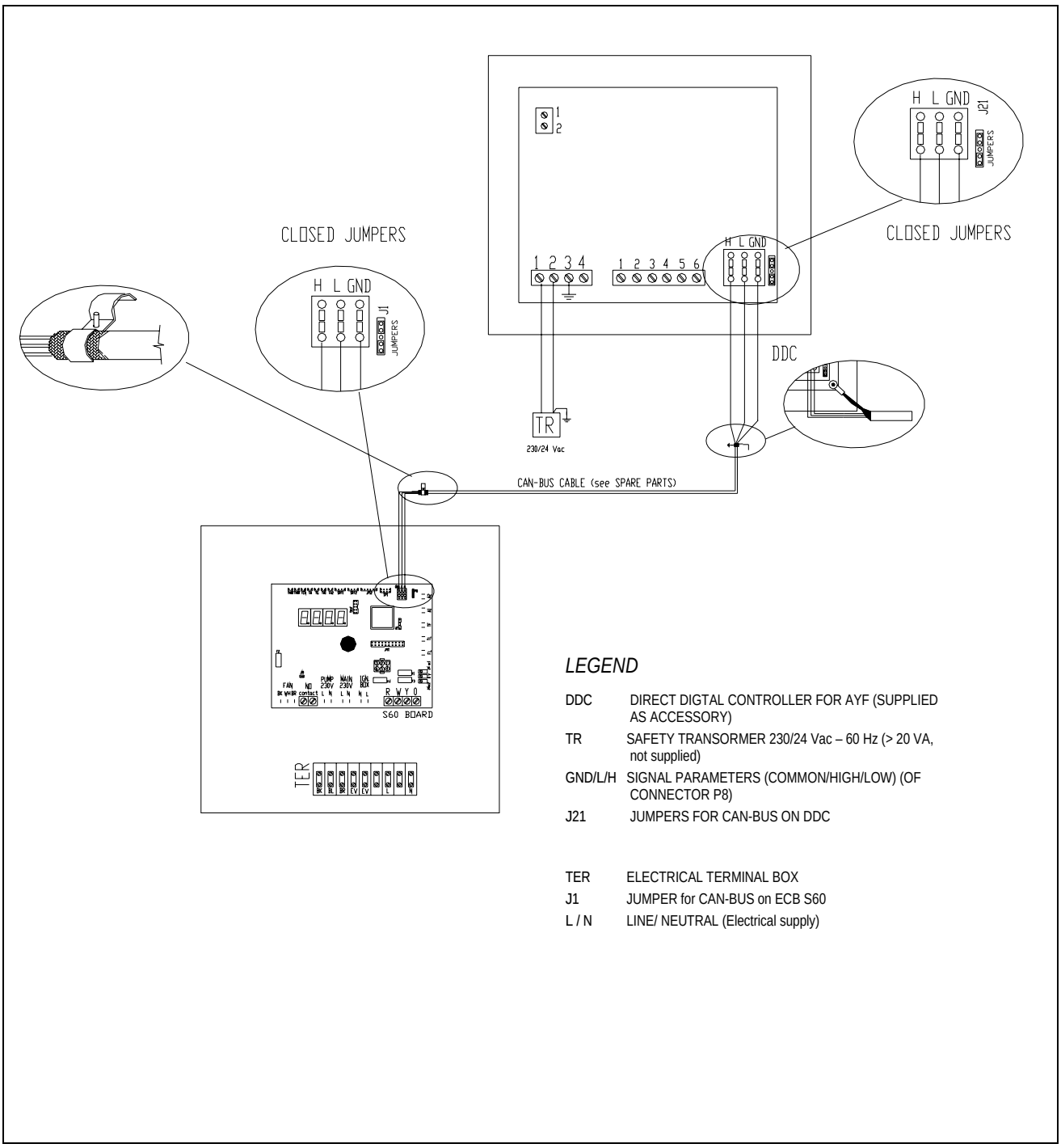


Figure 26 – CONNECTION OF DDC TO N. 1 ACF60-00.

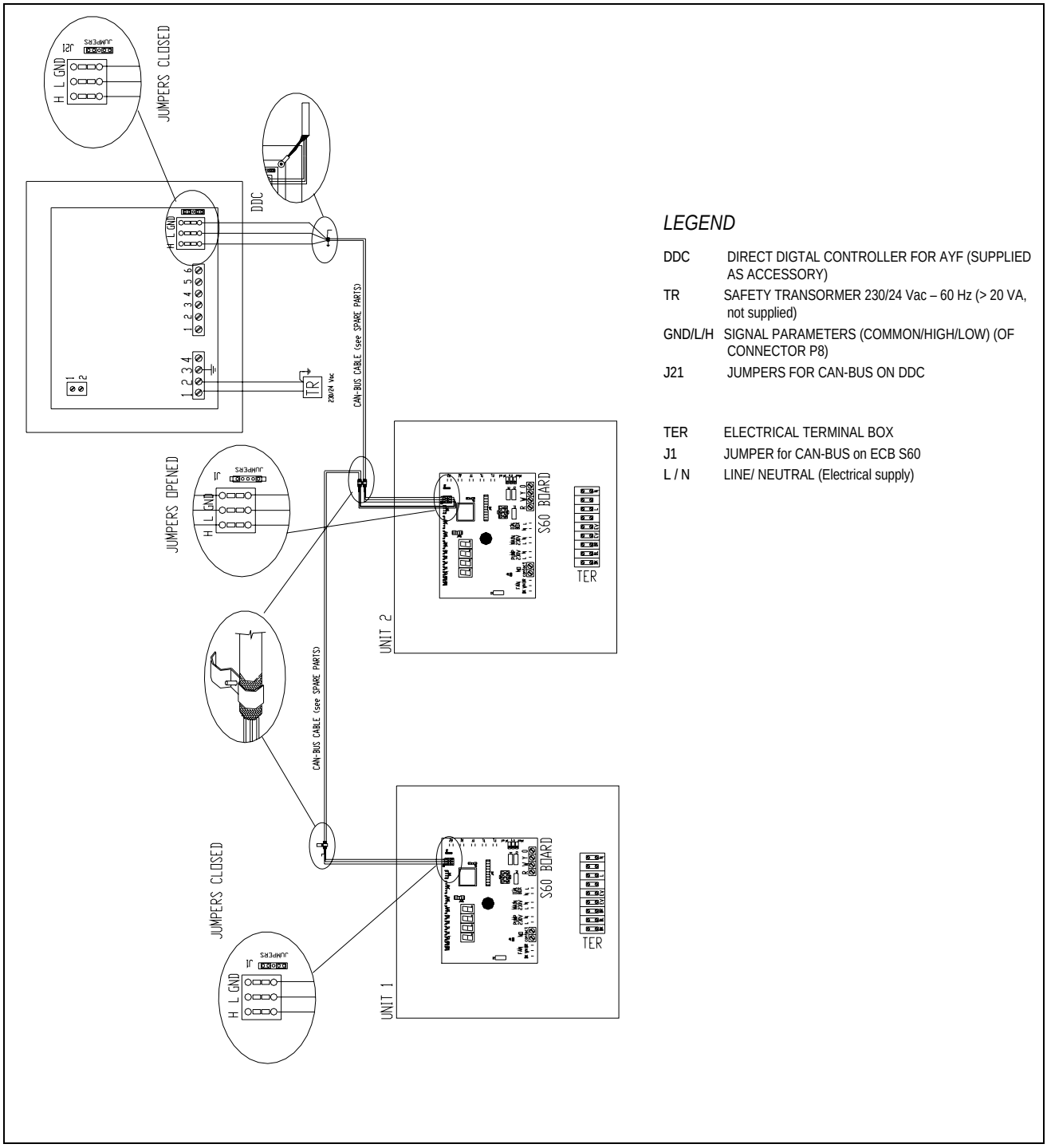


Figure 27 – CONNECTION OF DDC TO N. 2 ACF60-00.

6. START-UP AND ADJUSTMENT

WARNING

This unit should be started-up by Authorized Engineers according to the manufacturer's instructions. The end-user is not authorized to perform start-up and adjustment operations.

If during the first start-up (in site) a DANGEROUS or ANOMALOUS situation is met due to non-conform system, the start-up operations won't be completed. The user/installer must perform the proper adjustments indicated by authorized engineers, who will carry out the start-up.
The positive result of the first start-up (in site) is only reflecting the good operation of the unit 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. See warranty card for complete details.

DANGEROUS SITUATIONS FOR THE UNIT AND/OR PERSONS

If up on performing the 1st start-up, and one of the following conditions is found **don't proceed with the start-up**:

- Unit installed indoors, or in position unsafe for servicing and maintenance.
- The unit turned on and off by using the main electrical switch (not using control switch).
- Antifreeze mono-ethylene glycol not added to the water
- Unit damaged or defective due to transport and/or installation

ANOMALOUS INSTALLATION CONDITIONS FOR THE UNIT AND/OR PERSONS

The Authorized ROBUR Service can carry out the 1st start-up, but **the unit will be kept switched off** until the user/installer fully follows the manufacturer's directions/instructions. Anomalous installation conditions:

- Installations which show situations in contradiction to the directions/instructions of the manufacturer in part or fully;
- Installations which show situations which result or may result as a defective unit operation.

6.1 FILLING THE WATER PIPING

WARNING

To ensure correct operation of the unit and to avoid the water freezing, add 10% by volume of inhibited mono-ethylene glycol (antifreeze) to the circulation water. Add more mono-ethylene glycol as needed for the minimum external temperature of the installation zone (see Table 10, page 47).

The method described below is **only one of several ways** that can be used to fill the hydronic circuit. A container to mix water and mono-ethylene glycol and a water pump to drive the mixture into the hydronic system is required; 2 valves are placed on the circuit as shown in Figure 28.

1. Open air bleed(s) located at the highest point in the system. Connect a hose between the charging pump and Valve A. Connect a hose to Valve C and place the other end of this hose into the mixing container (See Figure 21).
2. Mix the desired concentration and volume of water/antifreeze in the container. If the container will not hold the volume required to fill hydronic circuit, multiple “batches” must be made.
3. Close Valve B. Open Valve A and Valve C. Start charging pump to push the water/antifreeze mixture into the hydronic system. Air will be removed through the hose on Valve C as the hydronic system fills. Continue to fill the system until the water/antifreeze mixture returns to the mixing container via the hose on Valve C.
4. If the volume in the mixing container is adequate to fill the hydronic system, skip to Step 14. If the volume in the mixing container is inadequate to fill the hydronic system, close Valve A prior to air entering the charging pump and shut the charging pump off.
5. Make a new container of water/antifreeze mixture.
6. Start the charging pump and open Valve A to continue filling hydronic system. Repeat Steps 4 through 6 as needed until hydronic system is filled or until charging pump is incapable of adding any additional mixture due to pump discharge head limitations.
7. If the system is filled, skip to Step 14. If the system is not full, turn on the hydronic system’s pump but do not start the unit. Jumping the N.O. CIRC. contacts on the electronic control board can start the hydronic system’s pump.
8. “Throttle” Valve B, if necessary to continue filling the hydronic system if the system does not start filling after the hydronic system pump was started.
9. If the volume in the mixing container is not sufficient to fill the hydronic system, close Valve A prior to air entering the charging pump and shut both pumps off.
10. Mix new container of water/antifreeze mixture.
11. Start both pumps and open Valve A.
12. Repeat Steps 9 through 11 until the system is filled and all air is removed from the hydronic system.
13. Close Valve A and Valve C. Shut off all pumps. Open Valve B.
14. Close any manual air bleed valves.
15. Start pumps and open Valve A.
16. Add additional inhibited antifreeze/water mixture until the hydronic system has a total pressure of at least 20 psig or sufficient pressure in the system to allow a positive pressure at pump suction at all times.
17. Close Valve A and shut down both pumps.
18. Disconnect the charging pump and the mixing container.
19. The hydronic system is now charged.

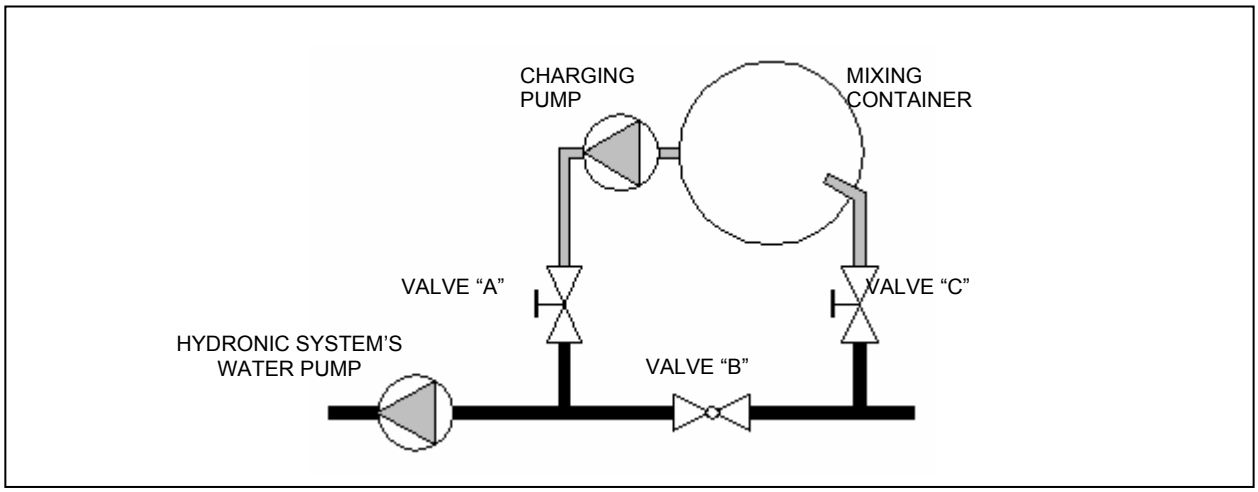


Figure 28 – COMPONENTS USED IN FILLING THE HYDRONIC SYSTEM

TYPE OF ANTIFREEZE	APPROXIMATE PERCENTAGE OF ANTIFREEZE BY VOLUME			
	20	30	40	50
MONO-ETHYLENE GLYCOL	16°F	4°F	-12°F	-35°F

Table 10 – FREEZING POINTS OBTAINED BY VARIOUS CONCENTRATIONS OF MONO-ETHYLENE GLYCOL ANTIFREEZE

6.2 GAS PRESSURE ADJUSTEMENT

The manufacturer supplies the units 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 unit. Nevertheless, before starting the unit it is necessary to check and adjust if necessary the Gas Input (HHV) to the burner. Using the table below, arrange the proper manifold pressure according to the local gas heating value (BTU content per cubic foot) and specific gravity. This table is based on the correct natural Gas Input (HHV) for the model by manifold pressure in inches of water column (in WC).

MJ CONTENT PER CU.Meter	BTU CONTENT PER CU.FT.	SPECIFIC GRAVITY OF NATURAL GAS			
		0,55	0,6	0,65	0,7
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

Nostro riferimento:

MJ CONTENT PER CU.Meter	BTU CONTENT PER CU.FT.	SPECIFIC GRAVITY OF NATURAL GAS
		0,555
37,78	1014	2,5

Table 11 - MANIFOLD PRESSURE BASED ON GAS INPUT (HHV) OF 94,900 Btu/hr USING 0.21" ORIFICE.

The conditions referred to by the table above are for the guidance of the installer and the CSA design certification does not cover the conditions described therein.

Note: For Propane Gas Models, follow the same instructions as given for natural gas. The manifold pressure for propane gas should be 4.8" W.C. and adjustment is made at the gas valve regulator. Manifold pressure at 94,900 Btu/hr. input using 0.14" orifice.

GAS TYPE	NATURAL GAS	LP GAS
MANIFOLD PRESSURE	2.5 WC Inches	4.8 WC Inches
NOZZLE DIAMETER	0.21"	0.14"

Table 12 - MANIFOLD PRESSURE AND NOZZLE DIAMETER

PRESSURE ADJUSTMENT PROCEDURE

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. Turn power “ON,” 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 (see dedicated procedure, end of Appendix). Repeat until all the air is purged from the piping and the burner ignites.
5. When the burner ignites read the manometer and compare to the required pressure in Table 11.
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 counter clockwise to reduce pressure. Replace seal screw after adjustment.
7. Open control switch and make sure unit is off.
8. Remove manometer and pressure tap. Replace plug in gas valve.
9. Turn unit on by closing control switch. Check all gas connections with soap for leaks.

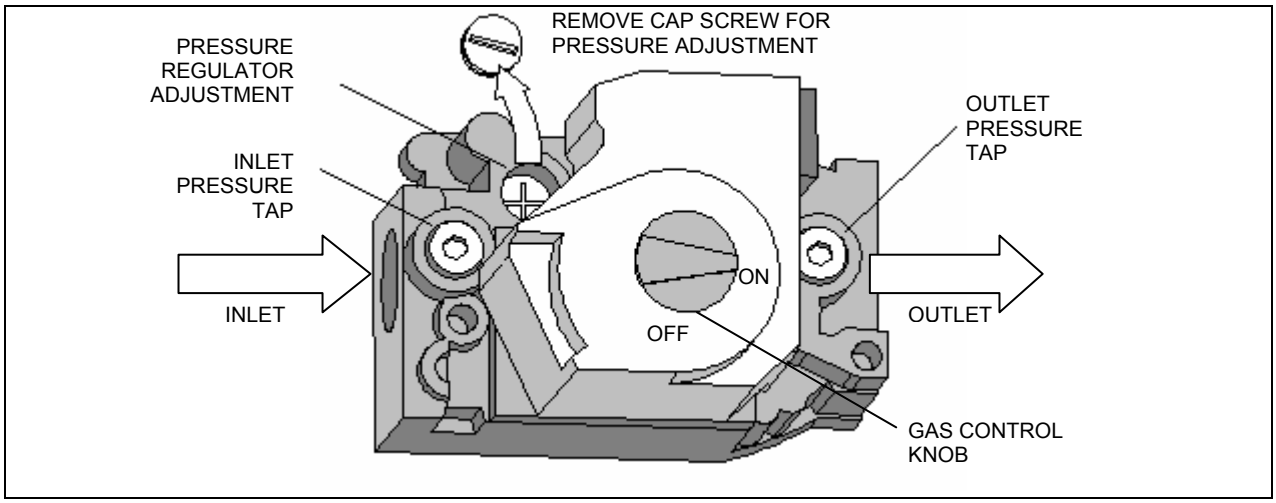


Figure 29 – GAS VALVE

6.3 CHILLED WATER TEMPERATURE REGULATION

When DDC is used, the following menu3 set-up is not to be done. It's necessary to consult "Installation and Programming manual of DDC - Direct Digital Controller".

If the unit isn't connected to a DDC, chilled water temperature regulation can be set up from menu 3 of the S60 card (see APPENDIX: S60 electronic card).

MENU 3 – End User Adjustment	
MENU SIGNALS	**DESCRIPTION OF MENU SIGNALS**
	Thermostat action
	Cold water set point
	Cold water temperature difference ΔT
	Exit

Table 13 – MENU 3 PARAMETERS

The **thermostat action** parameter can assume 2 values: 0 and 1. When 0 is set, temperature to drive the unit is read by the INLET probe; when 1 is set, the temperature is read by the OUTLET probe.
The **set-point** is intended to be the pre adjusted water temperature (in/out), when being achieved, the unit will start the switching off cycle as (since) the conditioning request is met. This parameter can assume values from a factory set minimum value up to 77°F.
The **temperature difference** is intended to be a value, which should be summed up by the pre adjusted set point temperatures. This parameter can assume values from 1.8°F up to 14.4°F.

The obtained value represents the water temperature. According to this temperature, the conditioning request will be re activated and then the unit will start–up again .

For example, let us suppose the following adjustments :

- Thermostat action: unit operation with outlet temperature
- set-point **+44°F;**
- Temp. difference **2 ;**

The unit behaves as follows :
- One time during the unit operation, the water of HYDRONIC system is getting cold until the outlet water temperature reaches **+44°F** (set-point temperature);
- Up on achieving that temperature, the unit will be switched off automatically.
- When the water temperature starts getting high, reaches **+46°F** (that is **+44°F** plus the temp difference of **2**) the unit will start-up again to cool the water once more until reaching **+44°F**, and so on.

Then, according to these adjustments the unit switches off at **+44°F** and starts-up at **+46°F.**

To set up the parameters use the encoder knob:

- To select a menu, a parameter or a value rotate the knob.
- To enter a value press the knob

(see APPENDIX: Electronic system of the ACF60-00 unit).

7. SERVICING AND MAINTENANCE

This manual is an integral and essential part of the product and must be given to the owner.

Performing correct preventive service and maintenance will help to guarantee long life of the unit with high efficiency and low maintenance costs.

WARNING

ONLY Authorized Technicians strictly complying with the manufacturer's instructions and the local standards should perform maintenance and service on the UNIT internal components.

Lubrication of condenser fan, hydraulic pump, and pre-mixer motor is not recommended.

The operations described below must be performed once a year. If the unit is installed on a heavy-duty installation (industrial plants, 24hr operation etc.), it is necessary to increase the frequency of checks and services.

Maintenance to be performed on the unit:

- Cleaning of the condenser /absorber coils
- Check condenser fan height

NOTE

Before any type of service is performed, ALWAYS shut-off the power supply at the main switch.

CLEANING THE CONDENSER / ABSORBER COILS

It is recommended to clean the condenser / absorber coils regularly since the UNIT cooling capacity can be greatly reduced by dirt on the coils (see Figure 30). The user, installer or service technician can perform this operation. To clean condenser / absorber coil proceed as follows:

1. Shut off the power and gas supply.
2. Remove the covering panels.
3. Use a brush to remove dirt from the outside and inside of the condenser/absorber coils.
4. Using water pressure, wash the coils from in to out and from top to bottom. Care should be taken not to spray electrical components or to damage the aluminum fins.
5. Check that all dirt is removed.
6. Replace the panels.
7. Turn on the power and gas supply.
8. Start unit to check for correct operation.

NOTE

Do not use solvents for cleaning the condenser/absorber coils; this could cause damage to the aluminum fins.

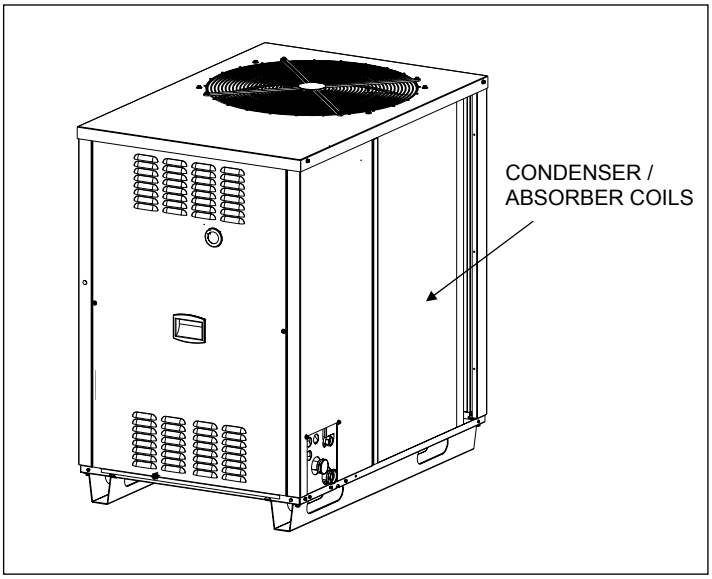


Figure 30 – FINNED CONDENSER / ABSORBER

WARNING

ALWAYS wear safety goggles!

BURNER CONTROL

Gas burners do not normally require scheduled servicing; however, deterioration or an accumulation of lint may cause yellowing flame or delayed ignition. Either condition indicates that a service call is required.

CHECK CONDENSER FAN HEIGHT

For proper air flow, 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.

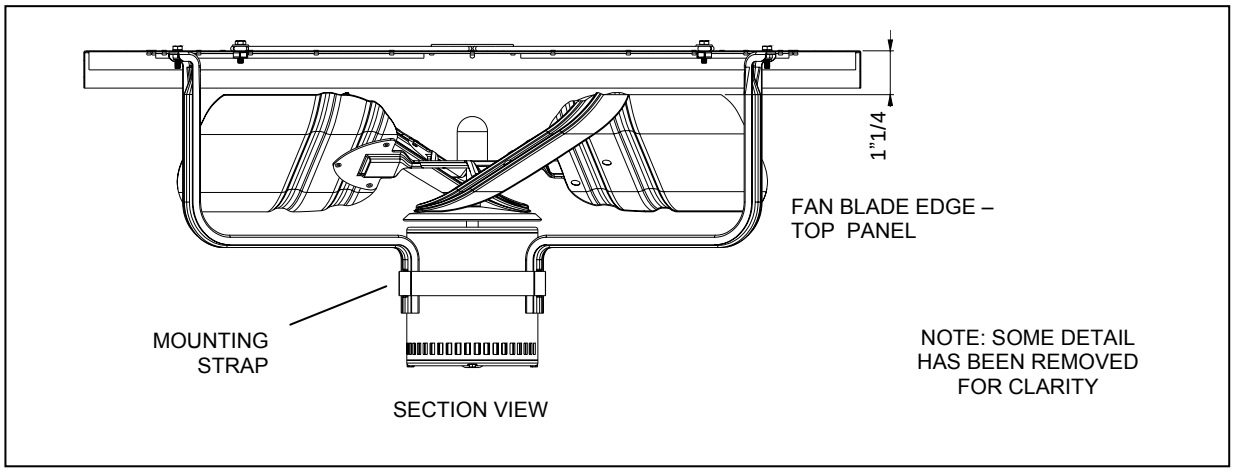


Figure 31 – SECTION VIEW SHOWING PROPER FAN HEIGHT

8. ADAPTING TO ANOTHER GAS

NOTE

ONLY an Authorized Technician can perform the operation described in this section.

If the type of gas indicated does not correspond to the type to be used (natural or propane gas) by unit, it must be converted and adapted to the type of gas to be used. The gas orifice (nozzle) must be changed and the gas valve must be converted.

For this operation proceed as follows:

1. Turn off the gas and electrical supply, remove front and left panel.
2. Remove the wires from the gas valve.
3. Remove the ring nut from the threaded gas nozzle.
4. Remove the gas nozzle from gas valve by removing the 4 screws from the valve flange (use 9/64 hex key wrench). Put the o-ring in a safe place, to be re-used with the new nozzle.
5. 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.
6. Tighten the ring nut and re-attach wires to the valve.
7. Turn on the gas and electrical supply.
8. Adjust the gas pressure for the gas to be used following the instructions reported in **SECTION 6.3 "GAS PRESSURE ADJUSTMENT**".
9. Replace the stickers indicating the type of gas for which the unit is preset with the new one, which indicates the type actually being used.

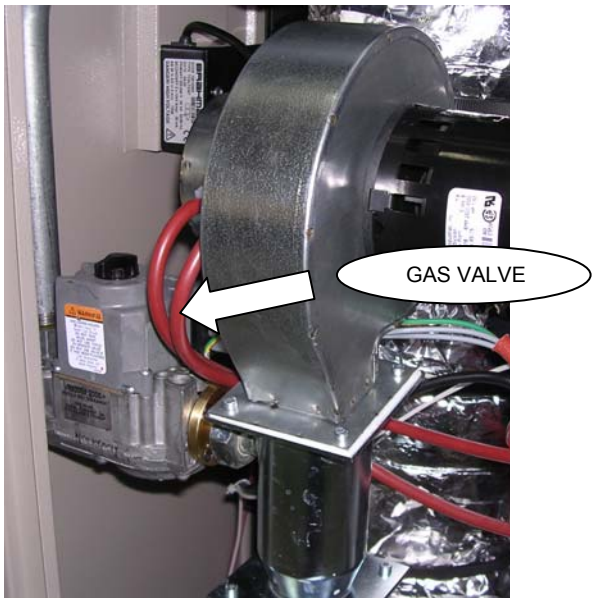


Figure 32 – GAS VALVE

9. SPARE PARTS

Below are the lists of the spare parts for ACF60-00 appliance. Each list comes after the respective exploded drawing, which pictures each part in the list with its progressive number.
Spare parts can be ordered from Robur S.p.A. .

Exploded drawing n.1: INSULATING, WATER PIPES AND ACCESSORIES

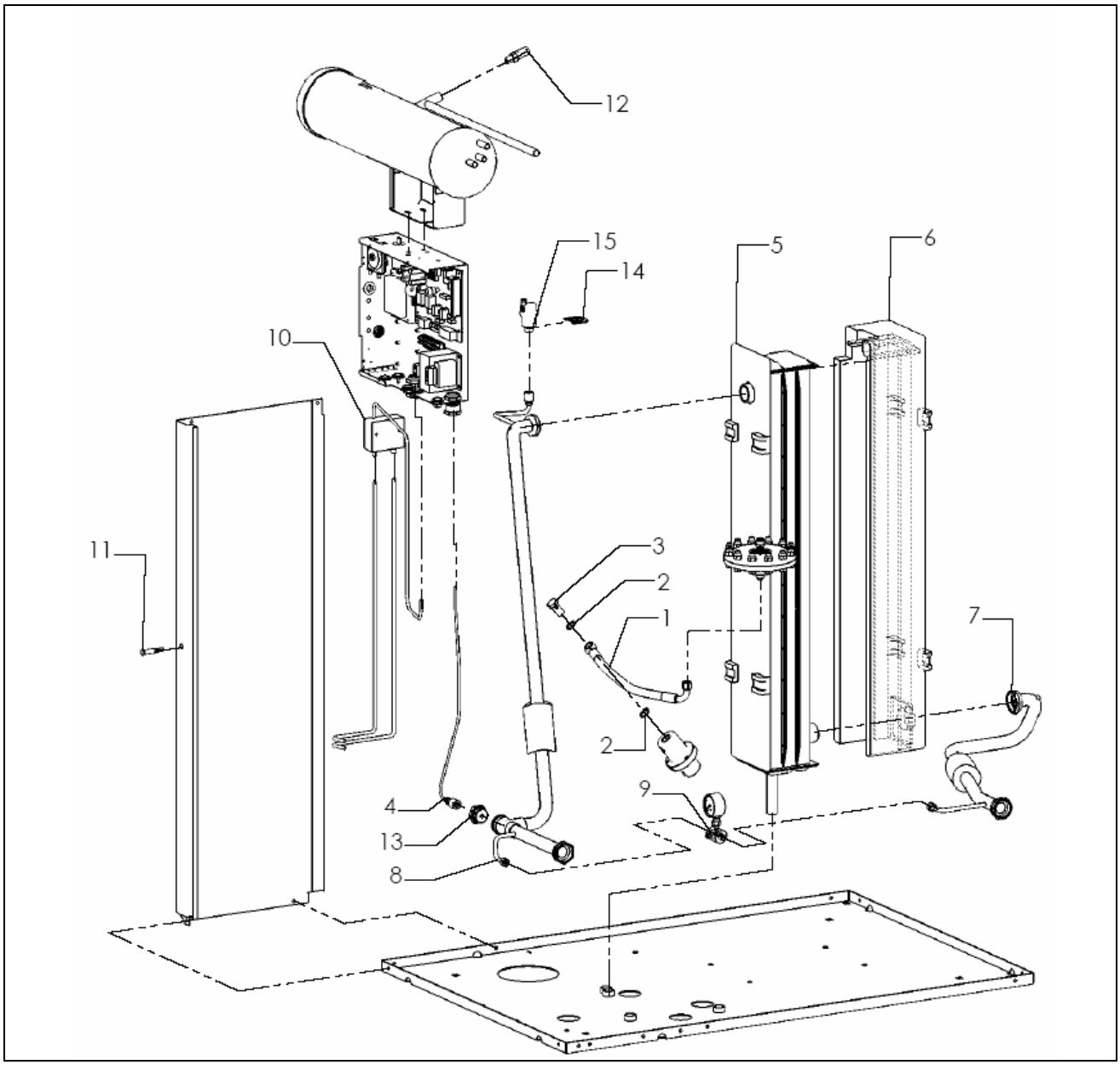


Figure 33 – EXPLODED DRAWING N.1 – SEE Table 14, PAGE 56 FOR THE RELATIVE PARTS LIST.

Rif.	Codice	Descrizione	Q.tà
1	J-TBO358	PUMP HIGH PRESSURE PIPE	1
2	N-RND016	D.3/8"x1,5 COPPER WASHER	2
3	N-BLL000	PUMP GAS SCREW 3/8”	1
4	J-FLS009	WATER FLOWSWICH FOR S60	1
5	C-CBN091	ABSORBER FRONT-SIDE INSULATING	1
6	C-CBN092	ABSORBER REAR-SIDE INSULATING	1
7	R-TBO418	WATER DELIVERY PIPE	1
8	R-TBO420	WATER RETURN PIPE	1
9	K-MNM002	DIFFERENTIAL MANOMETER KIT	1
10	J-TRS007	IGNITER TRANSFORMER	1
11	E-LMP013	SIGNAL LIGHT 230V WITH FAST-ON	1
12	G-VLV055	PRESSURE RELIEF VALVE	1
13	R-GFS001	FLOWSWICH CLAMPING RING NUT	1
14	L-STF189	AIR BREATHER VALVE BRACKET	1
15	H-VLV000	AUTOMATIC AIR BREATHER VALVE	1

Table 14 – SPARE PARTS PICTURED IN Figure 33: INSULATING, WATER PIPES AND ACCESSORIES

Exploded drawing n.2: ELECTRICAL BOX AND PUMP

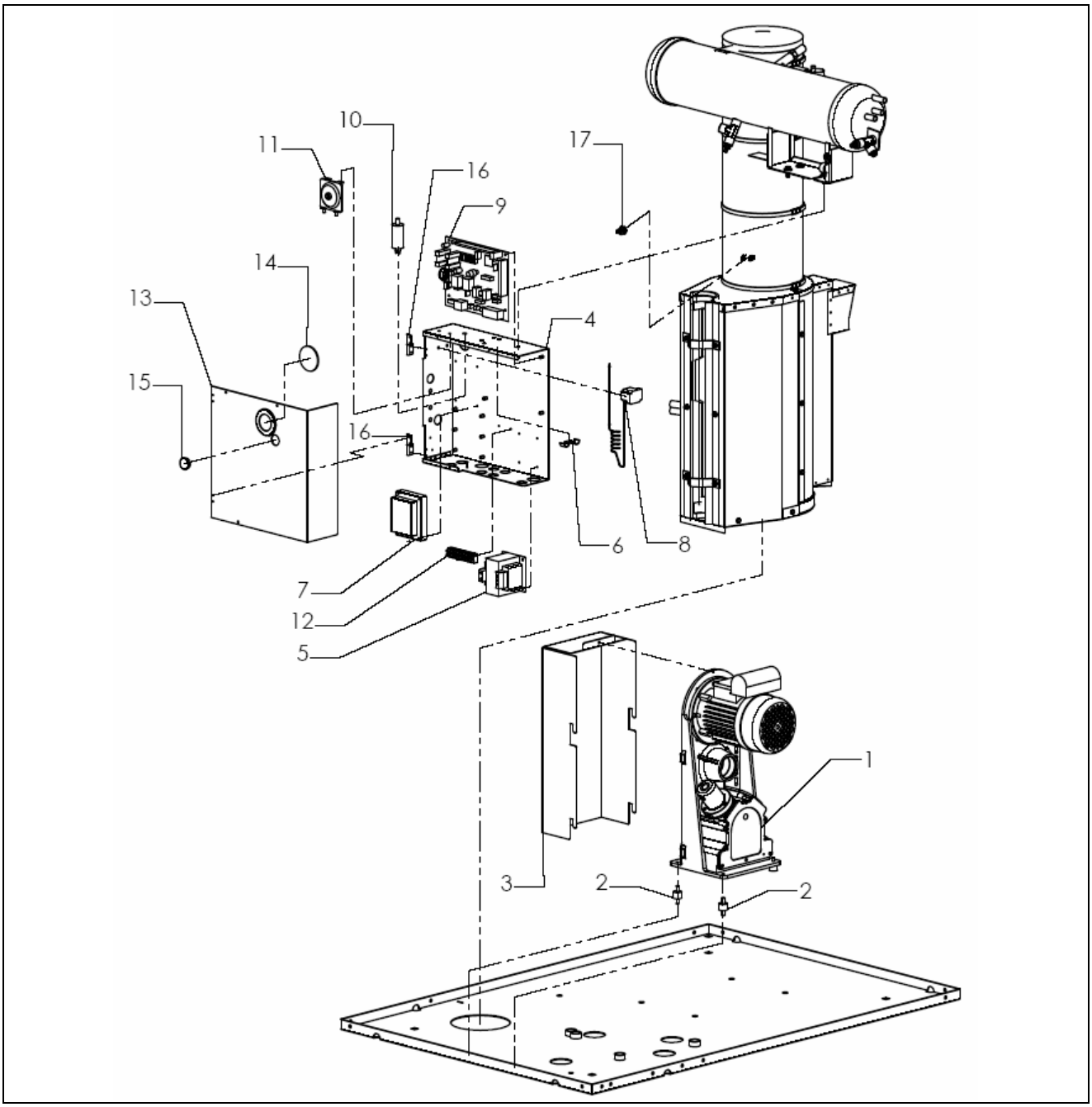


Figure 34 – EXPLODED DRAWING N.2 – SEE Table 15, PAGE 58 FOR THE RELATIVE PARTS LIST.

Rif.	Codice	Descrizione	Q.tà
1	R-PMP009	60 Hz OIL PUMP	1
2	J-NTV000/B	MX20/15 VIBRATION DAMPING	2
3	J-CRT003	PUMP CARTER	1
4	L-BQD018	ELECTRIC PANEL BASE	1
5	E-TRS013	60 Hz 208-240/24V/40VA ELECTRICAL TRANSFORMER	2
6	L-STF149	GROUND CONNECTION BRACKET	1
7	E-CNT031	24 Vac, 60Hz, MICROPROCESSOR BASED HSI CONTROL	1
8	J-TLT020	COMBUSTION CHAMBER THERMOSTAT	1
9	E-SLT031	S60CF24 ELECTRICAL BOARD	1
10	E-CND011	CONDENSER 12.5 µF 450 V	1
11	G-PRS000	AIR PRESSURE SWITCH ACF60.2 60 Hz	1
12	E-MRS020	9 STUD TERMINAL BOARD WITH REED	1
13	L-CQD011	ELECTRIC BOX COVER	1
14	C-12100960	INSPECTION HOLE GLASS	1
15	N-TPP019	D.25 PROTECTION CAP	1
16	N-CRN000	ELECTRIC BOX HINGE	2
17	J-TLT015	LIMIT THERMOSTAT FOR GENERATOR	1

Table 15 – SPARE PARTS PICTURED IN Figure 34: ELECTRICAL BOX AND PUMP

Exploded drawing n.3: COMBUSTION CHAMBER AND GAS SYSTEM

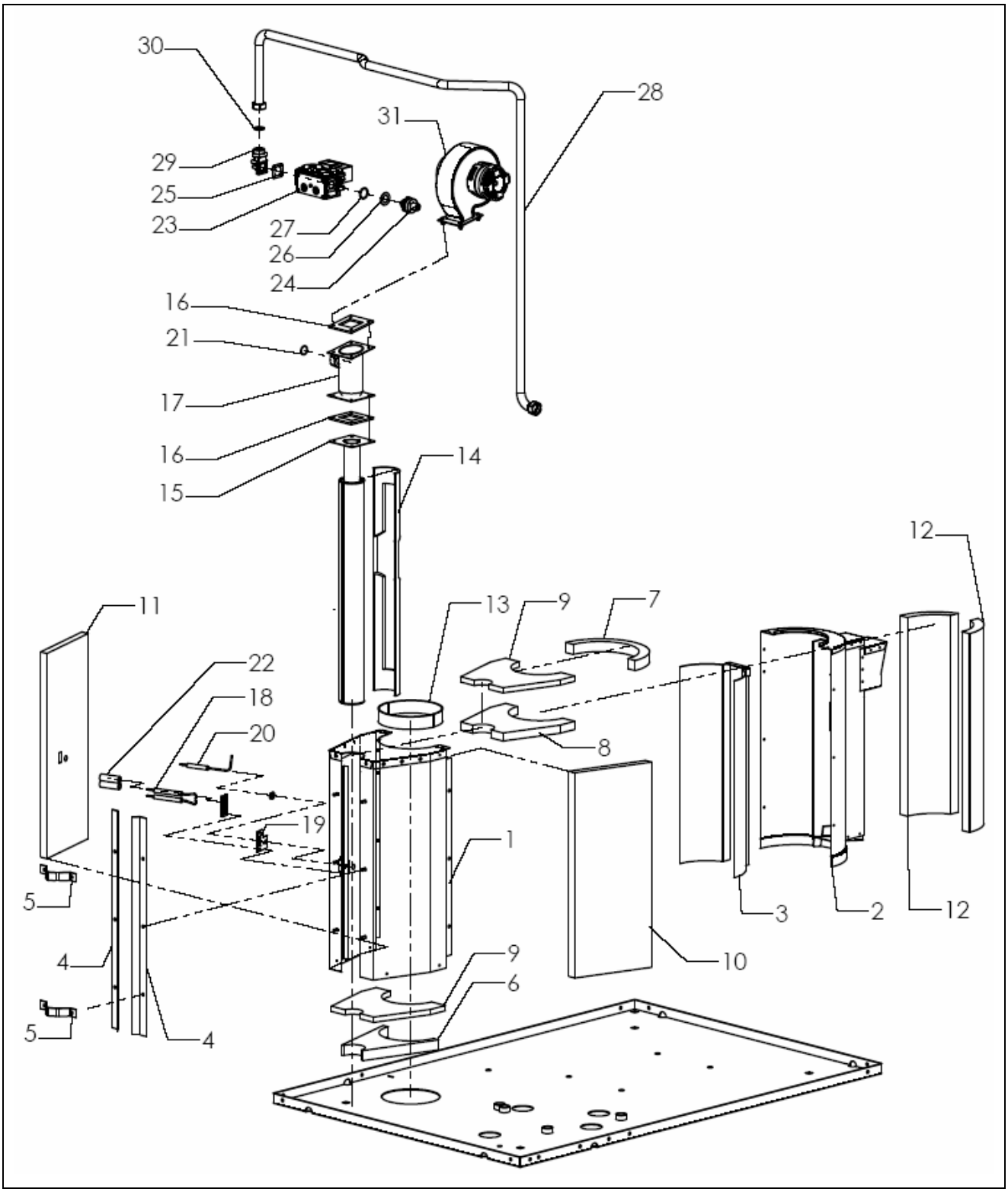


Figure 35 – EXPLODED DRAWING N.3 – SEE Table 16, PAGE 60 FOR THE RELATIVE PARTS LIST.

Rif.	Codice	Descrizione	Q.tà
1	J-CCM026	FRONT COMBUSTION CHAMBER ASSY	1
2	S-CMR000	REAR COMBUSTION CHAMBER ASSY	1
3	H-CMR002	COMB. CHAMBER INTERNAL CONVEYOR	1
4	L-STF120	RETAINER BURNER	2
5	L-MFS000	BURNER TUBE CLIP	2
6	C-CBN040	FRONT BOTTOM INSULATION	1
7	C-CBN038	REAR UPPER INSULATION	1
8	C-CBN037	FRONT-TOP INSULATION	1
9	C-CBN042	COMBUST. CHAMBER BASE INSULATION	2
10	C-CBN080	RIGHT COMBUST. CHAMBER INSULATION	1
11	C-CBN081	LEFT COMBUST. CHAMBER INSULATION	1
12	C-CBN039	COMB. CHAMBER REAR-SIDE INSULATION	2
13	C-CBN041	COMB. CHAMBER/GENERATOR INSULATION	1
14	J-CBN029	BURNER INSULATION	1
15	J-BRC017	BOILER BURNER	1
16	J-GRN028	BURNER UNION TRIMMING	2
17	R-DFF009	INCLINED AIR-GAS MIXER	1
18	J-LTT047	SPARKLING ELECTRODE	1
19	C-GRN086	SENSOR FLAME ELECTRODE GASKET	1
20	J-LTT046	SENSOR FLAME ELECTRODE	1
21	N-GRG006	2075 NB 70 O-RING	1
22	J-CSL000	D.11/16 x 50 CERAMIC INSULATION	1
23	G-VLV052	24 VAC GAS CONTROL VALVE	1
24	B-GLL150	Ø 5.3 METHANE NOZZLE	1
	B-GLL153	Ø 3.6 GPL NOZZLE	1
25	C-GRN041	24x24 GAS PIPE GASKET	1
26	C-GRN040	1” GASKET	1
27	N-GRG000	3087 NBR NT 70 O-RING	1
28	R-TBO645	GAS TUBE COMPONENT	1
29	G-FLN019	90° ½“ NPT GAS VALVE FLANGE	1
30	C-GRN057	CENTELLEN 200 ¾” GASKET	1
31	K-SFF038	BLOWER KIT	1

Table 16 – SPARE PARTS PICTURED IN Figure 35: COMBUSTION CHAMBER AND GAS SYSTEM

Exploded drawing n.4: PANELS KIT

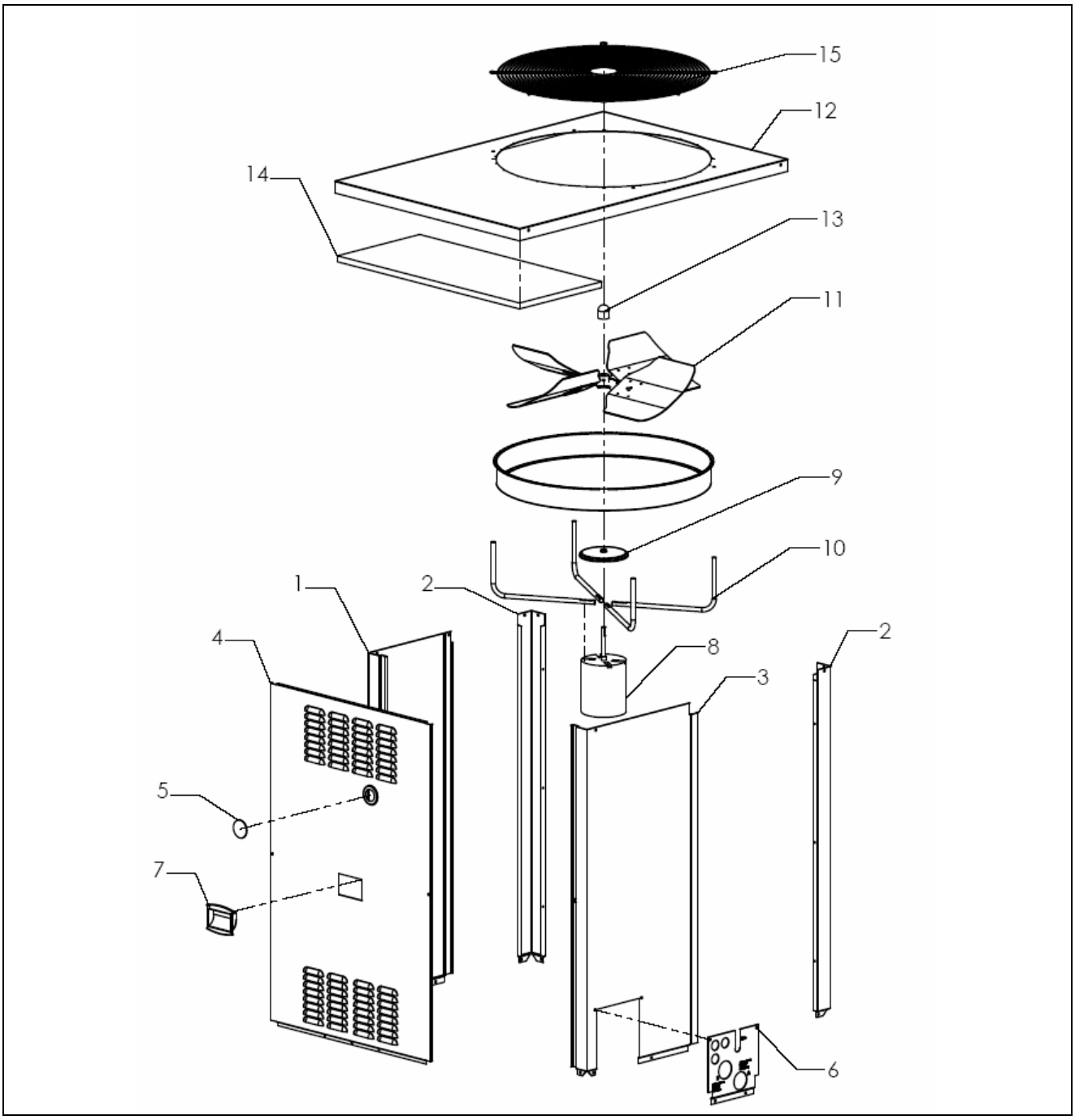


Figure 36 – EXPLODED DRAWING N.4 – SEE **Table 17**, PAGE 62 FOR THE RELATIVE PARTS LIST.

Rif.	Codice	Descrizione	Q.tà
1	P-MNS035	PAINTED FRONT-LEFT COLUMN	1
2	P-MDS004	PAINTED BACK RIGHT-LEFT COLUMN	2
3	P-MND020	PAINTED FRONT-RIGHT COLUMN	1
4	P-PNF063	COMPLETE PAINTED FRONT PANEL	1
5	C-12100960	INSPECTION HOLE GLASS	1
6	L-PST068	SILK SCREENED SERVICE PLATE	1
7	N-MNG000	PANELS HANDLE	1
8	E-MTR056	60 Hz FAN MOTOR	1
9	V-PRT000	60 Hz MOTOR RAIN SHIELD	1
10	L-STF210	60 Hz FAN MOTOR BRACKET	4
11	V-VNT025	BLADE ASSEMBLY – FAN – 26” Ø – 60 Hz	1
12	P-CPR048	PAINTED SUPERIOR PANEL	1
13	N-TPP061	Ø33.4 H.25 VINYL CAP	1
14	C-CBN028	380X840 SUPERIOR PANEL INSULATION	1
15	J-GPR000	FAN GRID	1

Table 17 - SPARE PARTS PICTURED IN Figure 36: PANELS KIT

10. APPENDIX

ELECTRONIC SYSTEM OF THE ACF60-00 UNIT

The electronic control board of the unit is placed inside the electrical box and is equipped with a 4 digits display, a regulating knob (*encoder*) and a terminal set (CAN PORT) for the remote connection.

The DISPLAY (particular **A**) shows the operation data (example: chilled water temperature) and possible anomalies, through the visualization of the unit codes.

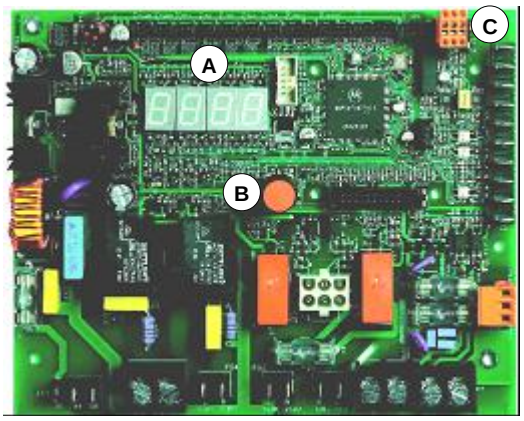
Besides, It is possible to visualize all relative available information (data, parameters, values, etc.).

LEGEND

A 4 digits DISPLAY for visualizing operational and unit codes

B REGULATING KNOB (*Encoder*) for scrolling/selection of data

C CAN PORT for the connection to DDC



Electronic Control Board S 60

Figure 37 – ELECTRONIC CONTROL BOARD DETAIL

Rotating and pressing the REGULATING KNOB (particular **B**) allows the scrolling and selection of the information on the display.

Through the regulating knob and Display, operation management and control take place.

The CAN PORT (particular **C**) allows the connection, by one can-bus wire, between the electronic control board and DDC (available as accessory). When such connection is made, the operation management and control of the unit takes place only through the DDC.

NOTE

The electronic control board is placed inside the electrical box of the unit and is visible from the front panel.

To interact with the regulating knob (*encoder*) of the electronic control board, it is necessary to remove the front panel of the unit and, without opening the electrical box, to act on the encoder by the supplied tube of about 4-3/4".

Operation Management And Control

The Display of the electronic control board, during the normal operation, shows in alternative mode the following information:

- Water inlet temperature (after the symbol r)
- Water outlet temperature (after the symbol L)
- Temperature difference ΔT (after the symbol Δt)

If anomalies are found, the electronic control board will show them on the display and will visualize the relative flashing unit codes. (i.e. ).
Until the unit code is not deactivated, display will show the unit code flashing. When there are more than one unit code deactivated, they will be visualized in alternative mode and flashing.
To enter the menu of electronic control board (visualization menu) press its ENCODER once: on the display the 1st menu entry will be visualized (menu 0, shown as ).

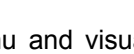
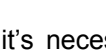
NOTE

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 an information is not available, the display visualizes :  .

Rotating the encoder, all the other menu will be visualized on the display.
To exit and return to the precedent level, it is necessary to select the letter "E"
() by pressing the encoder.

To enter in menu and visualize menu entries it's necessary to stop on the desired menu and press the encoder: on the display the first menu entry of the same menu will be visualized .

NOTE

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 :  indicates entry *0*, menu 0;  indicates menu entry 2, menu 0).

By **rotating the** *encoder*, all the other menu entries of the same menu will be visualized on the display.
To exit and return to the precedent level (default visualization), it is necessary to select the letter "E"
() by pressing the encoder.

MENU DESCRIPTION

The electronic control board presents nine menu (from 0 to 8), as follows:

Menu 0: Data Visualization	
Menu 1: Parameter Visualization	
Menu 2: Actions	
Menu 3: End User Adjustment	
Menu 4: Adjustment by (Assistance Centers)	
Menu 5: Adjustment (by Assistance Centers)	
Menu 6: Unit Type Adjustment (by Assistance Centers)	
Menu 7: Digital Inlet Visualization	
Menu 8: Set Password (not manageable)	
"E": Exit	

Table 18 – S60 MENUS

MENU 0, 1 and 7 are “Visualization Menu” (data and parameters are read-only). In menu 0 it’s possible to visualize the unit operation data detected from the electronic control board; In menu 1 it’s possible to real-time visualize the unit operation data and the unit management. In menu 7 a number will represent the state of digital Inlet.

MENU 2 is an “Execution Menu”; through this menu it’s possible execute actions like reset ignition control box and reset errors, as consequence of anomalies detected by the unit. The code will be visualized on the display of the electronic control board.

MENU 3, 4, 5 e 6 are “Adjustment Menu”, to adjust the contained information. Menu 3 is relative to the end-user, who can eventually (if allowed) modify the value of parameters; an example are cold water set point and the water temperature difference setup.

MENU 4, 5 e 6 are only to be managed by Robur Technical Assistance Authorized Centers.

NOTE

The electronic control board has three fuses for circuit protection. If the electronic control board does not start up or the condenser fan does not run, remove power from the unit and check the condition of the fuses. The S60 board requires a 10A (condenser fan) and two 2A fuses (electrical board). The size of the fuse is labeled on the electronic control board next to the respective fuse holder.

WARNING

The **maximum** current carrying capacity of the N.O. Contact is **4A.** Refer to Section 5.2, Pump Wiring.

WARNING

An isolation relay **MUST** be used to separate the UNIT transformer from additional equipment having a transformer or damage to the S60 board will occur. Refer to Section 5.3, Control Switch Wiring.

IGNITION CONTROL BOX

When power is supplied to the unit (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 volts 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 air flow fault will be appear 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 air flow fault will occur if the air pressure switch contacts remain opened 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 (24volts 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 ignition box from menu2:

- To enter menu2, proceed as indicated above.
- In menu2, push the *encoder* on *menu signal 0* to enter the *reset ignition control box option*, visualized by the flashing code "reS0" (rE50); push the *encoder* to confirm the reset operation.
- After confirmation, the display visualizes again the *menu signal* 2.000 .
- To exit, select the letter "E" (E.000) and push the encoder.

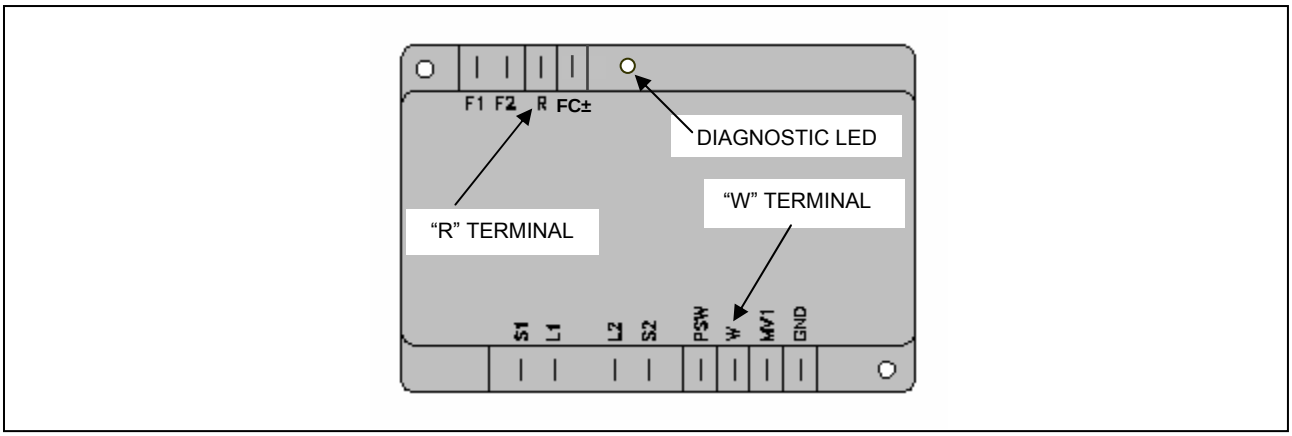


Figure 38 - IGNITION CONTROL BOX

TABLE OF OPERATING CODES GENERATED BY ELECTRONIC BOARD (firmware version 2.006)

COLD MODULE	
	U 1
	GENERATOR THERMOSTAT LIMIT TEMPERATURE
CODE GENERATED BY:	HIGH temperature detected by limit thermostat on body of generator.
RESET METHOD:	Reset limit thermostat manually: AYF operation will be restored automatically when the cause ceases.
	E 1
	GENERATOR THERMOSTAT LIMIT TEMPERATURE
CODE GENERATED WHEN:	Code U 1 is active for 1 hour, or U 1 intervenes 3 times in 2 hours of operation.
RESET METHOD:	Contact ROBUR TAC.
	U 2
	EXHAUST FUMES THERMOSTAT
CODE GENERATED BY:	HIGH temperature detected by exhaust fumes thermostat.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 14.4 °F (8 °C)
	E 2
	EXHAUST FUMES THERMOSTAT
CODE GENERATED WHEN:	code U 2 is active for 1 hour, or generated 3 times in 2 hours of operation.
RESET METHOD:	Reset may be performed via DDC (or via S60 board via menu 2, menu item 1). If codes U 2 and/or E 2 occur again, contact ROBUR TAC.
	U 3
	COLD WATER ANTIFREEZE THERMOSTAT
CODE GENERATED BY:	LOW temperature detected by cold outlet water sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 3.6 °F (2 °C).
	U 4
	INADEQUATE VENTILATION / CONDENSER OVERHEATING
CODE GENERATED BY:	(TCN - TA) values > limit set.
RESET METHOD:	Reset occurs automatically 20 minutes after the code is generated.
	E 4
	INADEQUATE VENTILATION / CONDENSER OVERHEATING
CODE GENERATED WHEN:	Code U 4 is generated twice in 2 hours of operation.
RESET METHOD:	Carry out appropriate checks. Reset may be performed via DDC (or via S60 board, menu 2, menu item 1). If the code persists, contact ROBUR TAC.
	E 5
	HIGH AMBIENT TEMPERATURE
CODE GENERATED BY:	HIGH temperature detected by ambient temperature sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.

E 6	
LOW AMBIENT TEMPERATURE	
CODE GENERATED BY:	LOW temperature detected by ambient temperature sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.
U 7	
HIGH CONDENSER INLET TEMPERATURE	
CODE GENERATED BY:	HIGH temperature detected by condenser inlet temperature sensor (T> limit set: menu 1, menu item 66)
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.
E 7	
HIGH CONSENSER INLET TEMPERATURE	
CODE GENERATED WHEN:	Code U 7 is active for 1 hour, or U 7 code is generated 12 times in 2 hours of operation.
RESET METHOD:	(with central flame control unit on)
E 8	
FLAME CONTROL UNIT ERROR	
CODE GENERATED BY:	Code E12 on cold module and condenser inlet temperature increasing by over 18 °F (10 °C) within 1 hour.
RESET METHOD:	Carry out appropriate checks. Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
U 10	
COLD WATER FLOW SWITCH: insufficient chilled water flow	
CODE GENERATED BY:	Insufficient cold water flow rate (circulator on and flow switch open).
RESET METHOD:	Reset occurs automatically when correct flow rate is restored.
E 10	
COLD WATER FLOW SWITCH: insufficient chilled water flow	
CODE GENERATED WHEN:	Code U 10 is generated 5 times since appliance was powered, or code U 10 is active for two hours.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
U 11	
INSUFFICIENT ROTATION OF OIL HYDRAULIC PUMP	
CODE GENERATED BY:	Insufficient rotation of oil hydraulic pump.
RESET METHOD:	Reset occurs automatically 20 minutes after the code is generated.
E 11	
INSUFFICIENT ROTATION OF OIL HYDRAULIC PUMP	
CODE GENERATED WHEN:	code U 11 is generated twice in 2 hours of operation.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
U 12	
FLAME CONTROL UNIT ARREST	
CODE GENERATED BY:	Failure of burner to ignite.
RESET METHOD:	Reset occurs automatically when the electrovalve opens again (new attempt at ignition) or after code is active for 5 minutes.

E 12	
FLAME CONTROL UNIT ARREST	
CODE GENERATED BY:	Flame arrest signal.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 0). If the code persists, contact ROBUR TAC.
E 16	
OUTLET WATER TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on outlet water temperature sensor.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
E 17	
COLD INLET WATER TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on condenser inlet water temperature sensor.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
E 18	
CONDENSER OUTLET TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on condenser outlet temperature sensor.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
E 20	
CONDENSER INLET TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on condenser inlet temperature sensor.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
U 29	
GAS ELECTROVALVE WITHOUT ELECTRICAL POWER	
CODE GENERATED WHEN:	Gas electrovalve is off for 5 seconds (with central flame control unit on).
RESET METHOD:	Reset occurs automatically if the gas electrovalve switches on again within 10 minutes (with central flame control unit on).
E 29	
GAS ELECTROVALVE WITHOUT ELECTRICAL POWER	
CODE GENERATED WHEN:	Code U 29 is active for more than 10 minutes (with central flame control unit on).
RESET METHOD:	Carry out appropriate checks. Reset may be performed via DDC (or S60 board via menu 2, parameter 1). If the code persists, contact ROBUR TAC.
U 51	
ANTIFREEZE FUNCTION ACTIVATED – COOLING MODULE	
Activation takes place only if the cold module is off and the antifreeze function is enabled (see menu 1, parameter 77).	
CODE GENERATED WHEN:	Inlet or outlet water temperature of the cold module falls below 39.2 °F (4 °C - the code generated signals that the antifreeze function has been activated). In this case the antifreeze function activates the plant water circulator.
RESET METHOD:	Reset (deactivation of antifreeze function) occurs automatically when, with only the circulator on, the inlet and outlet water temperatures return to over 41 °F (5 °C - in this case the circulator switches off), or if the function itself is disabled.

	U 77
	COLD MODULE FLOW SWITCH "ON"
CODE GENERATED BY:	The flow switch of the cold module detects that water is present in the plant , when (and only in this situation) the appliance is configured as a 2-pipe cold-hot plant and the plant is operating in hot mode at that moment.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.
ELECTRONIC BOARD	
	U 80
	INCOMPLETE PARAMETERS
CODE GENERATED BY:	Incomplete parameters.
RESET METHOD:	The code remains active until operating parameters have been entered and completed. Contact ROBUR TAC.
NB: If the board is replaced, code E80 may appear: this means that AY/AYF characterisation data has not been entered.	
	E 80
	INVALID PARAMETERS
CODE GENERATED BY:	Invalid parameters or damage to parameter memory.
RESET METHOD:	Reset is automatic when the correct parameters are entered. If the code persists, contact the ROBUR TAC: if the parameters are incorrect, it is necessary to enter and complete the operating and characterisation parameters; if the memory is damaged it is necessary to replace the board.
	U 81 - U 82
	INVALID BANK 1 DATA - INVALID BANK 2 DATA
CODE GENERATED BY:	Invalid Bank 1 data - Invalid Bank 2 data.
RESET METHOD:	Reset occurs automatically 5 seconds after the code is generated.
	E 81 - E 82
	INVALID BANK 1 DATA - INVALID BANK 2 DATA
CODE GENERATED BY:	Invalid Bank 1 data - Invalid Bank 2 data.
RESET METHOD:	Reset may be performed via the S60/AY10 board via menu 2, parameter 1 or 21. If the code persists, contact ROBUR TAC.
	E 84
	FAULTY CONNECTIONS OF 24 Vac TRANSFORMER OR FUSES
CODE GENERATED BY:	Damage to 1 of the 2 24-0-24 Vac input fuses or one of 24-0-24 Vac wires to the board not supplying current.
RESET METHOD:	Check 24-0-24 Vac fuses and electrical power connections on the board. Reset may be carried out via DDC (or via S60 board via menu 2, menu item 1). If the code persists or occurs again, contact ROBUR TAC.
	E 85
	INCORRECT MODULE TYPES (from menu 6)
CODE GENERATED WHEN:	The module type set (from menu 6) does not correspond to the one managed by the board.
RESET METHOD:	Reset occurs automatically when the correct parameters are entered. If the code persists, contact ROBUR TAC.
	E 86 - E 87 - E 88 - E 89
	MEMORY TEST UNSUCCESSFUL
CODE GENERATED BY:	Processor error.
RESET METHOD:	Contact ROBUR TAC.

E 90	
AMBIENT TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Interruption or short circuit of ambient temperature sensor.
RESET METHOD:	Reset may be performed via DDC (or S60 board via menu 2, menu item 1). If the code persists, contact ROBUR TAC.
E 91	
BOARD DEFECTIVE	
CODE GENERATED WHEN:	One of the following is absent: serial number of board, hardware version code or encryption key written during board test.
RESET METHOD:	Contact ROBUR TAC.

Table 19 - Operating codes generated by S60/AY10 electronic board (codes may also be visualised by DDC display).

IN TABLE, TAC = AUTHORISED ROBUR TECHNICAL ASSISTANCE CENTRE

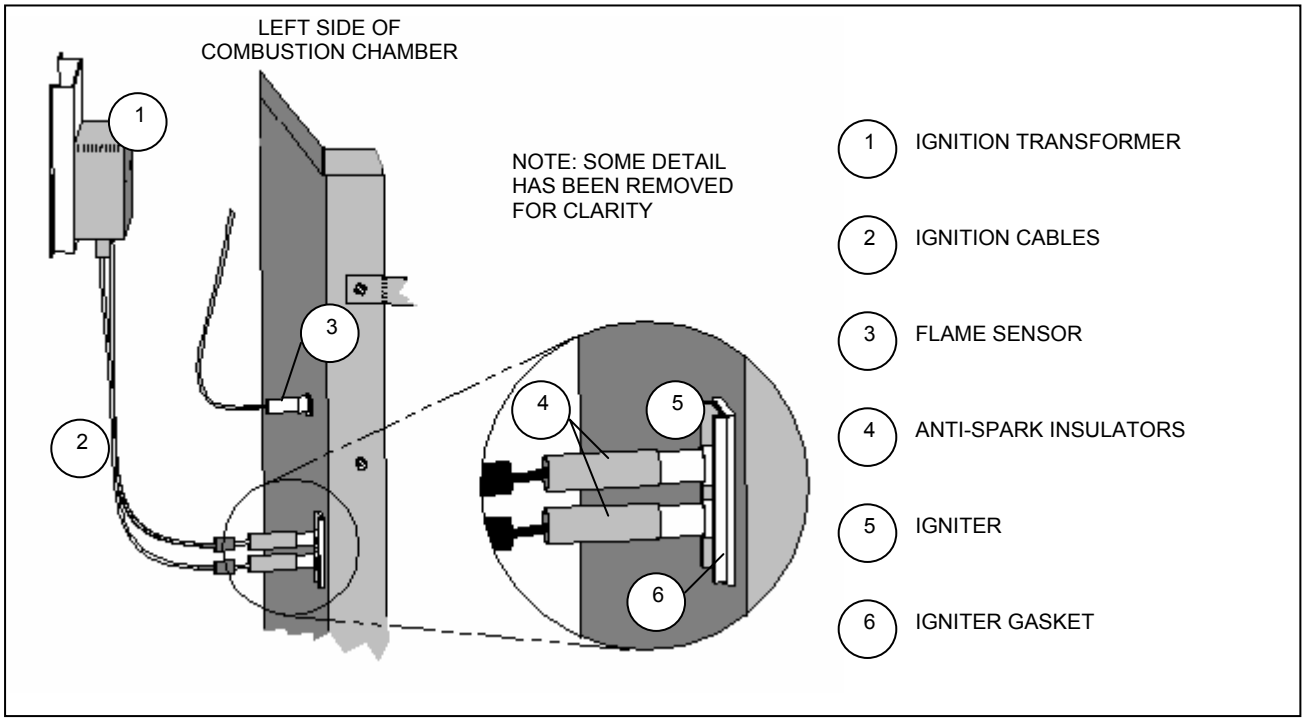


Figure 39 – IGNITION TRANSFORMER, IGNITER ASSEMBLY, AND FLAME SENSOR

Codice: D-LBR 323 rev.C 06 MCM PSS 040 30/11/2006

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in research, devepment and promotion
of safe, environmentally-friendly, energy-efficiency products,
through the commitment and caring
of its employees and partners

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ROBUR

caring for the environment

Installation, use and maintenance manual

GAHP Line AR Series

Air-Water reversible absorption heat pumps for heating and cooling medium-large areas

Natural gas/LPG fired

EDITION: 2010-03

CODE: D-LBR364

FOREWORD

This manual is designed to be an installation and user's guide for the Robur GAHP-AR, Gas Absorption Heat Pumps series.

This manual especially applies to the plumbing and electrical installers for the hook-up of the GAHP-AR and the initial configuration, and also for the end user regarding its use.

This manual also has a section regarding the operations that must be done before the first start-up and the primary maintenance operations.

Summary

This manual is composed of 6 sections and an appendix:

SECTION 1 pertains to the end user, the plumbing installer and the electrical installer; it provides general warnings, technical data and the construction characteristics of the GAHP-AR.

SECTION 2 is for the end user; it provides all the information necessary for the correct use of the GAHP-AR in relation to the end user's needs.

SECTION 3 is for the plumbing installer; it provides the necessary indications to the plumber in order to correctly install the GAHP-AR.

SECTION 4 is for the electrical installer; it provides the necessary information to the electrician in order to make the GAHP-AR electrical connections.

SECTION 5 provides the instructions to regulate the flow of gas and to perform the gas conversion. It also gives indications regarding maintenance.

SECTION 6 pertains to the end user, the plumbing installer and the electrical installer. It contains information regarding the available GAHP-AR spare parts.

The table of the machine codes is reported in the APPENDIX.

To quickly access these sections, make reference to the relative graphical icon (see Table 2, page II) seen in the right hand margin of odd numbered pages.

References

If the GAHP-AR is to be connected to a Direct Digital Controller (DDC), refer to the following documentation supplied with it:

- DDC manual for the electrical installer (electrician) – book 1.
- DDC manual for the end user – book 2.

Icon meaning definition

The icons present in the margins of the manual have the following meanings:

	Danger
	Warning
	Note
	Operational procedure start
	Reference to another part of the manual or to a different manual/book

Table 1 – Description icons

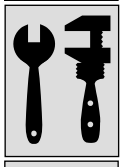
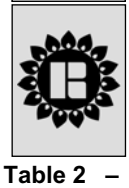
	OVERVIEW and technical SPECIFICATIONS
	End user
	Plumbing installer
	Electrical installer
	First start-up and maintenance
	Optionals and Spare Parts

Table 2 – Section icons

INDEX OF CONTENTS

SECTION 1 OVERVIEW AND TECHNICAL SPECIFICATIONS

In this section you will find the general instructions to follow for the installation of the GAHP-AR, outlines on the running of the unit, constructive characteristics and technical data.

1.1 WARNINGS

This manual is an integral and essential part of the product and must be given to the end user along with the GAHP-AR.

This appliance must be used exclusively for its intended purpose. All chilling and heating applications must be in accordance with the operating specifications of the unit. Any other use is considered improper and, therefore, dangerous.
Steps must be taken to avoid improper use and potential dangers.

The operational conditions and authorized areas of use are reported in paragraph 1.3 TECHNICAL DATA, page 9.

The manufacturer will not accept contractual or non-contractual liability for damages caused to people, animals, or things due to incorrect installation and improper use of the GAHP-AR and also by not observing the indications and instructions provided by the manufacturer.

Codes and standards

The installation of the appliance must conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1, the Natural Gas Installation Code, CAN/CGA-B149.1, or the Propane Installation Code, CAN/CGA-B149.2, as applicable.

The appliance electrical connections and grounding must be in accordance with any local codes, or in the absence of local codes, 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.

At the installation spot

After delivery of the GAHP-AR and at the location where it is to be installed, check the GAHP-AR to make sure there are no signs of damage to the packaging or to the external

paneling, an indication of possible damage during transportation. After removal of the packaging material, ensure that the GAHP-AR is whole and complete.

Do not leave the packaging material within the reach of children (plastic bags, Styrofoam spacers and insulators, nails, etc.), because they can be sources of danger.

The GAHP-AR has a sealed circuit that can be classified as a pressurized vessel; this means that its internal pressure is greater than the atmospheric pressure. The fluids inside the sealed circuit are dangerous to one's health if ingested, inhaled or if they come in contact with the skin.
Do not perform any interventions on either the sealed circuit or the valves on the GAHP-AR. If operation on the sealed circuit is necessary, call a qualified technician or engineer.

Only qualified technicians, strictly complying with the manufacturer's instructions and the local standards, should install this product. The manufacturer will not accept responsibility for personal injuries or property damage resulting from improper installation.

A "Qualified Technician" is defined as someone having specific technical competence in the air conditioning/heating and gas appliances, according to international and national standards.

In particular, current laws must be respected with regard to:

- Natural gas equipment
- Electrically powered equipment
- Any other standard that regulates the installation of air conditioning devices with gaseous fuel.

Before starting the appliance

Before installation, carefully clean the internal tubing and water components, both on the fuel side and the water system side; this is to remove any residue which could compromise the functioning of the GAHP-AR.

The company qualified to install the GAHP-AR must verify that:

- the electric and gas supply ratings are the same as those on the data plate
- the gas tubing system and the water distribution system are sealed
- the GAHP-AR is supplied with the type of gas for which it is preset
- the gas supply pressure is within the rating limits indicated by the manufacturer
- the gas and electric supply systems are suitable for the capacity needed by the GAHP-AR and that they are equipped with all safety and checking devices required by current regulations; the electrical safety of the GAHP-AR chiller is achieved only

when it is properly connected to an efficient grounding system, done according to electrical safety standards in force.

Do not operate the GAHP-AR if electrical or safety components have been excluded, by-passed or do not function correctly.

If the above mentioned conditions have been satisfied, the installation procedure (done by the qualified company) and the successive start-up (done by a Robur Corporation authorized Technical Service Centre, "TAC") may begin.

The initial start-up of the GAHP-AR must only be done by a Robur Corporation authorized Technical Service Centre (TAC) following the indications provided by the manufacturer. The warranty of the GAHP-AR is effective only if validated by a Robur Corporation "TAC".

In case of fault during installation and ignition with the smell of natural gas

If you smell gas:

- Do not operate electrical devices near the GAHP-AR, such as telephones, multi-meters or other devices that can create sparks.
- Close the gas supply valve.
- Shut off electrical power to the GAHP-AR.
- Call a Qualified Service Engineer using a telephone that is not near the GAHP-AR.

In case of fault during installation and ignition without the smell of natural gas

In case of fault or poor functioning of the GAHP-AR without the escape of gas, immediately shut it down using the appropriate control switch (see “ACTIVATION (AND DEACTIVATION) OF THE APPLIANCE”, page 15); if the shutdown cycle begins, wait for it to complete, which takes about 10 minutes; remove electrical power by shutting off the main power switch and close the gas valve. If the shutdown cycle does not start due to an occurring problem, directly shut off the electrical power and gas supplies.

Do not attempt any type of intervention or repair.

Perform these operations even if the cooling unit has not been used for a long period of time, see the “PROLONGED PERIODS OF DISUSE” paragraph on page 24.

To ensure the correct functioning of the chiller and to prevent possible problems, it should only be shut down using the control switch or through the Direct Digital Controller (DDC) if mounted.
Avoid turning off the GAHP-AR by interrupting the electrical power supply upstream of the control switch before this has been turned off and the shutdown cycle has completed.

Do not use the GAHP-AR if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and gas control, which has been under water.

Maintenance

Correct and regular maintenance ensures that the GAHP-AR will continue to run properly and efficiently over time.

Trust the maintenance of the internal components of the GAHP-AR to a Qualified Service Engineer, who will perform the operations following the manufacturer's instructions.

For other maintenance operations, go to the "MAINTENANCE" paragraph, page 73.

Any repairs to the GAHP-AR must be done by a Robur authorized Technical Service Centre (TAC), using only original replacement parts. Not following these regulations could compromise their functioning and safety, and also void the warranty if still valid.

If the GAHP-AR is sold or transferred to another owner, make sure that this manual is included in the transaction so that the new owner and any installers may use it for consultation purposes.

If the GAHP-AR is decommissioned, contact Robur Corporation for its disposal.

1.2 OPERATION OF THE GAHP-AR

GAHP is the acronym for "Gas Absorption Heat Pump". The GAHP-AR is a high efficiency reversible air-water heat pump, operating by a water-ammonia absorption cycle and designed for outdoor use.

The GAHP-AR is able to chill water down to a temperature of 37.4 °F, or to heat it up to 140°F in heat pump mode with a nominal[1] efficiency of 126%.

The cycle of the GAHP-AR is fed by thermal energy provided by a gas burner, therefore the required electric energy is limited to driving the fan and pump motors (the only mechanical moving components of the unit).

The GAHP-AR is fed by natural gas or LPG, and supplied with 208-230 V – 60 Hz single phase electrical power. The inversion (cooling-heating) is done by a complex dedicated valve.

The evacuation of combustion products takes place through appropriate exhaust terminal, located on the side of the appliance (see paragraph "GAHP-AR DIMENSIONS", page 14), with outlet in a vertical position.

Operating mode

- When operating in **cooling** mode (in summer)
  the appliance operates as an absorption chiller, and the heat, taken away from the cooled environment via the HYDRAULIC CIRCUIT, is dissipated towards the outside via the air-cooled FINNED COIL.
- When operating in **heating** mode (in winter)
  the appliance uses the absorption cooling cycle to recover heat from the outside environment via the FINNED COIL which, added to the heat produced by the combustion of natural/L.P.G. gas, is transferred into the EXCHANGER and then into the environment to be heated, ensuring efficiency of 126 % (under nominal conditions).

[1] Nominal conditions: external ambient temperature 44.6°F; inlet water temperature 122°F.

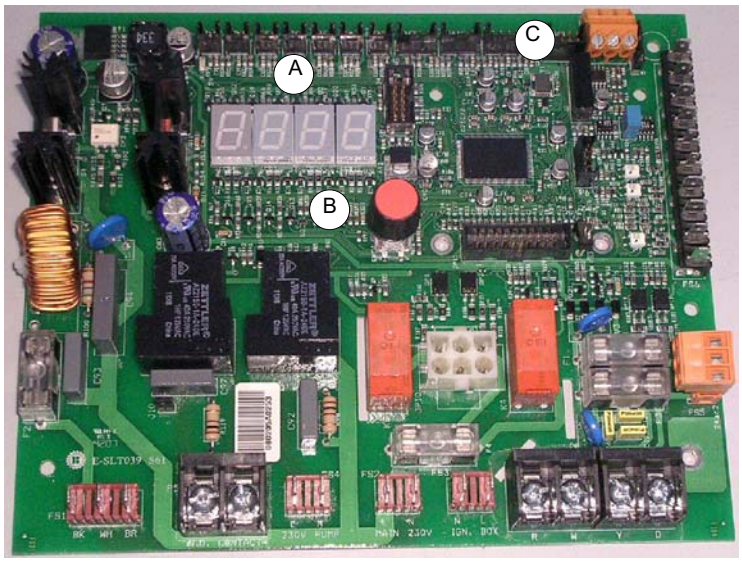
The GAHP-AR is equipped with the following devices:

- Steel sealed circuit, painted with external epoxy paint.
- Premixed multigas burner with ignition and flame sensing device managed by electronic control box.
- Steel pipe air exchanger with single-rank fin coil and aluminium fins.
- Titanium stainless steel tube bundle water exchanger, with external insulation.
- Reversal valve on the refrigerant circuit; it switches the unit between heating and chilling mode.
- Two-way automatic defrosting valve, controlled by microprocessor, allows the fin coil defrosting.
- Variable (summer operations) air flow helicoidal fan, controlled by microprocessor.

CONTROL AND SAFETY DEVICES

The GAHP-AR is controlled and monitored by the S61 control board through the peripheral AR10 card. These cards and many other devices compose the control and safety devices set of the GAHP-AR, listed below:

- S61 control board with integrated microprocessor, with LCD display and encoder; AR10 peripheral card.
- Plant water flow meter sensor.
- High temperature limit thermostat, manual reset.
- Differential air pressure switch.
- Flue temperature limit switch, automatic reset.
- Sealed circuit safety relief valve.
- Safety by-pass valve, between high and low pressure sealed circuit.
- Antifreeze function for hydronic system.
- Ionization flame control box.
- Double shutter electric gas valve.
- Direct Digital Controller (DDC) with LCD display and knob (encoder), see Figure 2, page 8.



Electronic Control Board S 61

AR10 peripheral board

KEY
A 4 digit DISPLAY for data and codes visualization
B KNOB (encoder) to scroll/select operating data
C CAN PORT for the CAN-BUS cable connection

Figure 1 – S61 control board and AR10 peripheral board

For board operating instructions see the paragraph “ON-BOARD ELECTRONICS”, page 17. The CAN BUS port allows the connection of one or more GAHP-AR to one or more DDC, Display digital Controller.

The DDC, available as optional, allows a precise control and monitoring on each single GAHP-AR; a single DDC supports up to 16 GAHP-AR on a single hydraulic plant, operating them according to the requested thermal load.

Figure 2 – DDC, Direct Digital Controller

If up to do a DDC - GAHP-AR connection, see paragraph “USE OF THE DIRECT DIGITAL CONTROLLER (DDC)”, page 58.

1.3 TECHNICAL DATA

GAHP-AR – TECHNICAL SPECIFICATIONS

QUANTITY	UNITS	GAHP-AR
PERFORMANCE RATINGS – HEATING (1)		
EXTERNAL AMBIENT OPERATING TEMPERATURE (DRY BULB / WET BULB)	°F	44.6 / 42.8
OUTLET (TO PLANT) WATER TEMPERATURE	°F	122.0
HEATING CAPACITY	kBtu/hr	120.4
G.U.E.	%	126
WATER FLOW (ΔT=18 °F)	GPM	13.4
PRESSURE DROP (NOMINAL CONDITION)	Feet of Head PSIg	9.80 4.20
PERFORMANCE RATINGS – COOLING (1)		
EXTERNAL AMBIENT OPERATING TEMPERATURE	°F	95.0
OUTLET (TO PLANT) WATER TEMPERATURE	°F	44.6
COOLING CAPACITY	kBtu/hr	57.7
G.U.E.	%	60
WATER FLOW (ΔT=9 °F)	GPM	12.8
PRESSURE DROP (NOMINAL CONDITION)	Feet of Head PSIg	10.46 4.50
OPERATIONAL LIMITS – HEATING		
EXTERNAL AMBIENT OPERATING TEMPERATURE (DRY BULB) MAX MIN	 °F °F	 95.0 -20.0
WATER FLOW MAX MIN	GPM	22.0 6.2
INLET (TO THE UNIT) WATER TEMPERATURE MAX MIN	 °F °F	 122.0 35.6
OUTLET (TO PLANT) WATER TEMPERATURE MAX (ΔT=27 °F)	°F	 140.0
OPERATIONAL LIMITS – COOLING		
EXTERNAL AMBIENT OPERATING TEMPERATURE MAX MIN	 °F °F	 120.0 32.0
WATER FLOW MAX MIN	GPM	14.1 11.0
INLET (TO THE UNIT) WATER TEMPERATURE MAX MIN	 °F °F	 113.0 42.8
OUTLET (TO PLANT) WATER TEMPERATURE MIN	 °F	 37.4

Table 3 - GAHP-AR performance ratings and operational limits.

(1) ALL ILLUSTRATIONS AND SPECIFICATIONS CONTAINED HEREIN ARE BASED ON THE LATEST INFORMATION AVAILABLE AT THE TIME OF PUBLICATION APPROVAL. ROBUR RESERVES THE RIGHT TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE, IN MATERIALS, SPECIFICATIONS, AND MODELS OR TO DISCONTINUE MODELS.

BURNER SPECIFICATIONS		
GAS INPUT (HHV)	kBtu/hr	95.5
ELECTRICAL RATINGS		
REQUIRED VOLTAGE, 60 HZ, SINGLE PHASE (2)	V	208 - 230
MINIMUM CIRCUIT AMPACITY (MCA) Unit only	A	8.0
MAXIMUM OVER CURRENT PROTECTION (MOCP)	A	10.9
TOTAL ELECTRICAL OPERATING CONSUMPTION (NOMINAL) (3)	kW	0.75
PHYSICAL DATA		
SHIPPING WEIGHT	Pounds	883
OPERATING WEIGHT	Pounds	838
UNIT WATER VOLUME (4)	Gallons	0.79
DIMENSIONS (5) WIDTH LENGTH HEIGHT	Inches	$33^1/_2$ $48^1/_2$ 57
WATER CONNECTIONS (INLET / OUTLET)	FPT	1
GAS INLET CONNECTION	FPT	$^1/_2$
HEATER GASES DUCT INTERNAL DIAMETER	Inches	$3^1/_8$

Table 4 - GAHP-AR technical data

(2) UNITS ARE FACTORY-WIRED FOR 208-230 VOLTS OPERATION.

(3) MAY VARY BY ±10% AS A FUNCTION OF BOTH POWER SUPPLY AND ELECTRICAL MOTOR INPUT TOLERANCE.

(4) REFERRED TO A SOLUTION OF QUALITY TAP WATER AND 10% BY VOLUME OF INHIBITED PERMANENT ANTIFREEZE. HIGHER ANTIFREEZE CONCENTRATIONS MAY BE REQUIRED IN CERTAIN APPLICATIONS. MONO-ETHYLENE GLYCOL CAUSES CORROSION PHENOMENON IN GALVANIZED METAL PIPES.

(5) FOR GASES DUCT DIMENSIONS SEE FIGURE 3, PAGE 14.

HEATING MODE CAPACITY – Btu/hr				
EXTERNAL AMBIENT OPERATING TEMPERATURE (DRY BULB)	OUTLET (TO PLANT) HOT WATER TEMPERATURE			
	86°F	113°F	122°F	140°F
	ΔT=18°F			ΔT=27°F
-20.0°F	91.1	82.9	82.9	80.9
-13.0°F	92.1	83.9	83.9	81.9
-4.0°F	93.2	85.0	85.0	82.9
5.0°F	97.2	89.4	88.0	85.6
14.0°F	105.4	94.5	92.1	90.1
19.4°F	111.9	100.3	96.9	95.5
35.6°F	123.9	118.7	109.9	102.4
44.6°F	129.3	128.0	**120.4**	112.6
50.0°F	131.7	131.0	124.2	117.7
59.0°F	134.1	133.4	128.3	122.2
68.0°F	134.8	134.4	129.3	123.9
77.0°F	134.8	134.4	129.7	126.2

Table 5 - Heating mode capacity. Nominal value is in bold type.

CHILLING MODE CAPACITY - Btu/hr			
EXTERNAL AMBIENT OPERATING TEMPERATURE (DRY BULB)	OUTLET (TO PLANT) CHILLED WATER TEMPERATURE		
	37.4°F	44.6°F	50.0°F
	ΔT=9°F		
59.0°F	64.8	63.8	64.3
68.0°F	63.5	63.5	64.1
77.0°F	60.1	62.4	63.3
86.0°F	54.3	60.7	61.8
95.0°F	44.0	**57.7**	59.4
104.0°F		51.2	54.6
113.0°F			46.1

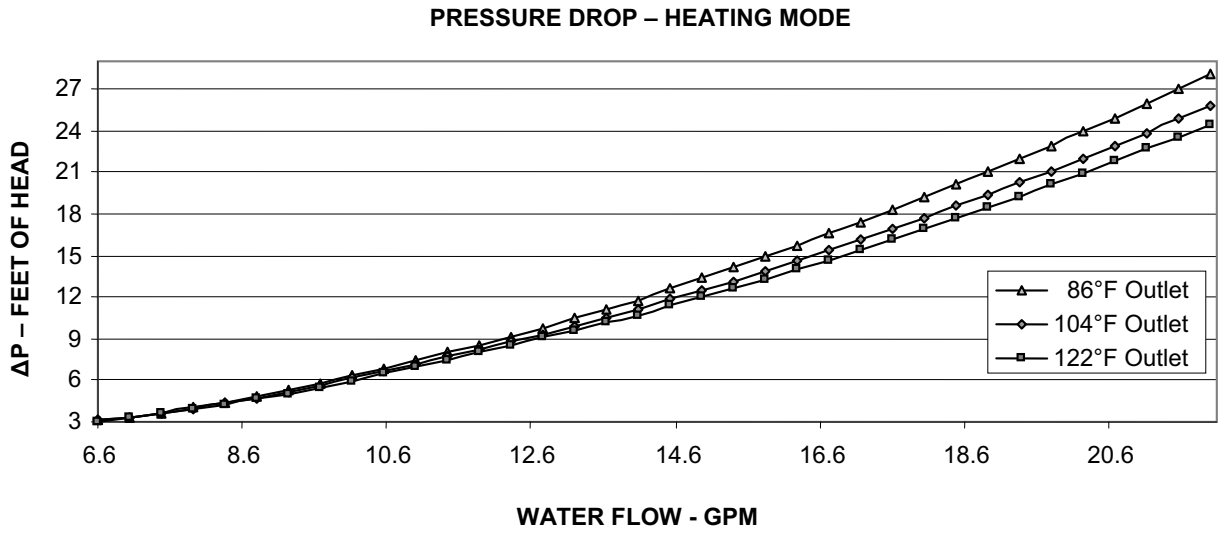
Table 6 - Chilling mode capacity. Nominal value is in bold type.

GAHP-AR ΔP condenser/absorber			
Hot water flow	**Outlet water temperature**		
	122.0°F	**104.0°F**	**86.0°F**
GPM	ΔP ft of Head	ΔP ft of Head	ΔP ft of Head
6.60	3.05	3.08	3.15
7.04	3.30	3.32	3.35
7.48	3.58	3.62	3.65
7.93	3.89	3.98	4.05
8.37	4.25	4.35	4.42
8.81	4.64	4.76	4.86
9.25	5.05	5.19	5.28
9.69	5.50	5.66	5.77
10.13	5.96	6.18	6.29
10.57	6.45	6.66	6.83
11.01	6.95	7.16	7.39
11.45	7.47	7.68	7.97
11.89	7.99	8.21	8.57
12.33	8.52	8.76	9.18
12.77	9.06	9.32	9.80
13.21	9.59	9.90	10.43
13.65	10.12	10.50	11.07
14.09	10.64	11.11	11.72
14.53	11.36	11.81	12.60
14.97	11.98	12.48	13.35
15.41	12.63	13.17	14.12
15.85	13.29	13.87	14.91
16.29	13.97	14.60	15.72
16.73	14.67	15.35	16.55
17.17	15.39	16.11	17.40
17.61	16.13	16.90	18.27
18.05	16.88	17.70	19.16
18.49	17.65	18.53	20.07
18.93	18.44	19.37	21.00
19.37	19.25	20.23	21.94
19.81	20.08	21.11	22.91
20.25	20.92	22.01	23.90
20.69	21.78	22.93	24.90
21.13	22.66	23.87	25.93
21.57	23.56	24.82	26.97
22.01	24.48	25.80	28.03

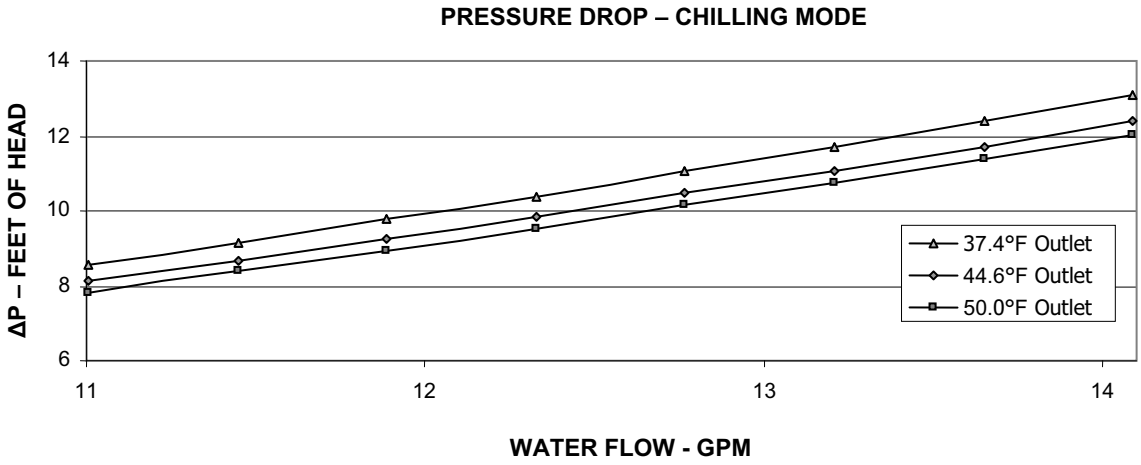
Table 7 - Pressure drop – heating mode

GAHP-AR ΔP evaporator			
Chilled water flow	**Outlet water temperature**		
	37.4°F	**44.6°F**	**50.0°F**
GPM	ΔP ft of Head	ΔP ft of Head	ΔP ft of Head
11.01	8.55	8.11	7.84
11.45	9.15	8.67	8.39
11.89	9.77	9.25	8.96
12.33	10.40	9.85	9.54
12.77	11.05	10.46	10.15
13.21	11.71	11.08	10.76
13.65	12.38	11.72	11.40
14.09	13.07	12.38	12.04

Table 8 - Pressure drop – chilling mode



Graph 1 - Pressure drop – heating mode (see Table 7)



Graph 2 - Pressure drop – chilling mode (see Table 8)

1.4 GAHP-AR DIMENSIONS

GAHP-AR external dimensions – (*) vibration damping positions

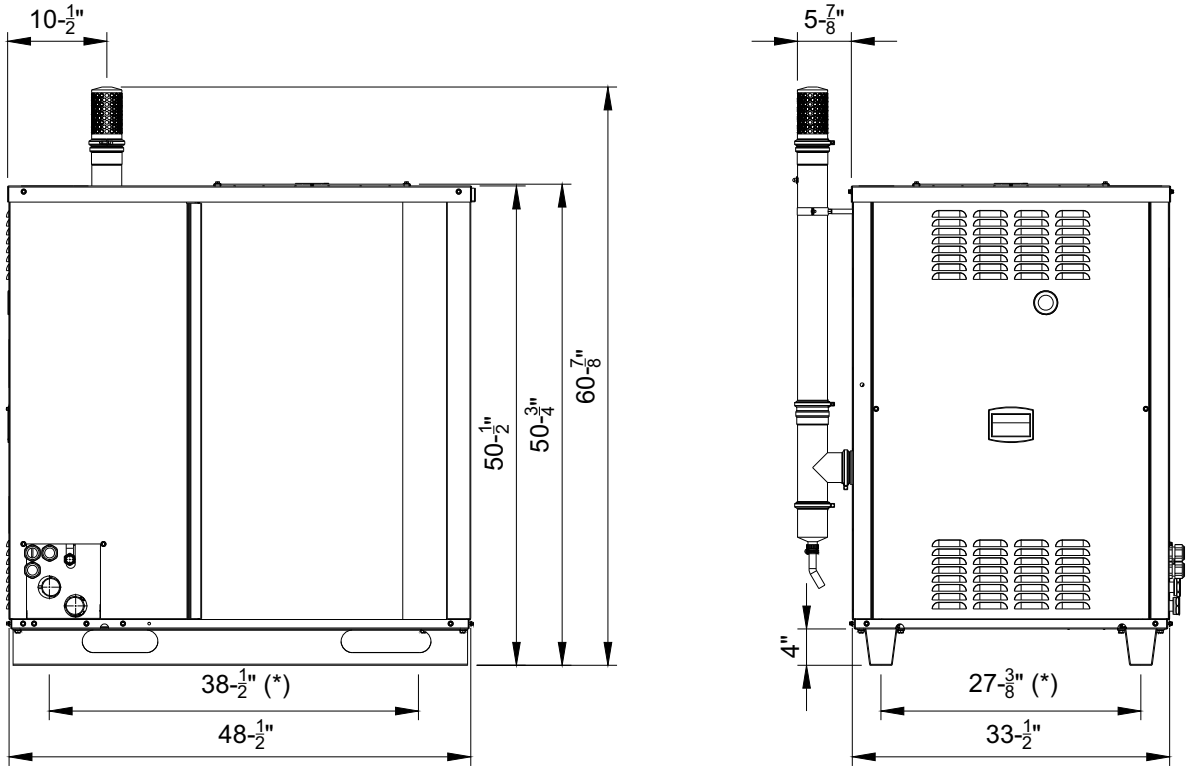
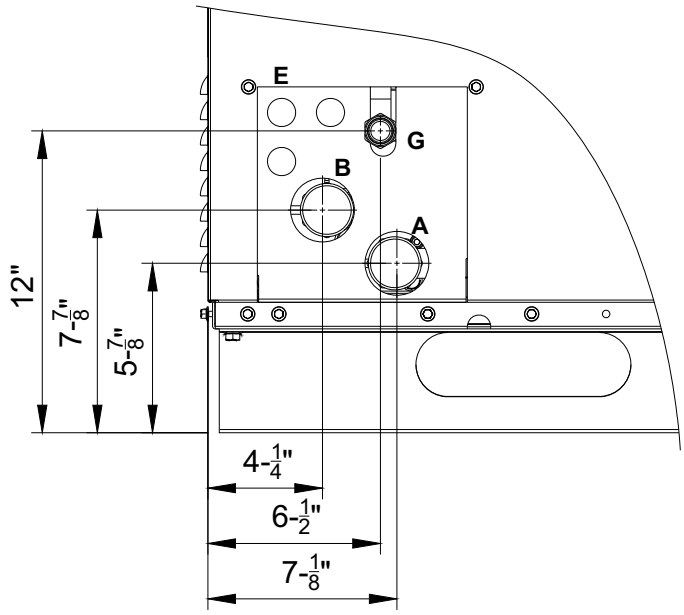


Figure 3 – GAHP-AR external dimensions.

GAHP-AR service plate dimensions



LEGEND

A – WATER OUTLET (TO PLANT)	**Ø 1 FPT**
B – WATER INLET (TO THE UNIT)	**Ø 1 FPT**
G – GAS INLET	**Ø 1/2 FPT**
E – ELECTRICAL KNOCKOUTS	**Ø 7/8**

Figure 4 – GAHP-AR service plate dimensions. Some details were removed for clarity.

SECTION 2 END USER

In this section you will find all the indications necessary for the activation, regulation and control of operation of the appliance via the board present in the electrical panel.

2.1 ACTIVATION (AND DEACTIVATION) OF THE APPLIANCE

☞ Efficient operation and long life of the appliance depend largely on correct use!

If the appliance is connected to a Direct Digital Controller (DDC) and the DDC is in controller mode, activation and control of the appliance will occur exclusively by operating the DDC. In this case, refer to the manual supplied with it.

If the appliance is not connected to a DDC, it may be activated and deactivated only by means of the on/off commands provided by the electrical installation technician.

According to requirements, these on/off commands may be:

- **An on/off switch (CS, consent switch)** for activation and deactivation of the appliance. This switch may be an on/off button, an ambient thermostat, a programmable timer, or one or more clean contacts controlled by another process. For details about the type of on/off command installed, contact the plant's electrical installation technician.
- **A summer/winter selector switch (W/Y)**, for selecting the operating mode of the appliance (cooling or heating).

Activation: the on/off commands are essential.
Do not switch the appliance on or off by connecting it to or disconnecting it from the power supply directly, as this may be a source of danger and in any case damage the appliance or the plants connected to it.

Before activating the appliance, check that:

- the gas valve is open;
- the appliance is powered electrically: the general electrical switch must be in the "ON" position;
- the installation technician has ensured that the hydraulic circuit is supplied in the correct conditions.

If these conditions are satisfied, it is possible to proceed with activation.

ACTIVATION

Select the operating mode required (cooling or heating) by means of the summer/winter selector switch, if the mode desired is not already selected.
Switch on the appliance by means of the on/off command (placing it in the "ON" position).

☞ During operation of the appliance, the summer/winter switch (from summer to winter operation and vice versa, or so-called "cycle inversion") may require a maximum of 11 minutes from the time this inversion is invoked by the user.

DEACTIVATION

Switch off the appliance via the on/off command (placing it in the "OFF" position).

☞ the shutdown cycle takes approximately 10 minutes to complete.

Visualization and clearing of operating codes

Operating codes can be generated by the electronic board or by the DDC (if connected to the appliance).

If these codes arise, it is necessary to follow the instructions in paragraph "WARNINGS AND ERRORS" on page 90, provided in the APPENDIX, on page 89.

The operating codes generated by the electronic board are visualized on its display and may also be visualized on the display of the DDC (if fitted).
Operating codes generated by the electronic board can be cleared through the board itself or from the DDC (if fitted or where possible).

☞ For a description of operating codes generated by the electronic board and how to clear them, refer to the list of operating codes contained in paragraph “TABLE OF OPERATING CODES (firmware release 3.016)”, on page 91.

The electronic board (see Figure 1, page 8) is located inside the electrical panel of the appliance and the display may be viewed through the viewing hole on the front panel of the unit itself.

Operating codes generated by the DDC:
The operating codes generated by the DDC may be viewed only on the display of the DDC, and may only be cleared via the DDC.

Operating codes generated by the electronic board during the activation phase of the appliance (see “TABLE OF OPERATING CODES (firmware release 3.016), page 91).

If the appliance remains inactive for a prolonged period, it is possible that air is present in the gas pipes. In this case, activation fails and the appliance reports the operating code: "␣612" - on the display, indicating (temporary) arrest of the flame control unit. After a short interval of time, it automatically begins the activation sequence again. If the code "␣612” persists after three attempts to start the appliance, the appliance flame control unit is arrested and the display shows a new operating code "E612" – indicating arrest of the flame control unit. In this case reset is not automatic.

To restore operation of the appliance, carry out a reset of the flame control unit via menu 2 of the electronic board: the procedure is illustrated in Paragraph 2.4, on page 21. After it is reset, the appliance will make a new attempt to activate.

If operation of the appliance is arrested several times, contact an authorised Robur Technical Assistance Centre (TAC).

When activation is successful, the appliance is managed by the electronic board (see following paragraph).

2.2 ON-BOARD ELECTRONICS

The following descriptions refer to the electronic board with firmware version 3.016.

If the appliance is connected to a Direct Digital Controller (DDC):
if the DDC is in controller mode, control of activation and deactivation of the appliance occurs exclusively via the DDC. If the DDC is in "monitor" mode, control of activation and deactivation of the appliance occurs via the on/off commands provided by the electrical installation technician. For instructions regarding the use of the DDC, refer to the two books supplied with it, and in particular manual 2:

"final user manual - book 2".

The appliance is equipped with a microprocessor-controlled S61 electronic board interconnected with an AR10 satellite board, located on the side of the S61 board itself (see Figure 1, page 8).

The S61 electronic board, contained in the electrical panel, controls the appliance and displays data, messages and codes during operation. This is how the S61 appears, with its main components highlighted:

KEY

- **A** 4-figure DISPLAY for visualisation of data and operating codes
- **B** KNOB (Encoder) for scrolling and selecting operating data
- **C** CAN port for connecting the CAN bus network cable

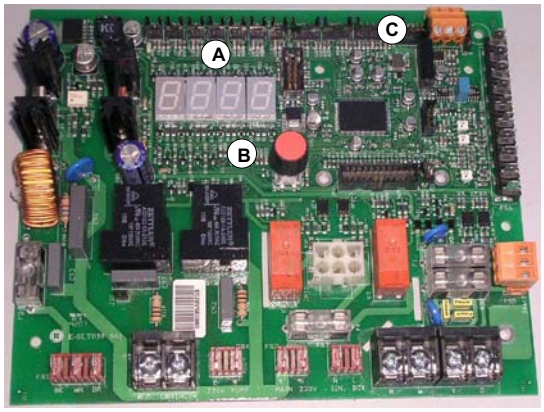


Figure 5 - S61 electronic board, showing display, encoder and CAN bus

Programming, control and monitoring of the appliance take place by interacting with the display and encoder of the board. The CAN bus port allows one or more appliances to be connected to a Direct Digital Controller (DDC).

The AR10 satellite board (see Figure 1, page 8) is used for connecting the inversion valve and the defrosting valve.

Description of menu of S61 board

The parameters and settings of the appliance are grouped in the menus of the electronic board:

MENU	MENU DESCRIPTION	THE DISPLAY SHOWS
Menu 0	VIEW DATA (TEMPERATURE, VOLTAGE, PUMP SPEED)	
Menu 1	VIEW ALL PARAMETERS	
Menu 2	RESET FLAME CONTROL UNIT AND RESET BOARD ERRORS	
Menu 3	USER SETTINGS (THERMOSTATING, SET-POINT, T. DIFFERENTIAL)	
Menu 4	INSTALLATION TECHNICIAN SETTINGS	
Menu 5	TECHNICAL ASSISTANCE CENTRE SETTINGS	
Menu 6	TECHNICAL ASSISTANCE CENTRE SETTINGS (MACHINE TYPE)	
Menu 7	VIEW DIGITAL INPUTS	
Menu 8	(MENU NOT USED)	

Table 9 - Menu of electronic board

Menus 0, 1 and 7 are viewing menus: they only allow the information displayed to be read, and not modified. Via menu 0 it is possible to view the appliance operating data as detected by the board in real time. In menu 1 it is possible to view the parameters that characterise the operation of the appliance and their current values.

Menu 7 pertains exclusively to Robur's authorised Technical Assistance Centres (TAC).

To view the information contained in these menus, proceed as illustrated in the paragraph “Access to board menus“ on page 20.

Menu 2 is an "action" menu: it allows the operations of resetting the flame control unit, error reset and the manual defrosting command to be performed.
If it is necessary to perform these procedures, see the paragraph "RESET OPERATIONS AND MANUAL DEFROSTING COMMAND" on page 21.

Menu 3 is a "settings" menu: it allows the values displayed to be set. The correct values of these parameters, for optimum performance of the appliance with the plant to be used, have already been set during installation. In any case, to set new values for the parameters, see Paragraph 3.8 on page 44.

Menus 4, 5, 6 and 7 exclusively concern the installation technician and Robur's authorised Technical Assistance Centre (TAC).

Menu 8 may currently be selected, but not used.

Display and knob (encoder)

The display of the electronic board can be viewed through the glass of the viewing aperture on the front panel of the appliance.

Upon activation, all of the LED of the display light up for approximately three seconds, and then the name of the board, S61, appears. Subsequently (if the on/off command switch is in the closed position and the summer/winter selector is in the correct position for the operating mode required), the appliance begins to operate.

During correct operation the display shows, alternately, the following information (regarding the operating mode that is currently active: cooling or heating): outlet water temperature, inlet water temperature and the difference between the two water temperatures.
Table 10 illustrates an example of what is visualised on the display for an appliance that has been started up and is operating in "cooling" mode:

OPERATING MODE: COOLING	
OPERATING DATA OF GAHP-AR	**THE DISPLAY SHOWS**
COLD INLET WATER TEMPERATURE	
COLD OUTLET WATER TEMPERATURE	
INLET WATER TEMPERATURE - OUTLET WATER TEMPERATURE	

Table 10 - Example of data visualised on display: cold water temperature and differential

Table 11 illustrates an example of what is visualised on the display for an appliance that has been started up and is operating in "heating" mode:

OPERATING MODE: HEATING	
OPERATING DATA OF GAHP-AR	**THE DISPLAY SHOWS**
HOT OUTLET WATER TEMPERATURE	
HOT INLET WATER TEMPERATURE	
OUTLET WATER TEMPERATURE - INLET WATER TEMPERATURE	

Table 11 - Example of data visualised on display: hot water temperature and differential

If there are operating problems, the display shows, sequentially, the operating codes corresponding to the problem detected. A list of these codes with their description and the procedure to follow to bring the appliance back to correct operation is provided in "TABLE OF OPERATING CODES (firmware release 3.016)" on page 91.

The knob is used for moving between and inside the menus and parameters and for setting the parameters, when possible. To operate the knob:

You will need: the appliance installed and activated.

1. Remove the front panel by removing the fixing screws.
2. Remove the special key from the tube above the electrical panel.
3. Remove the plug of the electrical panel to gain access to the knob.
4. Operate the knob through the hole provided by means of the special key.

The special key allows the user to operate the knob of the electronic board without opening the cover of the electrical panel, so as to be able to operate it safely, protected from live components.

When the necessary settings have been completed, return the special key to where it was found, replace the plug on the aperture of the electrical panel and refit the front panel of the appliance.

To access the menus listed in Table 9, page 18 during operation of the appliance, it is sufficient to press the knob once.

To move inside the menus using the knob:

You will need: access to the electrical panel (see previous procedure).

1. Scroll through the displayed items by turning the knob in both directions, clockwise to view the next element and anticlockwise for the previous item.
2. Select an item by pressing the knob. In this way the user can access the menus and the parameters grouped together in the menus, or, if the letter E is displayed, return to the previous item.
   Access to the viewing menus (menu 0, menu 1 and menu 7) is described in the next paragraph, "Access to board menus".
   Access to the operating menus for control of the appliance (menu 3, setting) and for error, flame control unit and manual defrosting command (menu 2, execution) is described in Paragraph **3.8** on page 44 and in Paragraph 2.4 on page 21.

Access to board menus

The following procedure illustrates how to access all the menus of the board. The information provided is sufficient for access to the "viewing" menus 0, 1 and 7; for access to the other menus (if allowed), additional information given in the specific paragraphs is required (see the paragraph entitled "Description of menu of S61 board" on page 18).

To access the menu and view the current value of the parameters:

1. Press the knob; the display shows the first menu (menu 0): 
2. Press the knob again to enter menu 0 which is displayed. The display shows the menu number and the first parameter of the menu: 
3. To scroll to other parameters of the current menu, turn the knob. The display shows all the parameters of the menu, and lastly, the letter E:  . Press the knob on E to exit the current menu.

4. To access a parameter, press the knob. For example, to access parameter 7 (electrical voltage to the board), turn the knob until it is displayed,  , then press the knob to access it.

   The display shows the current value of the parameter, for example: 
   Press the knob to return to the current parameter. To exit the menu, scroll to the letter E and press the knob (as described in point 3).

5. To access the other viewing menus, proceed as described in the previous points.

2.3 OPERATING SETTINGS

The operations described require basic knowledge of the plant installed and of the S61 electronic board fitted to the appliance; before proceeding it is necessary to be aware of this information, provided in Paragraph 2.2 on page 17.

At the moment of installation, the appliance is set up by the installation technician for best operation according to the type of plant installed. Subsequently it is possible to modify the operating parameters, but this is not recommended if not in possession of the necessary knowledge and experience in order to operate thus. In any case, to set new operating parameters for the appliance see Paragraph 3.8 "PROGRAMMING OF HYDRAULIC PARAMETERS" on page 44.

2.4 RESET OPERATIONS AND MANUAL DEFROSTING COMMAND

There are several possible reasons why the appliance may have error status and therefore its operation arrested; such an error situation does not necessarily correspond to damage or malfunction on the part of the appliance. The cause that has generated the error may be temporary: examples include the presence of air in the gas supply circuit or a momentary power outage. In such cases, by operating in menu 2 of the electronic board it is possible to clear the error status, thereby restoring the appliance to normal operation.

The three parameters available in menu 2 through which it is possible to perform the actions permitted are: 0 (execution of flame control unit reset), 1 (execution of board error reset) and 22 (execution of manual defrosting command). By selecting E it is possible to exit the menu.

PARAMETERS	NECESSARY TO	SHOWN ON DISPLAY AS
0	FLAME CONTROL UNIT RESET	
1	OTHER WARNINGS/ERRORS RESET	
22	MANUAL DEFROSTING	
E	EXIT MENU	

Table 12 - Menu for reset operations and manual defrosting command

Parameter 0: reset of flame control unit. This may be necessary when the appliance is switched on for the first time – see Paragraph 2.1 on page 15 – or after a long period of inactivity – see Paragraph “PROLONGED PERIODS OF DISUSE”, on page 24.

You will need: access to the electrical panel – see "Display and knob (encoder)" on page 19.

To reset the flame control unit select menu 2, as indicated in "Access to board menus" on page 20; then proceed as follows:

1. The display shows  : press the knob to access the menu. The display initially shows Parameter 0,  .
2. Press the knob to bring up the flashing reset request:  .
3. Press the knob again to carry out a reset of the flame control unit. The reset request stops flashing, and the display shows  again. The reset operation has been performed.
4. To exit the menu, turn the knob clockwise until  is displayed, then press it to return to the menu selection,  .
5. To exit the menu selection and return to the normal visualisation of the parameters of the appliance, turn the knob clockwise until  is displayed, and press it to exit.

Parameter 1: other appliance warnings/errors reset. This is required to reset any warnings and errors that may occur during operation of the appliance.

You will need: access to the electrical panel – see "Display and knob (encoder)" on page 19.

To carry out a board error reset, select menu 2 as described in "Access to board menus" on page 20, and then:

1. The display shows  : press the knob to access the menu. The display initially shows Parameter 0,  .
2. Turn the knob clockwise to display Parameter 1,  .
3. Press the knob to display the flashing reset request:  .
4. Press the knob again to perform a board error reset. The reset request stops flashing, and the display shows  again. The reset operation has been performed.

5. To exit the menu, turn the knob clockwise until  is displayed, then press it to exit and return to the menu selection:  .
6. To exit from the menu selection and return to the normal display of the parameters of the appliance, turn the knob clockwise until  is displayed; press the knob to exit.

Parameter 22: manual defrosting. The execution of the manual defrosting (provided that the conditions for this to be executed exist: these are verified electronically), allows the fan coil to be defrosted, overriding software control regarding the starting time of this operation.

defrosting mode is managed automatically by the on-board electronics and is activated only under specific operating conditions (the on-board electronics verify the appropriate requirements).

You will need: access to the electrical panel - see "Display and knob (encoder)" on page 19.

To execute the manual defrosting command, select menu 2 as described in "Access to board menus" on page 20, then proceed as follows:

1. The display shows  : press the knob to access the menu. The display initially shows Parameter 0:  .
2. Turn the knob clockwise to display Parameter 22,  .
3. Press the knob to display the flashing request for manual defrosting command:  .
4. Press the knob again to execute the manual defrosting command. The manual defrosting request stops flashing, and the display shows  again. The defrosting operation is carried out if the right conditions exist.
5. To exit the menu, turn the knob clockwise until  is displayed, then press it to exit the menu selection:  .
6. To exit from the menu selection and return to the normal display of the parameters of the appliance, turn the knob clockwise until  is displayed; press the knob to exit.

2.5 PROLONGED PERIODS OF DISUSE

When the appliance is to be inactive for a long period, it is necessary to disconnect the appliance before the period of disuse and reconnect it before it is used again.
To carry out these operations, contact a reliable hydraulic system installation technician.

Disconnecting the appliance before a period of disuse

You will need: the appliance connected to the electricity/gas supply

1. if the appliance is in operation, switch it off by means of the on/off commands (or via the DDC, if connected and in controller mode) and wait for the shutdown cycle to terminate completely (approximately 10 minutes);
2. if the appliance is connected to a Direct Digital Controller (DDC): deactivate the DDC electrically;
3. disconnect the appliance from the power supply, putting the external disconnection switch (GS - see Figure 17, page 53) provided in the appropriate panel by the installation technician in the "OFF, closed" position;
4. close the gas valve.

Do not leave the appliance connected to power and gas supply if it is to remain inactive for a long period.

If the appliance is to be switched off in view of the winter period, make sure that the hydraulic plant connected to the appliance contains an adequate percentage of glycol antifreeze (consult the specific notes "Possible use of glycol antifreeze" present in Paragraph “FILLING OF HYDRAULIC CIRCUIT (to be carried out by installation technician)” on page 39, and the accompanying Table 13).
If glycol antifreeze is not to be used, empty the hydraulic circuit completely: for this purpose the plant must be provided with water drainage points that are adequately equipped, sized and located, to allow the water present in the circuit to drain away completely and to allow the correct disposal of any glycol antifreeze present.
For these operations, contact a reliable hydraulic system installation technician.

Connecting the appliance before it is used again (to be carried out by the installation technician)

Before starting this procedure, the hydraulic system installation technician must:

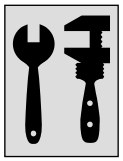
- ascertain whether the appliance requires any maintenance operations (contact your authorized Robur Technical Assistance Centre (TAC) or consult Paragraph 5.2 "MAINTENANCE", on page 73.
- fill the hydraulic circuit if it has been emptied, following the instructions given in Paragraph 3.5 on page 39;
- if the hydraulic circuit has not been emptied, check that the water content of the plant is correct; if necessary, add the right amount of water, making sure that the plant contains the minimum amount Paragraph 3.5 on page 39)
- if necessary, add antifreeze inhibited monoethylene glycol (free of impurities) in a quantity in proportion to the MINIMUM winter temperature in the area of installation (see Table 13, page 40);
- bring the plant to the correct pressure, making sure that the pressure of the water in the plant is not less than 14.5 PSIg and not over 29.0 PSIg;

You will need: the appliance disconnected from the gas/electricity supply

5. open the plant gas supply valve and check that there is no smell of gas (indicating possible leaks);

   if you smell gas, close the gas valve again immediately without operating any other electrical device and, from a safe place, request the assistance of professionally qualified personnel.

6. if no smell of gas is detected, connect the appliance to the electricity supply via the external switch provided by the installation technician in the appropriate panel (set the "GS" switch to the "ON" position - see Figure 17, page 53);
7. if the appliance is to be connected to a Direct Digital Controller (DDC), provide power to the DDC;
8. check that the hydraulic plant is suitably sized to guarantee the correct water flow;
9. switch on the appliance using the appropriate on/off commands (or via the DDC if connected and in controller mode).



SECTION 3 PLUMBING INSTALLER

In this section you will find all the instructions necessary for installing the appliance from a hydraulic viewpoint. The hydraulic system installation technician must consult the electrical system installation technician in order to decide upon the correct sequence of the operations to be carried out.

WARNING: incorrect installation may cause damage to people, animals or things. Before installing the appliance, read carefully the information contained in the paragraph entitled "WARNINGS", on page 3.

3.1 GENERAL INSTALLATION PRINCIPLES

Prior to installation, carry out careful internal cleaning of all piping and every other component to be used in both the hydraulic and the fuel supply plants, in order to remove any residues that might compromise operation of the appliance.

Installation of the appliance must be carried out in compliance with regulations regarding planning, installation and maintenance of heating/cooling plants and must be executed by professionally qualified personnel according to the manufacturer's instructions.

During the installation phase, observe the following instructions:

- Check that an adequate gas supply and distribution network exists, according to the manufacturer's indications; see "GAS SUPPLY SYSTEM" on page 37 for the correct gas supply pressures, .
- The appliance must be installed on the outside of buildings, in an area in which air circulates naturally and which does not require any particular protection from weather phenomena.
  In no case must the appliance be installed inside a room.
- No obstruction or overhanging structure (protruding roofs, eaves, balconies, ledges, trees) must obstruct either the air flowing from the top part of the appliance, or the exhaust fumes outlet.
- The appliance must be installed in such a way that the exhaust fumes outlet is not in the immediate vicinity of any external air inlets of a building.
  Respect current regulations regarding the exhaust fumes outlet.
- Do not install the appliance close to flues, chimneys or other similar structures, in order to prevent hot or polluted air from being drawn by the fan through the condenser. In order to function correctly the appliance must use clean air from the environment.
- If the appliance must be installed in the vicinity of buildings, make sure that the appliance itself is outside the line of water dripping from gutters or suchlike.
- A cut-off valve must be fitted on the gas supply.
- Fit vibration dampings on the hydraulic connections to prevent vibrations from the appliance from being transmitted to the circuit.

3.2 POSITIONING OF THE APPLIANCE

Lifting the appliance and placing it in position

The appliance must be moved on site keeping it in the same packing conditions in which it leaves the factory.

☞ Packaging must be removed only upon final installation.

If the appliance has to be lifted, connect braces to the openings provided on the base bar, and use suspension and spacer bars to prevent these braces from damaging the panels during moving operations (see Figure 6).

⚠ the lifting crane and all accessory devices (braces, cables, bars) must be suitable sized for the load to be lifted. For the weight of the appliance, consult Table 4, page 10.
The manufacturer cannot be held responsible for any damage arising during the set-up stage of the appliance.

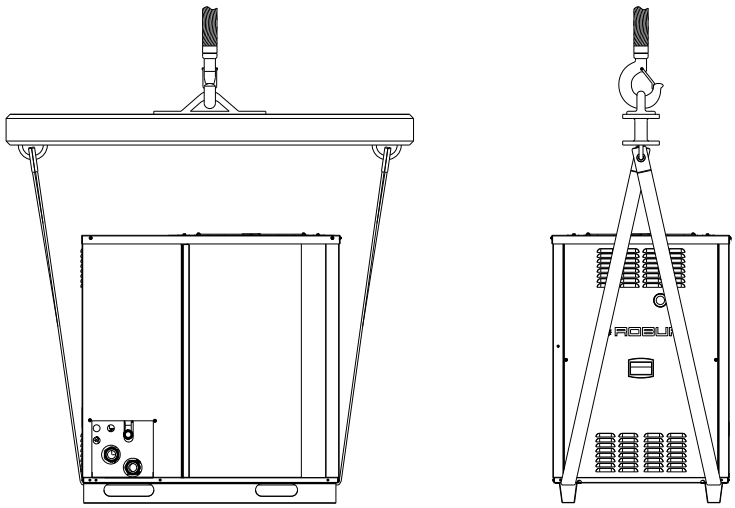


Figure 6 - Moving the appliance - example

The appliance can be installed at ground level, on a terrace or on a roof (if compatible with its dimensions and weight).

The dimensions and weight of the appliance are given in Table 4, page 10.

MOUNTING BASE

Always place the appliance on a flat, levelled surface made from fireproof material and that is able to sustain the weight of the appliance itself.
In addition, provide a small “containing” step that will prevent water from spreading during possible winter defrosting phases.

during winter operation, the appliance, on the basis of temperature and humidity conditions of the outside air, can carry out defrosting cycles that cause the layer of frost/ice on the fan coil to melt.
Take this possibility into consideration, adopting appropriate measures (for example: a containing step and channeling of water into a suitable drain) in order to prevent uncontrolled spread of water around the appliance and the consequent risk that a dangerous layer of ice will form.
The manufacturer may not be held responsible for any damage arising from the failure to observe this warning.

- Installation at ground level
  If a horizontal support base is unavailable (see also "SUPPORTS and LEVELLING" on page 30), it is necessary to create a flat level base in concrete which is larger than the dimensions of the base of the appliance by at least 4÷6” on each side.
  The dimensions of the appliance are given in Table 4, page 10.
  Provide a “containing” step and a suitable drainage channel for the water.

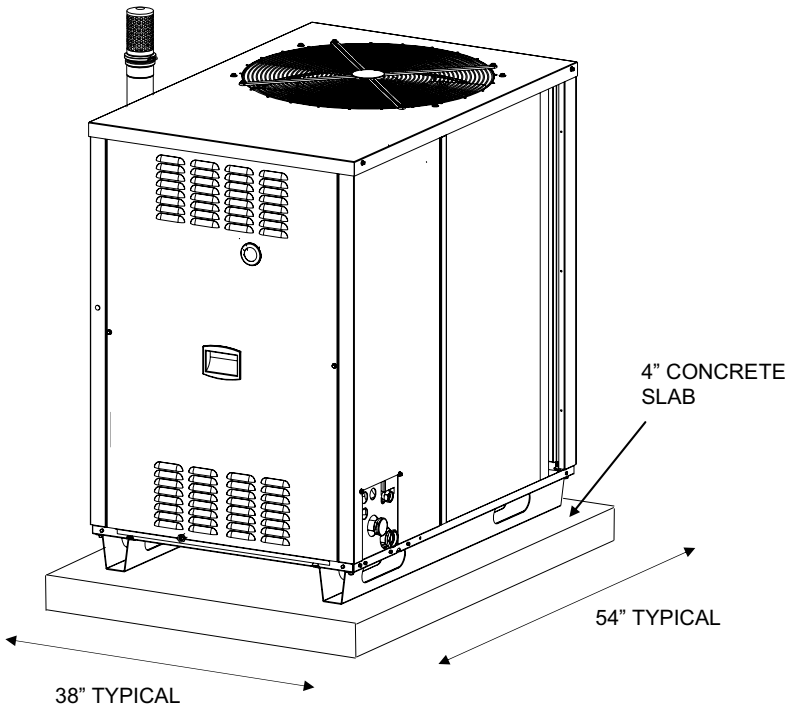


Figure 7 – Suggested dimensions of the unit bed.

- Installation on a terrace or roof
  Position the appliance on a leveled flat surface made of fireproof material (see also "SUPPORTS and LEVELLING" - page 30).
  The structure of the building will have to support the weight of the appliance added to the weight of the supporting base.
  The weight of the appliance is given in Table 4, page 10.
  Create a “containing” step and a suitable drainage channel for the water, providing a gangway around the appliance for maintenance purposes.

Although the appliance produces vibrations of limited intensity, the use of vibration dampings (available as accessories, see “Optionals and Spare Parts, page” 79) is strongly recommended in such cases of installation on roofs or terraces in which resonance phenomena may arise.
In addition, it is advisable to use flexible connections (vibration dampings) between the appliance and the hydraulic and gas supply pipes.

☞ Avoid positioning the appliance directly above places of rest or places which require quiet.

SUPPORTS and LEVELLING

The appliance must be correctly leveled by placing a level on the top part of the appliance.

If necessary, level the appliance by using metal spacers, to be placed in line with the supports; do not use wooden spacers, as they quickly degrade.

CLEARANCES

Position the appliance so that **minimum clearances** from combustible surfaces and constructions, walls and other equipment are maintained, as shown in Figure below.

The appliance may me instead installed directly on wood flooring.

☞ Minimum clearances are necessary for operating security, and in order to be able to carry out maintenance operations and to ensure the correct airflow required for heat exchange with the finned coil.

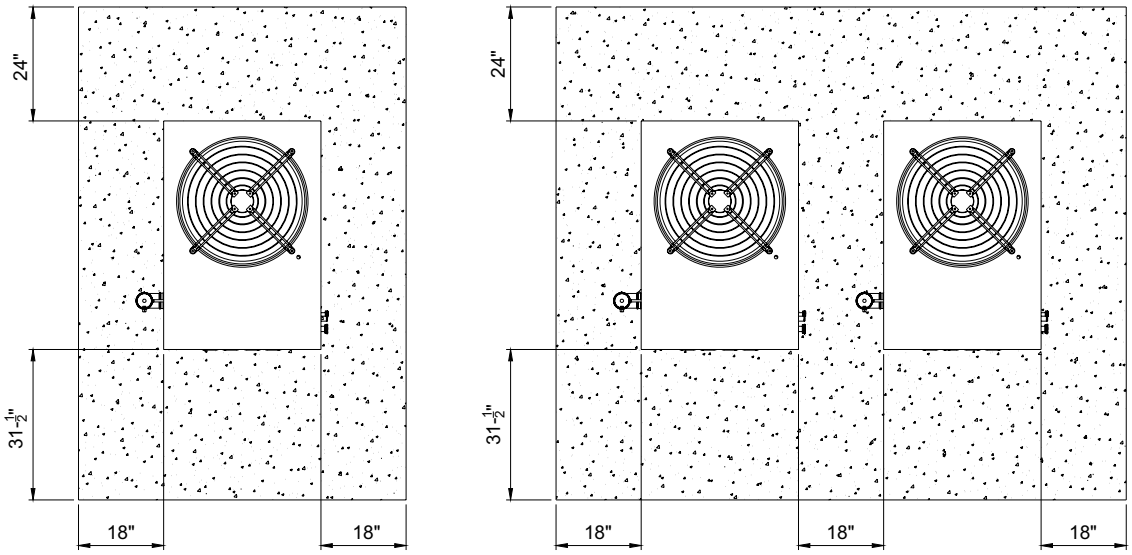


Figure 8 - Minimum clearances (dimensions expressed in inches)

There **MUST NOT** be any obstructions or structural overhangs (roof edges, balconies) over the top of the unit. The re-circulation of the air discharged from the condenser results in a poor unit performance.

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

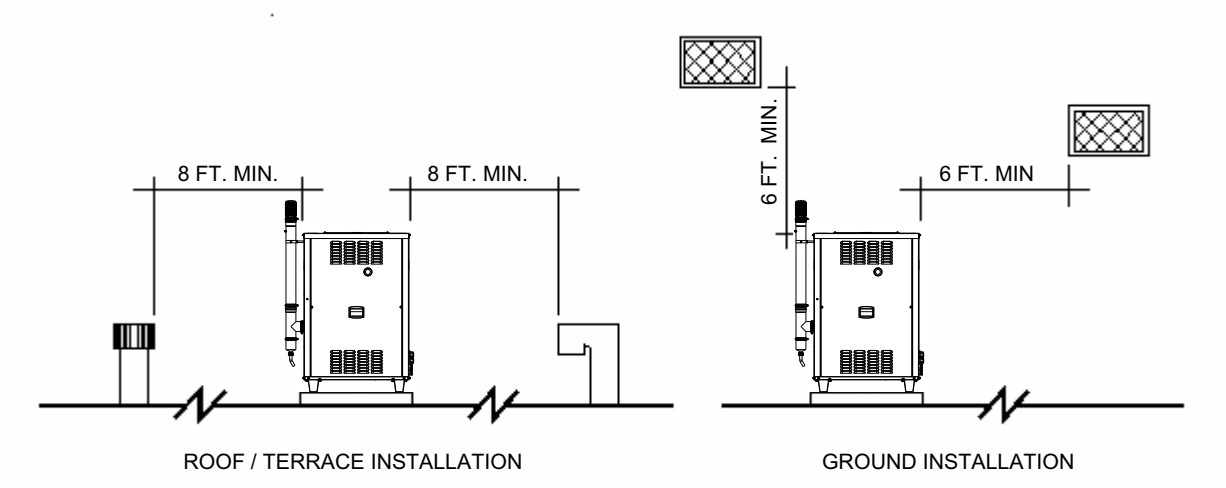


Figure 9 - Clearances from vent outlets, chimney flues and air intake openings.

Place the appliance, preferably, in a position that is not in the immediate vicinity of rooms and/or spaces where a high degree of quiet is required, such as bedrooms, meeting rooms, etc.

Evaluate the acoustic impact of the appliance on the basis of the installation site: avoid locating the appliance in positions (corners of buildings, etc.) that could amplify the noise it produces (reverb effect). See the following figure:

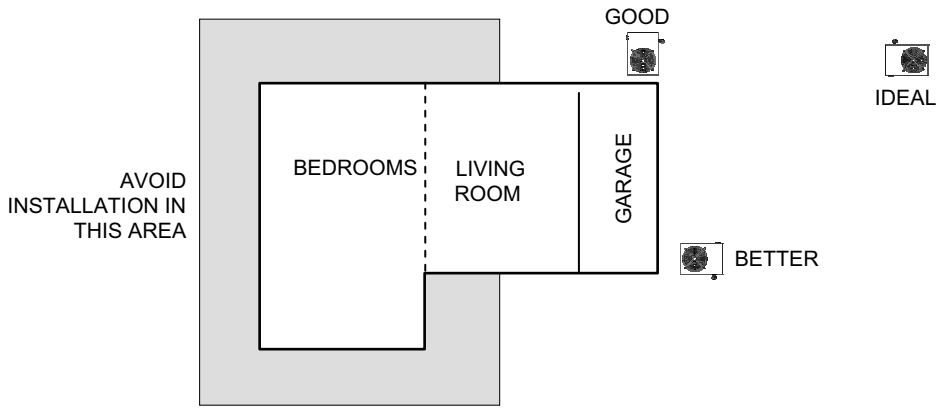
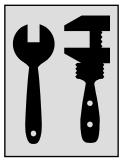


Figure 10 – Location of the unit.

3.3 HYDRAULIC CONNECTIONS

General indications

- The hydraulic plant may be created using pipes in stainless steel, black steel, copper or cross linked polyethylene for heating/cooling plants. All water pipes and pipe connections must be adequately insulated in accordance with current regulations, to prevent heat loss and the formation of condensate.
- If glycol antifreeze is to be used (see Paragraph 3.5 on page 39), DO NOT USE galvanized pipes, as they are potentially subject to corrosion phenomena in the presence of glycol.



- When rigid pipes are used, to prevent the transmission of vibrations, it is recommended that the appliance water inlet and outlet are connected with vibration dampings (see examples in Figure 11 and Figure 12, on page 35 and 36).

The components described below, to be provided near the appliance, are shown in the example hydraulic plant diagrams in Figure 11 and Figure 12, on page 35 and 36.

- ANTIVIBRATION JOINTS in line with the water and gas connections of the appliance.
- MANOMETERS installed in the inlet and outlet water pipes.
- INLET FLOW CALIBRATION VALVE, either of the gate valve or the over centre valve type, installed in the water inlet pipe of the appliance.
- WATER FILTER installed in the appliance water inlet pipe with a mesh of minimum 0.7 mm, maximum 1 mm.
- ISOLATION BALL VALVE in the water and gas pipes of the plant.
- RETAINING VALVE (for plants with several appliances see Figure 12, on page 36) installed in the water inlet pipe of each appliance (primary side).
- 507 PSIg SAFETY RELIEF VALVE installed in the appliance outlet water pipe (for plants with a single appliance – see Figure 11 on page 35).
- PLANT EXPANSION TANK (for plants with a single appliance see Figure 11 on page 35) installed in the appliance inlet water pipe.
- EXPANSION TANK for individual appliance (for plants with several appliances, see Figure 12, on page 36) installed in the appliance water outlet pipe (primary side). Provide a plant expansion tank in any case (secondary side), installed in the appliance water outlet pipe.

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 water in the plant (see figures mentioned above for reference).

- PLANT WATER CIRCULATION PUMP (for plants with a single appliance – see Figure 11 on page 35), located on the water inlet pipe of the appliance, flowing towards the appliance, and selected with characteristics that satisfy the requirements of the plant.
- WATER CIRCULATION PUMP for single appliance (for plants with several appliances see Figure 12, on page 36), located on the appliance water inlet pipe (primary side), flowing towards the appliance, and selected with characteristics that satisfy the requirements of the plant.
  Provide in any case a plant water circulation pump (secondary side), flowing towards the plant and chosen with characteristics that meet the plant's requirements.
- 4-CONNECTION COLD WATER STORAGE TANK with anti-mixing separators (for plants with several appliances, see Figure 12, on page 36), having the function of hydraulic separator (configuration of primary, variable-flow circuit), complete with 45 PSIg safety valve, air bleeder valve and drain tap.
- PLANT FILLING SYSTEM: if automatic filling systems are used, a seasonal check of the percentage of monoethylene glycol in the plant is recommended.

During the winter period, to prevent the water in the primary circuit from freezing:
the appliance is equipped with an antifreeze control that activates the external water circulation pump of the primary circuit and the burner of the appliance itself (when necessary).

It is therefore necessary to ensure a continuous supply of electrical power and gas to the appliance throughout the whole winter period.
If the continuity of supply of electrical power and gas cannot be guaranteed, provide for the use of glycol antifreeze of the inhibited monoethylene type.

If glycol antifreeze is used, DO NOT USE galvanized piping in creating the hydraulic circuit.
(Consult the notes regarding "Possible use of glycol antifreeze" in Paragraph 3.5 on page 39 and in any case the technical specifications of the glycol that is to be used).

The sizing of the tubes and of the pump must guarantee the nominal water flow rate necessary for the correct operation of the appliance (for calculation of internal pressure drops of the appliance refer to the TECHNICAL DATA paragraph, on page 9).

The operations necessary for the first activation or regulation of the appliance and of the Direct Digital Controller must be carried out exclusively by an authorized Robur Technical Assistance Centre (TAC).
These operations are described in the SECTION 5, on page 67.

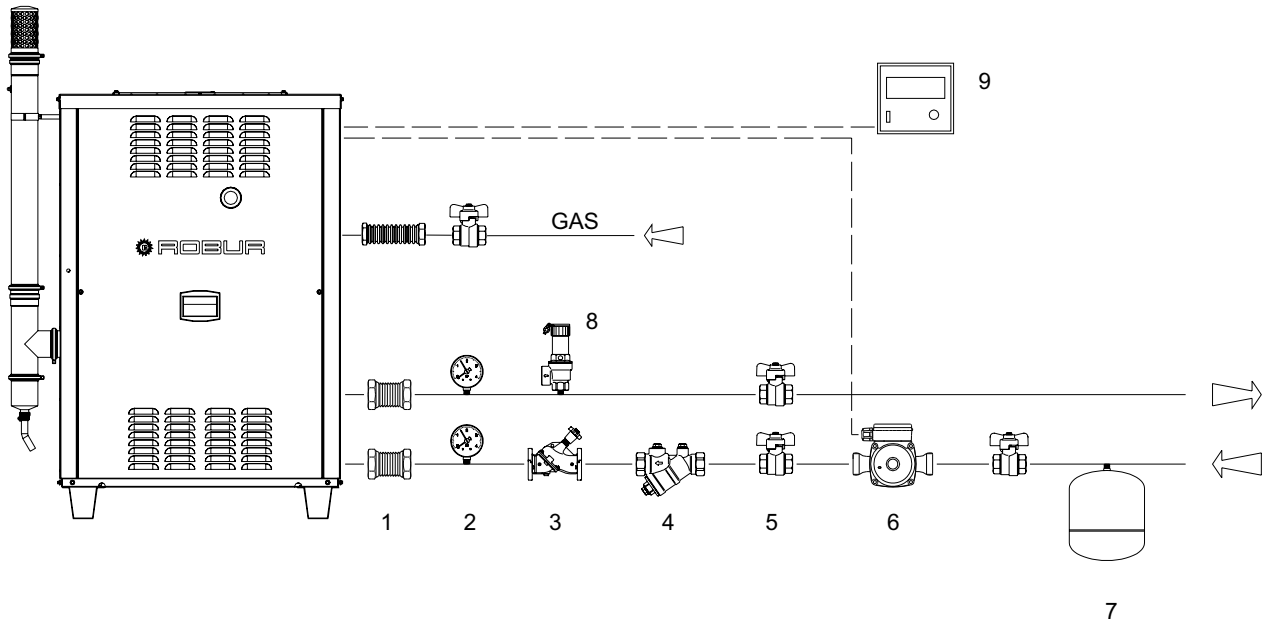
The product's guarantee may be void if the first activation is not carried out by a Robur TAC.

The following Figure 11 on page 35 shows a typical example of a hydraulic plant for a single appliance.

Figure 12 on page 36 shows instead a typical example of a hydraulic plant for several appliances.

For information or technical support in this regard, contact Robur Corporation (phone: (812) 424.1800).

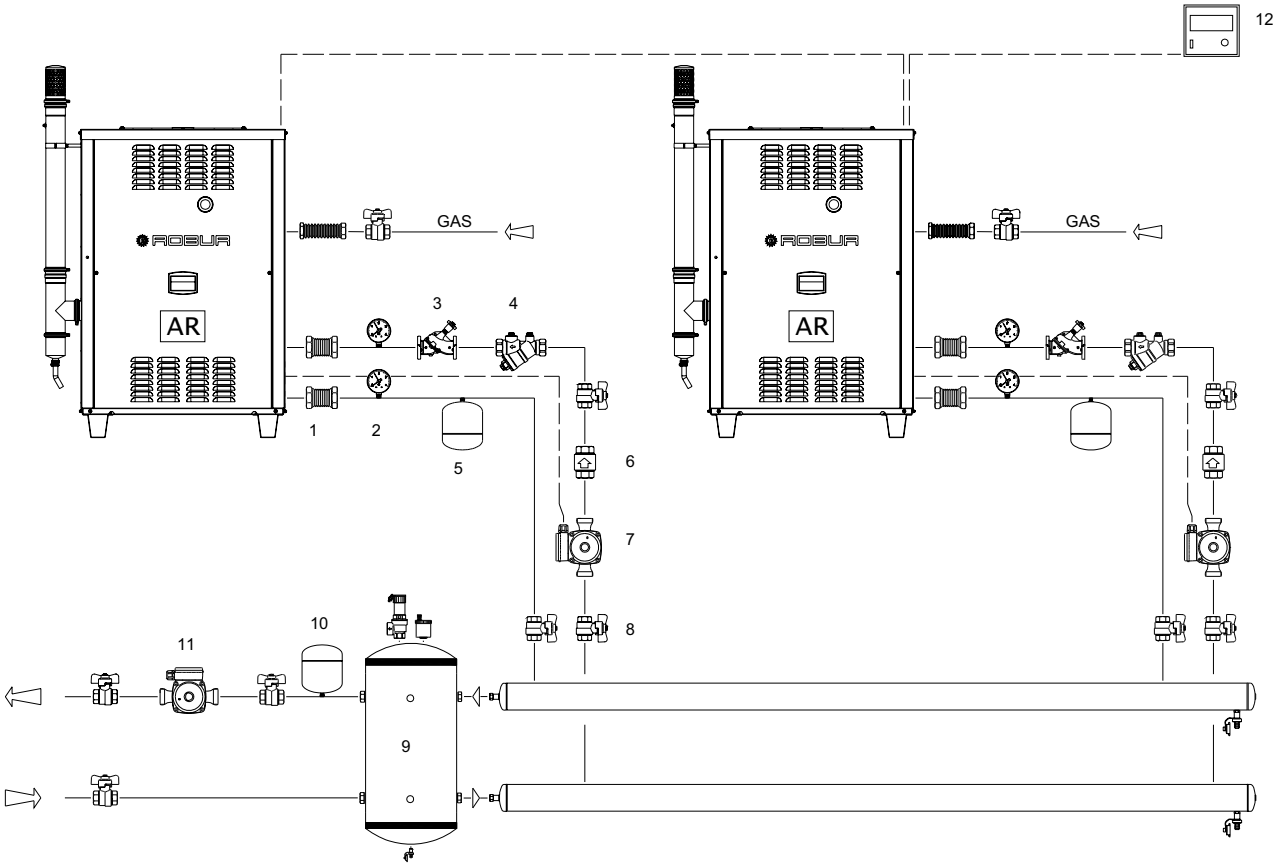
EXAMPLES OF TYPICAL HYDRAULIC PLANT SCHEMES FOR GAHP-AR APPLIANCES



KEY

1	ANTIVIBRATION JOINTS	2	MANOMETER RANGE 0-60 PSIg
3	FLOW REGULATION VALVE	4	WATER FILTER ∅ 2" ½ * (filter mesh MIN 0.7 mm, MAX 1 mm)
5	CUT-OFF VALVE	6	PLANT WATER CIRCULATION PUMP
7	PLANT EXPANSION TANK	8	SAFETY RELIEF VALVE 45 PSIg
9	DIRECT DIGITAL CONTROLLER (DDC, available as optional)		

Figure 11 - Example of hydraulic plant diagram for connection of 1 appliance



KEY

1	ANTIVIBRATION JOINTS	2	MANOMETER RANGE 0-60 PSIg
3	FLOW REGULATION VALVE	4	WATER FILTER ∅ 2" ½ * (filter mesh MIN 0.7 mm, MAX 1 mm)
5	SINGLE APPLIANCE EXPANSION TANK	6	RETAINING VALVE
7	SINGLE APPLIANCE WATER CIRCULATION PUMP	8	CUT-OFF VALVE
9	STORAGE TANK WITH ANTIMIXING SEPARATORS COMPLETE WITH 45 PSIg SAFETY RELIEF VALVE, AIR BLEEDER VALVE AND DRAIN TAP	10	PLANT EXPANSION TANK
11	PLANT WATER CIRCULATION PUMP	12	DIRECT DIGITAL CONTROLLER (DDC, available as optional)

Figure 12 - Example of hydraulic plant diagram for connection of 2 appliances

3.4 GAS SUPPLY SYSTEM

The appliance is designed to run on natural gas and L.P.G.

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 and .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 chiller, 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.

For Natural Gas the minimum Inlet gas pressure to the chiller is 5" W.C. and the maximum is 14” W.C. For Propane Gas the minimum Inlet gas pressure to the chiller is 11" W.C. and the maximum is 14" W.C.

For size of gas connection to the unit, see Figure 4 on page 14.

Supplying gas to the appliance at higher pressures than those indicated above can damage the gas valve, giving rise to a situation of danger.
The installation of gas supply pipes must be carried out in compliance with norms and current regulations.

L.P.G. may cause corrosion. The connectors between the pipes must be made of a material that is resistant to this corrosive action.

Vertical gas pipes must be equipped with a siphon and provided with a drain for the condensate that may form inside the pipe during cold periods. It may also be necessary to insulate the gas pipe to prevent the formation of excessive condensate.

An approved union should be installed in the gas line near the unit and down stream of any external shut-off valve that may be required by local codes.

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 chiller and its gas connections must be leaked tested before placing the chiller in operation.

The chiller 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 chiller 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**

In any case, provide a cut-off valve (tap) on the gas supply line, to isolate the appliance if required.

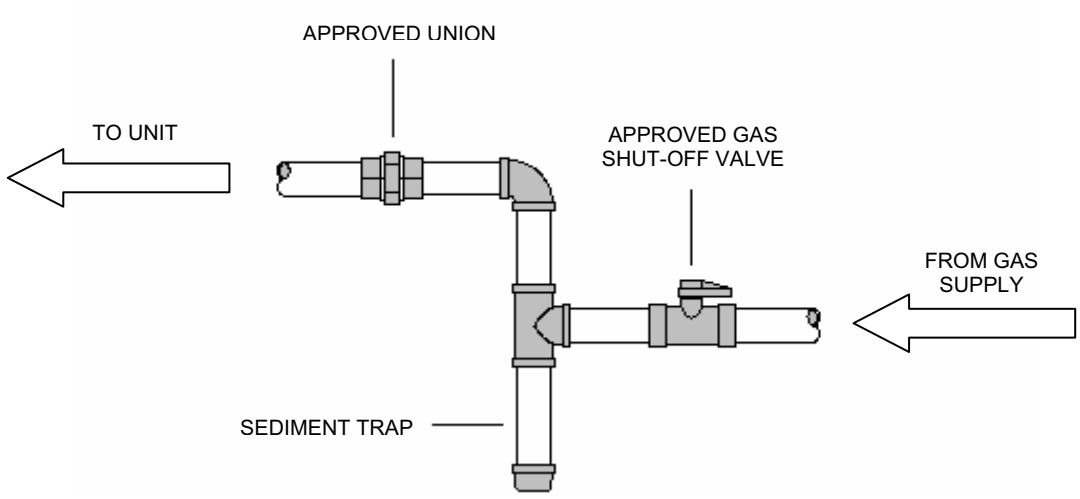


Figure 13 - Typical gas connection

3.5 FILLING OF HYDRAULIC CIRCUIT (to be carried out by installation technician)

After having completed all the connections of the hydraulic, electrical and gas supply plants, the hydraulic system installation technician can proceed with filling the hydraulic circuit, observing the following stages:

You will need: the appliance connected hydraulically and electrically.

1. Activate the automatic air bleeding valves present in the plant;
2. Fill the hydraulic circuit, ensuring the minimum water content in the plant, and adding, if necessary, to the plant water (free of impurities) a quantity of monoethylene glycol in proportion with the minimum winter temperature in the installation zone, as indicated in Table 13, page 40.
3. Bring the plant to the correct pressure, making sure that the pressure of the water in the plant is not less than 14.5 PSIg and not over 29.0 PSIg.

To facilitate the operation of bleeding air from the hydraulic circuit, the appliance is equipped with an additional air bleeding valve.

Possible use of glycol antifreeze

Glycols, normally used to lower the freezing point of water, are substances in an intermediate state of oxidation which, in the presence of oxidizing agents such as oxygen, are transformed into corresponding acids. This transformation into acids increases the corrosive nature of the fluid contained in the circuit. For this reason, mixtures that are commercially available almost always contain inhibiting substances that are able to control the pH of the solution. A necessary condition for the oxidation of the glycol, and therefore its degradation, is the presence of an oxidizing agent such as oxygen. In closed circuits in which no replenishment of water, and therefore of oxygen, occurs over the course of time, once the oxygen initially present has reacted, the degenerative phenomenon of glycol is hugely inhibited.
Most circuits, however, are of the non-sealed type, and therefore receive a more or less continuous supply of oxygen.
Therefore it is essential, whatever type of glycol is in question, to verify that it is adequately inhibited and that the necessary checks are regularly performed during its entire period of use.

Antifreeze liquids for cars, which do not contain inhibiting components other than mono-ethylene glycol, are not recommended for cooling and heating plants.

The manufacturer does not accept any contractual or extra-contractual liability for damage caused by the incorrect use or disposal of glycol antifreeze.

It is equally important to recall that the use of monoethylene glycol modifies the thermo physical characteristics of the water in the plant, and in particular its density, viscosity and specific average heat. Always check the date of expiry and/or degradation of the product with the supplier.

Table 13 gives the approximate freezing temperature of the water, the consequent increased pressure drop of the appliance and of the circuit, according to the percentage of monoethylene glycol. This table should be taken in regard for the sizing of the pipes and the circulation pump (for calculation of internal pressure drops of the appliance, refer to the TECHNICAL DATA paragraph, on page 9).

Nevertheless, it is advisable to consult the technical specifications of the monoethylene glycol used. If automatic loading systems are used, a seasonal check of the quantity of glycol present in the plant is also necessary.

% of MONOETHYLENE GLYCOL	10	15	20	25	30	35	40
WATER FREEZING POINT TEMPERATURE	26.6 °F	23.0 °F	17.6 °F	10.4 °F	5.0 °F	-4.0 °F	-13.0 °F
PERCENTAGE OF INCREASE IN PRESSURE DROPS	—	6%	8%	10%	12%	14%	16%
LOSS OF EFFICIENCY OF UNIT	—	0.5%	1%	2%	2,5%	3%	4%

Table 13 - Approximate water freezing point temperatures

As other hydronic appliances, Robur heating and cooling systems operate with grid-water of good quality. In order to prevent any possible problem of operation or reliability caused by filling or top-up water, please refer to codes and norms about water treatment for thermo-hydraulic installations in civil or industrial applications. Parameters indicated in Table 14 must be complied with.

CHEMICAL AND PHYSICAL PARAMETERS OF WATER IN HEATING/COOLING SYSTEMS		
PARAMETER	UNIT OF MEASUREMENT	ALLOWABLE RANGE
pH	\	6,5 - 8,0
Chlorides	ppm	< 125
Total chlorine	ppm	< 5
Total hardness ($CaCO_3$)	°f	10 - 15
Iron	ppm	< 50
Copper	ppm	< 3
Aluminium	ppm	< 3
Langelier's index	\	0
HARMFUL SUBSTANCES		
Active Chlorine	ppm	< 0,2 (*)
Fluorides		ABSENT
Sulphides		ABSENT

* In accordance and respecting current legislation.

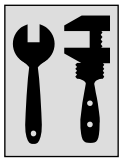
Table 14 – Chemical and physical parameters of water.

Water quality can be measured through parameters like acidity, hardness, conductivity, chlorides content, chlorine content, iron content and the like.

The presence of active chlorine in the water, in particular, can jeopardize parts of the installation and Robur units. Therefore, please make sure that active chlorine content and total hardness are compliant with the allowable ranges reported in Table 14.

The way the installation is operated can be the cause of possible degradation of water quality.

Moreover, abnormally massive water top-up or reintegration can cause a drift of chemical or physical above-mentioned parameters. Reintegration should not exceed 5% per year of



the total amount of water. It is advised to check regularly the water quality, especially in case of automatic or periodic top-up.

In case water treatment is needed, this operation should be carried out by a professional or competent person, following strictly the instructions by the manufacturer or supplier of the chemical substances for the treatment, since dangers could arise for health, for the environment and for Robur appliances.

Several products for water treatment are available on the market.

In case washing of the pipes is needed, this operation should be carried out by a professional or competent person, following strictly the instructions by the manufacturer or supplier of the chemical substances for the washing, avoiding the use of substances aggressive for stainless steel or containing/releasing active chlorine.

Please make sure the pipes are properly rinsed in order to remove any residue of chemical substances from the pipes.

Robur is not liable for ensuring that water quality is always compliant with what reported in Table 14 is not's. Non-compliance with indications above may jeopardize the proper operation, integrity and reliability of Robur appliances, invalidating the warranty.

For any further detail, please contact directly Robur Corporation Evansville, IN
Phone (812) 424-1800; Fax (812) 422-5117.

3.6 GAS PRESSURE ADJUSTEMENT

The manufacturer supplies the units 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 unit. Nevertheless, before starting the unit check and if necessary adjust the Gas Input (HHV) to the burner. Using the table below (natural gas; for Propane gas models see further), arrange the proper manifold pressure according to the local gas heating value (BTU content per cubic foot) and specific gravity. This table is based on the correct natural Gas Input (HHV) for the model by manifold pressure in inches of water column (in WC).

BTU CONTENT PER CU.FT.	SPECIFIC GRAVITY OF NATURAL GAS			
	0,55	0,6	0,65	0,7
950	3,15	3,43	3,72	4,01
975	2,99	3,26	3,53	3,80
1000	2,84	3,10	3,36	3,61
1025	2,70	2,95	3,20	3,44
1050	2,58	2,81	3,04	3,28
1075	2,46	2,68	2,90	3,13
1100	2,35	2,56	2,77	2,99
1125	2,24	2,45	2,65	2,86

OUR REFERENCE:

BTU CONTENT PER CU.FT.	SPECIFIC GRAVITY OF NATURAL GAS
	0,555
1014	2,77 IN. W.C.

Table 15 - Manifold pressure based on gas input (HHV) of 95,500 Btu/hr USING 0.21" orifice.

The conditions referred to by the table above are for the guidance of the installer and the CSA design certification does not cover the conditions described therein.

Note: For Propane Gas Models, follow the same instructions as given for natural gas. The manifold pressure for propane gas should be 5.1” W.C., manifold pressure at 95,500 Btu/hr. input using 0.14” orifice.

GAS TYPE	NATURAL GAS	LP GAS
MANIFOLD PRESSURE	2.8 WC INCHES	5.1 WC INCHES
NOZZLE DIAMETER	0.21”	0.14”

Table 16 - Manifold pressure and nozzle diameter.

Pressure adjustment procedure

You will need: the unit shut off; a manometer.

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. Turn power “ON,” 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 (see dedicated procedure, end of Appendix). Repeat until all the air is purged from the piping and the burner ignites.
5. When the burner ignites read the manometer and compare to the required pressure in Table 15 or Table 16.
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 counter clockwise to reduce pressure. Replace seal screw after adjustment.
7. Open control switch and make sure unit is off.
8. Remove manometer and pressure tap. Replace plug in gas valve.
9. Turn unit on by closing control switch. Check all gas connections with soap for leaks.

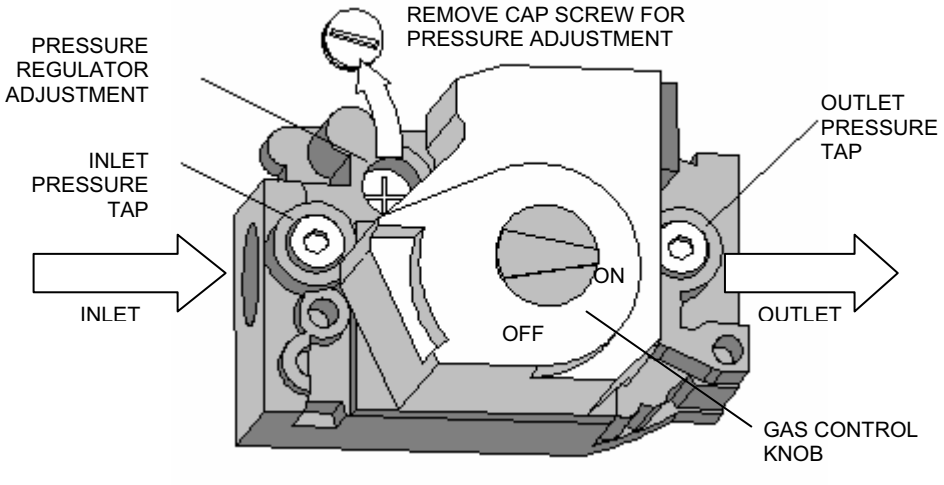


Figure 14 - Gas valve.

3.7 CONNECTION OF COMBUSTION PRODUCT EXHAUST PIPE

The appliance is approved for the connection of the combustion product exhaust pipes, present on each single unit, to a flue linked directly to the outside.

Each single unit is provided with a connection of ∅ 3-$^1/_8$" (equipped with a suitable seal) located on the left side (see Figure 15, page 44) and outlet in a vertical position.

If the type of installation and/or current regulations require the canalization of combustion products, for the sizing of the flue duct for combustion products, refer to data given in Table below:

EXHAUST FLUE FLOW, TEMPERATURE AND CO_2%			
NATURAL GAS COMBUSTION	**FLUE FLOW** **FLUE TEMPERATURE** **CO_2%**	SCF °F —	1750 293 9.2
LPG COMBUSTION	**FLUE FLOW** **FLUE TEMPERATURE** **CO_2%**	SCF °F —	1522 284 11.3

Table 17 - Exhaust gas flow and temperatures

The appliance shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

Each unit of the appliance is supplied complete with an exhaust air duct, to be fitted to the appliance by the hydraulic system installation technician.

The exhausted air duct installation kit consists of (see Figure 15):

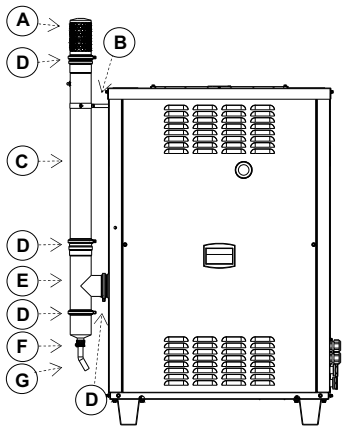
- 1 exhausted air pipe ∅ 3-$^1/_8$" (length 29-$^1/_2$");
- 1 "T" connector;
- 1 condensate trap;
- 1 terminal;
- 1 clamp for fixing pipe to left side panel;

- 4 hose clamps;
- 1 hose adaptor and condensate drain pipe in silicone rubber.

To assemble and fit the external exhaust air duct, for each single unit of the appliance, proceed as follows:

You will need: the appliance positioned in its installation site.

1. position the clamp for fixing the pipe, with the relative metallic spacer, to the upper part of the side panel of the unit, which comes supplied with a suitable hole;
2. using 1 hose clamp, fit the condensate trap to the T connector, then fit the latter to the exhaust air pipe (∅3-$^1/_8$") of the appliance and fix using a hose clamp;
3. using 1 hose clamp, fit the exhaust air pipe (length 29-$^1/_2$") to the T connector;
4. fasten the pipe with the clamp previously fixed to the side panel of the unit;
5. position the exhaust terminal and fix it with 1 hose clamp;
6. fix the hose adaptor, condensate drain pipe and the relative silicon tube;
7. complete the operation, checking carefully that all components are correctly fixed in place.



FRONT VIEW

KEY

A TERMINAL
B CLAMP FOR FIXING PIPE TO PANEL OF UNIT
C EXHAUST AIR PIPE L= 750 mm
D HOSECLAMP
E "T" CONNECTOR
F CONDENSATE TRAP
G HOSE CONNECTOR + CONDENSATE DRAIN TUBE

Figure 15 - Components of exhaust air duct kit

3.8 PROGRAMMING OF HYDRAULIC PARAMETERS

The operations described in this paragraph are necessary only if the appliance is not connected to a Direct Digital Controller (DDC).
If the appliance is connected to a DDC, see the manual supplied with it.

This paragraph explains how to set the hydraulic parameters on the electronic board of the appliance. Users not familiar with the basic procedures for the use of the board should refer to Paragraph 2.2 "ON-BOARD ELECTRONICS" on page 17.

To configure the appliance, access menu 3 of the electronic board.

With regard to the hydraulic configuration, three parameters may be set for cooling mode and three for heating mode. Select the letter E to exit to the previous menu.

HYDRAULIC PARAMETER	THE DISPLAY SHOWS
SELECT COLD WATER THERMOSTATING	
COLD WATER SET-POINT	
COLD WATER TEMPERATURE DIFFERENTIAL	
SELECT HOT WATER THERMOSTATING	
HOT WATER SET-POINT	
HOT WATER TEMPERATURE DIFFERENTIAL	
(EXIT TO PREVIOUS MENU)	

Table 18 - Parameters for hydraulic configuration of the appliance

Description of parameters:

- Select water thermostat action, parameters 73 and 160: these parameters may have two values, 0 or 1. When the user chooses:
    - 0: the temperature that affects the activation and deactivation of the appliance is detected by the sensor on the INLET water, i.e. water flowing into the appliance.
    - 1: the temperature that affects the activation and deactivation of the appliance is detected by the sensor on the OUTLET water, i.e. water flowing out of the appliance.
- Water set-point, parameters 75 and 161: these parameters set the water temperature that, when reached, causes the appliance to be deactivated.
- Water differential, parameters 76 and 162: these parameters represent an interval in degrees that, when added to the set-point, defines the temperature at which the appliance is reactivated.

Operation in cooling mode:

The appliance functions by cooling the water until it reaches the set-point temperature. At this point it switches off. The temperature of the water rises until it reaches the temperature corresponding to "set-point + differential"; when this is reached the appliance switches on again.

Example:

Thermostating: reading from outlet sensor.

Set-point: +44.6 °F

Differential: 3.6 °F

- The appliance is functioning: the water in the plant cools down until it reaches the set-point temperature = +44.6 °F.
- The appliance switches off: the water in the plant, returning from use, becomes progressively hotter, until it reaches a temperature of +48.2 °F = 44.6 °F + 3.6 °F.
- The appliance switches on again, and the plant water cools down again.
- The cycle is repeated.

Operation in heating mode:

The appliance functions by heating the water until it reaches the set-point temperature. At this point it switches off. The temperature of the water rises again until it reaches the temperature corresponding to "set-point + differential"; when this is reached the appliance switches on again.

Example:

Thermostating: reading from inlet sensor.

Set-point: +104.0 °F

Differential: -3.6 °F

- The appliance is functioning: the water in the plant heats up until it reaches the set-point temperature = +104.0 °F.
- The appliance switches off: the water in the plant, returning from use, becomes progressively cooler, until it reaches a temperature of +100.4 °F = 104.0 °F + (-3.6 °F).
- The appliance switches on again, and the plant water heats up again.
- The cycle is repeated.

The following procedure illustrates in detail how to configure the parameters on the electronic board incorporated in the appliance.

If the procedures for how to access the knob and menus are not familiar, see paragraphs "Display and knob (encoder)" and "Access to board menus" on page 19 and following.

To set the parameters of menu 3:

You will need: the appliance on and access to the electrical panel – see "Display and knob (encoder)" on page 19.

Access menu 3. The display shows the first parameter of the menu, number 73:  .

1. Turn the knob clockwise to scroll through the parameters:  ,  ,  ,  ,  ,  . Lastly the letter E,  ., is shown.
2. Press the knob when a parameter is displayed to select it, or when E is displayed to exit the menu.
3. For example, to set parameter 75 (cold water set-point), proceed as follows:
   - Select the parameter: turn the knob until the display shows  ;
   - Press the knob to access the value of the parameter; the display shows the previously set value, which flashes, for example 44.6 °F:  ;
   - Turn the knob to modify the value of the parameter, for example 47.3 °F:  ;
   - Press the knob to confirm the value selected. The display shows the current parameter again,  . The new value for this parameter has been set.
4. If other parameters are to be modified, proceed as described previously, and then exit from the menu by pressing the knob on the letter E,  .

To exit the menu, turn the knob clockwise until  is displayed, then press it to confirm. For details regarding the codes displayed by the appliance during operation, see paragraph "Display and knob (encoder)" on page 19.

SECTION 4 ELECTRICAL INSTALLER

This section illustrates the operations to perform for the correct installation of the appliance, and contains electrical diagrams that may be of use in the event of maintenance operations.

☞ Installation of the appliance must be carried out only by a firm which is authorized according to current legislation in the country of installation - that is, by professionally qualified personnel.

⚠ All wiring should be installed 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.

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

⚠ Installation or that is incorrect or that does not comply with current legislation may cause damage to people, animals or things; Robur Corporation is not responsible for any damage caused by installation or that is incorrect or that does not comply with current legislation.

Control of the operation of the appliance may take place in one of the following ways:

1. By means of specific on/off commands: an on/off switch and a summer/winter selector switch for selecting the operation mode. This on/off command may be an on/off switch, an ambient thermostat, a programmable timer, or other such device.
2. By means of the Direct Digital Controller (DDC) available as an accessory (see Optionals and Spare Parts, page 79).

Electrical diagrams for the connection of the appliance may be found in Paragraph 4.4, "PUMP AND ELECTRICAL WIRING DIAGRAMS" on page 55.
If the appliance is to be connected to a Direct Digital Controller (DDC), see also the electrical diagrams in Paragraph 4.5 on page 58.

The use of antifreeze is important to prevent water on the secondary side from freezing during the winter period. See SECTION 3 on page 27.

4.1 S61 AND UNIT ELECTRICAL DIAGRAM KEY

S61 electronic control board key

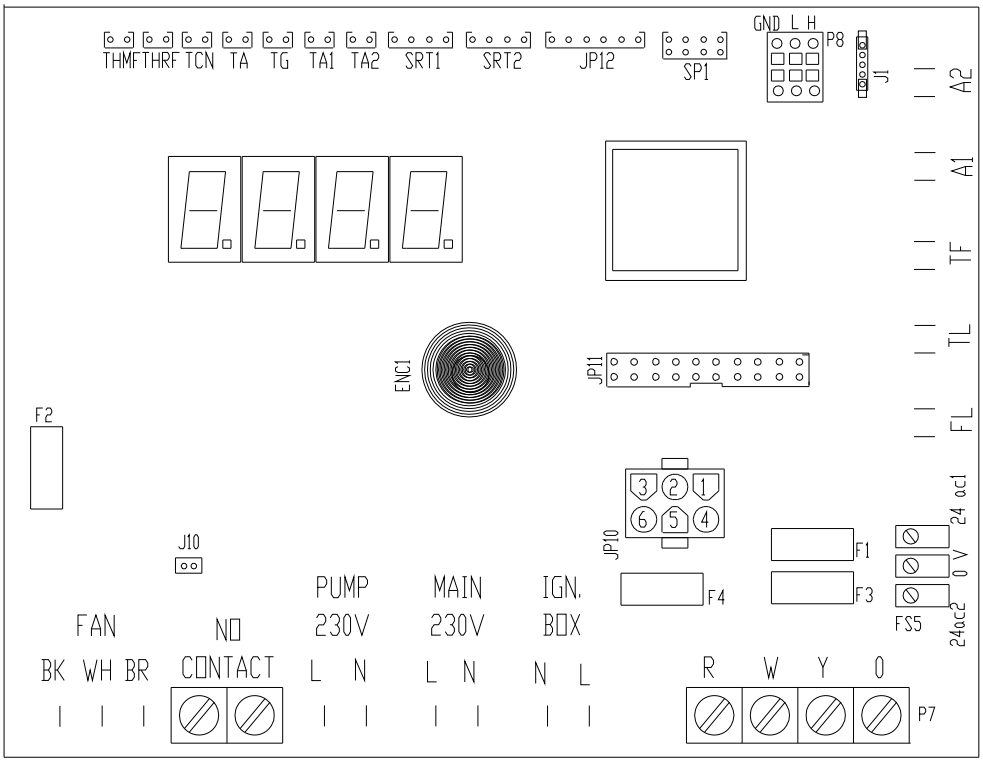


Figure 16 - S61 electronic control board key.

Top edge

THMF	WATER OUTLET TEMPERATURE PROBE
THRF	WATER INLET TEMPERATURE PROBE
TCN	CONDENSER TEMPERATURE PROBE
TA	EXTERNAL AMBIENT TEMPERATURE PROBE
TG	GENERATOR TEMPERATURE PROBE
TA1	EVAPORATOR OUTLET PROBE TEMPERATURE
TA2	NOT USED
SRT1	OLEODYNAMIC PUMP OPERATION REED SENSOR
SRT2	NOT USED
JP12	NOT USED
SP1	NOT USED
P8 (GND, L, H)	CAN BUS CONNECTOR
J1	CAN BUS JUMPER

Bottom edge

FAN (BK, WH, BR)	FAN MOTOR CONNECTOR (BLACK, WHITE, BROWN)
N.O. CONTACT	NORMALLY OPENED PUMP SWITCH (MAX 700W)
PUMP 230V (L, N)	OLEO PUMP TERMINAL
MAIN 230V (L,N)	POWER SUPPLY TERMINAL
IGN. BOX (L, N)	IGNITION BOX TERMINAL
J10	N.O. CONTACT JUMPER
P7 (R, W, Y, O)	CONSENT TERMINAL

Left and Right edge

F2	FUSE
FS5 (24V AC)	BOARD FEEDING TERMINAL
FL	FLOW METER SENSOR CONNECTOR
TL	GENERATOR LIMIT THERMOSTAT CONNECTOR
TF	GASES THERMOSTAT
A1, A2	AUXILIARY CONNECTORS
JP10	FLAME CONTROL BOX CONNECTOR

Inner zone

ENC1	ENCODER
JP11	AR10 BOARD CONNECTOR

Robur electric diagrams key

SYMBOL	DESCRIPTION
R	Common (Chilling/Heating) Terminal
W	Heating Consent Terminal
Y	Chilling Consent Terminal
0	Not used
W/Y	Chilling/Heating Selector
L	Live Wire/Connection
N	Neutral Wire/Connection
GROUND	Ground Wire/Connection
C	Condenser
F	Fuse
CS	Consent Switch
GS	General Switch
PY	Chiller side Pump
PW	Heater side pump
PY/W	Chiller/Heater Pump (2 pipe systems)
PWRTR	Board Power Transformer
DDCTR	DDC Power Transformer
IGNTR	Ignition Transformer
PTR	Pump Transformer
MV	Motor Valve
DV	Defrosting Valve
GV	Gas Valve
DDC	Direct Digital Controller
CNTBOX	Flame Control Box
BLW	Blower
PSW	Air Pressure Switch
IGN	Ignition Electrode
FLS	Flame sensor
FAN	Condenser Fan
TER	Terminal Board
PMP	Pump
KP	Relay for Water Pump Control – not supplied
IP	Water Pump Bipolar Electrical Disconnection Switch – not supplied
MC	Micro switch - Heater side
MF	Micro switch - Chiller side
THL	Water Thermostat

Table 19 - GAHP-AR electric diagram key.

4.2 OPERATION WITH ON/OFF COMMAND SWITCH

Before making the electrical connections, make sure that work is not carried out on live elements.

General indications

- Check that the power supply voltage is 208-230 V 1N - 60 Hz.
- Connect the appliance to the mains supply according to the electrical diagrams in Figure 17 and Figure 18, Figure 19 or Figure 20 or Figure 21, pages 53 and following.
- Make the electrical connection in such a way that the ground wire is longer than the live wires. In this way it will be the last wire to be pulled away if the mains cable should accidentally be pulled, and will thus guarantee the ground connection.

The electrical safety of the appliance is guaranteed only when it is correctly connected to an efficient grounding system, executed in accordance with current safety regulations. Do not use gas pipes to ground electrical appliances.

Connecting the appliance

To connect the appliance to the mains supply and to connect the appropriate on/off commands:

You will need: the appliance in its permanent location.

3. Prepare a cable of the 3x16 AWG type for the power supply to the appliance. Ground cable is conventionally yellow-green colored.
4. Connect the appliance to the mains (with the cable indicated in point 1), fitting in proximity to the mains a general external bipolar disconnecting switch (see detail GS) with 2 type T 5A fuses or a 10 A magnetothermic switch.
5. Connect the on/off command and the summer/winter selector (W/Y) to the terminals **R, W** and **Y** of the control circuit of the appliance as shown in Figure 18 on page 53 (see details "CS" and "W/Y").

For the appliance to operate correctly, it is ALWAYS necessary to provide specific on/off commands. Do not use the general mains external disconnecting switch (GS) to switch the appliance on or off.

6. Complete the installation by connecting the pump electrically, as indicated in Paragraph 4.3 on page 54.

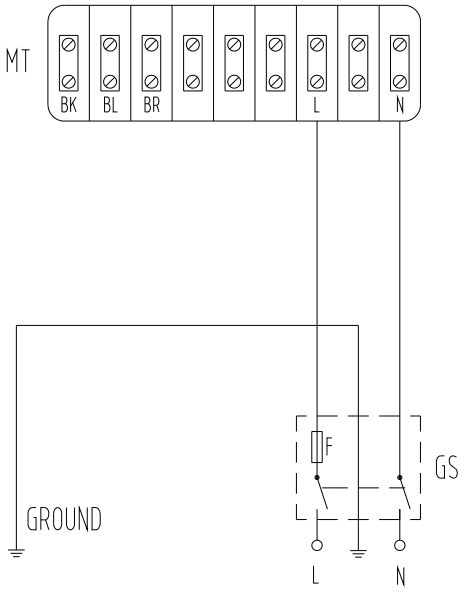


Figure 17 - Example of connection of appliance to 208-230 V 1 N - 60 Hz electricity supply; fuse type: T-type, 2x5A or 1x10A.

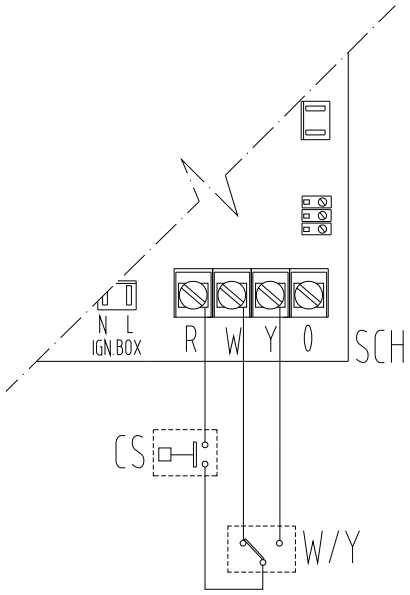


Figure 18 - Example of electrical connection of on/off commands and summer/winter selector.

4.3 CONTROL OF PLANT PUMP

Plant pump is controlled by the electronic board.

Controlling the pump from the electronic board of the appliance

Control of the plant water circulation pump from the electronic board of the appliance depends on the power rating of the pump itself. 2 cases may be distinguished:

- Direct control from the electronic board with power absorbed by the pump of less than 4 A.
  If the power absorbed by the pump is less than 4 A, make the connection as shown in Figure 19, page 55 and check that the jumper (J10, located at the bottom left of the electronic board, above the "NO Contact" contacts) is CLOSED, as shown in the detail "jumper closed".
- Direct control from the electronic board with power absorbed by the pump of more than 4 A.
  If the power absorbed by the pump is less than or equal to 4 A, make the connection as shown in Figure 20, page 55 using a control relay.
  In this case it is necessary to OPEN the jumper (J10, located at the bottom left of the electronic board, above the "NO Contact" contacts) positioning it as shown in the detail "jumper open" of the Figure.

☞ For the connection of a single pump for several appliances connected on the same hydraulic circuit, it is always necessary to provide a safety transformer (secondary SELV) and a respective control relay, and to make the connections according to the diagram in Figure 21, page 56.

4.4 PUMP AND ELECTRICAL WIRING DIAGRAMS

Connection of the plant water circulation pump

Pump controlled directly by appliance, power < 700W

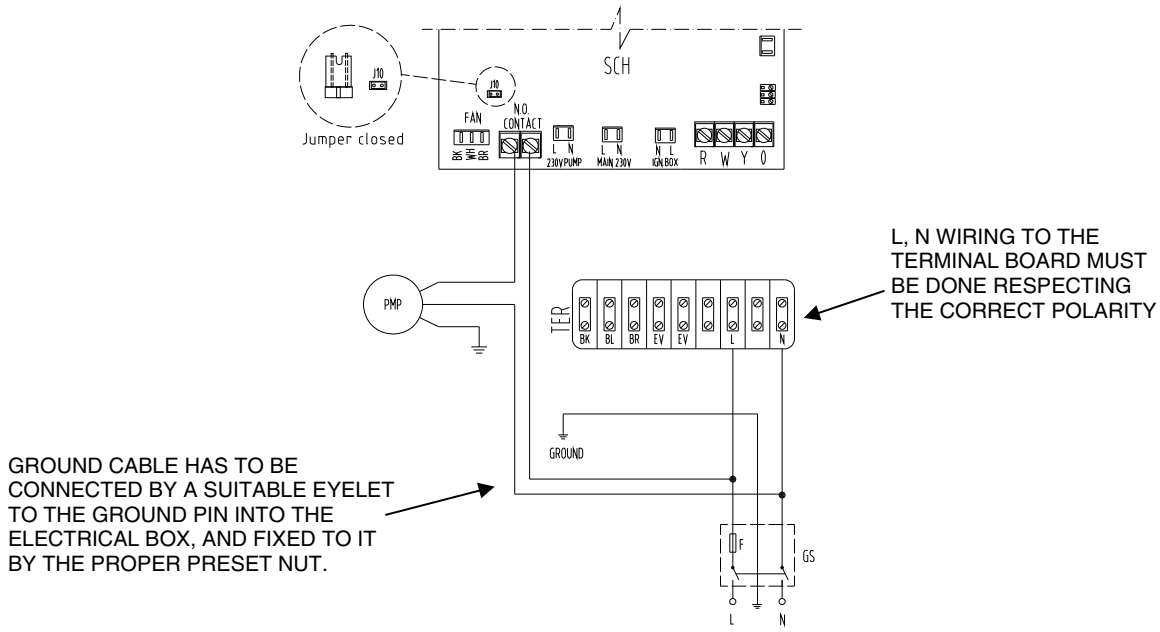


Figure 19 - Example of pump/appliance electrical connection with 230 Vac pump (with absorbed power of < 4 A), controlled directly by the appliance

Pump controlled by appliance with interposed relay, power ≥ 700W

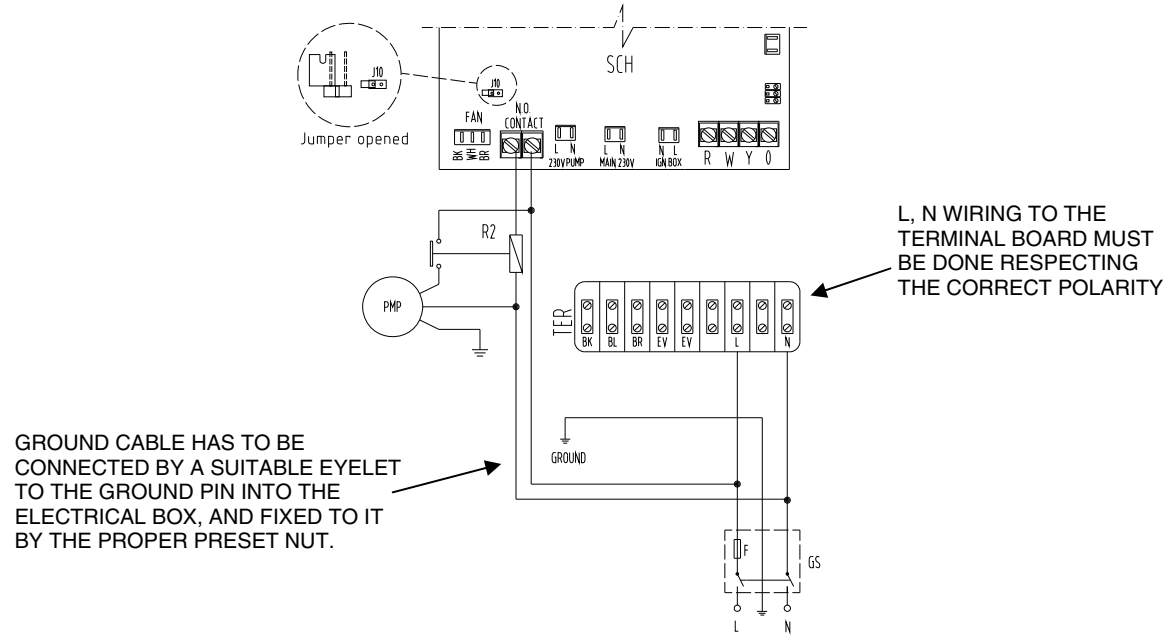


Figure 20 - Example of pump/appliance electrical connection with 230 Vac pump (with absorbed power of ≥ 4 A), controlled directly by the appliance through a relay

The diagram in Figure 21 below shows an example of connection between two appliance and a single pump, the pump being controlled directly by the two appliances via an interposed relay and SELV safety transformer. In this case, no matter if pump current absorption is more or less than 4 amp.

The SELV transformer is necessary for the safety of operators:

When doing maintenance and a unit is shut off, these contacts could still remain fed.

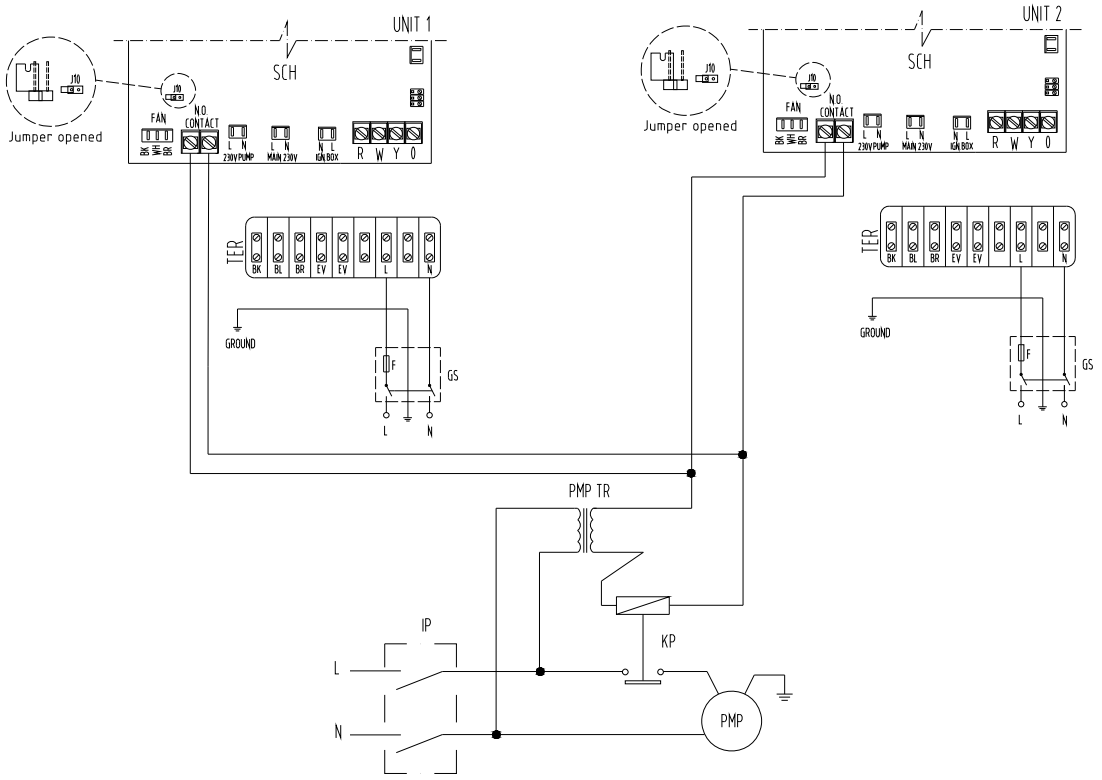


Figure 21 - Example of pump/appliance electrical connection with 208-230 Vac pump, controlled directly by the appliance through a relay and a SELV safety transformer

GAHP-AR WIRING

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

Igniter and flame sensor wire have to be replaced with Robur spare parts. See Optionals and Spare Parts, page 79.

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

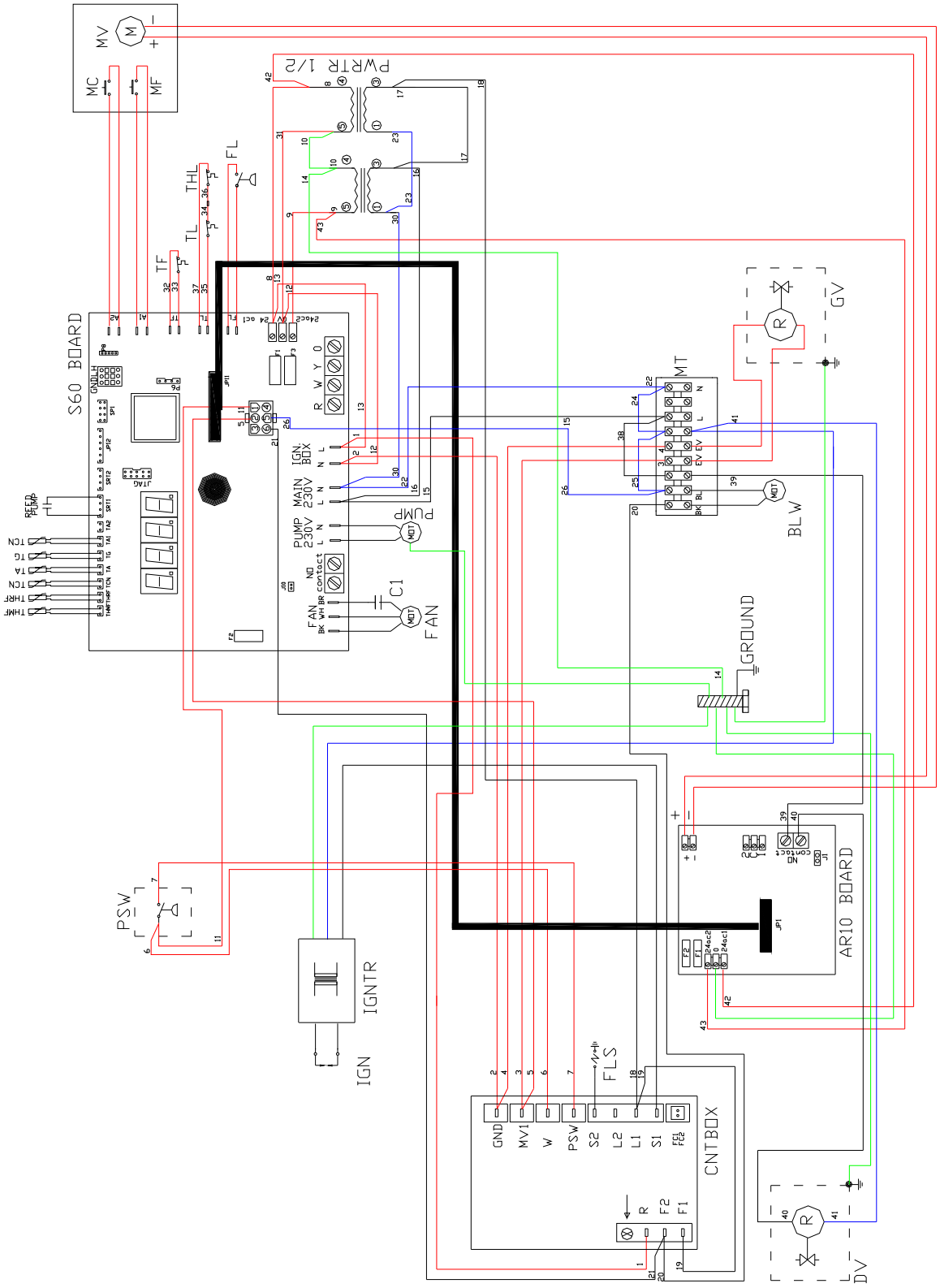


Figure 22 - Internal electrical wiring diagram

4.5 USE OF THE DIRECT DIGITAL CONTROLLER (DDC)

This paragraph illustrates the operations to be performed when one or more appliances are connected to a Direct Digital Controller (DDC). For specific information regarding the DDC, refer to the specific manuals supplied with it.

The appliance and the DDC communicate with each other via a CAN bus network.

The CAN bus network is characterized by a series of elements (appliances or DDCs) called nodes, connected to each other by a three-wire cable. The nodes are of two types: terminal nodes and intermediate nodes.

- Terminal nodes are appliances or DDCs that are connected to one other element only.
- Intermediate nodes are appliances or DDCs that are connected to two other elements.

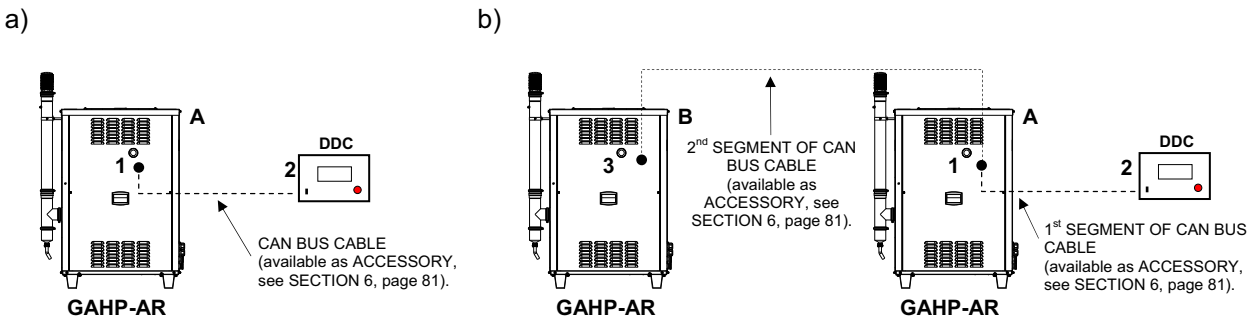


Figure 23 - Examples of CAN bus with: a) 2 nodes = 1 appliance + 1 DDC; b) 3 nodes = 2 appliances + 1 DDC

The diagram illustrates 2 cases of connection on a CAN BUS network:

a) 1 appliance is connected to 1 DDC. The two elements, appliance and DDC, are terminal nodes of the network, as they are each connected to one other element only.

b) 2 appliances are connected to each other and to 1 DDC. Appliance "B" and the DDC are terminal nodes, while appliance "A" is an intermediate node as it is connected to 2 elements, which are appliance "B" and the DDC.

It is possible to place one DDC at any point of the CAN bus network: appliances and DDCs may act equally as terminal or intermediate nodes.
One DDC can control and monitor up to 16 appliances. If there are more than 16 appliances on the network, it is necessary to connect more than one DDC on the same network, up to a maximum of 3.

The CAN bus cable

☞ The CAN bus cable must meet the Honeywell SDS standard.

The following table gives details of some types of CAN bus cable, grouped according to the maximum distance covered by each single type.

NAME OF CABLE	SIGNALS / COLOUR			MAX LENGTH	Note
Robur					
ROBUR NETBUS	H= BLACK	L= WHITE	GND= BROWN	450 m	- - - - - - - - -
Honeywell SDS 1620					
BELDEN 3086A	H= BLACK	L= WHITE	GND= BROWN	450 m	**In all cases, the 4th wire is not used**
TURCK type 530					
DeviceNet Mid Cable					
TURCK type 5711	H= BLUE	L= WHITE	GND= BLACK	450 m	
Honeywell SDS 2022					
TURCK type 531	H= BLACK	L= WHITE	GND= BROWN	200 m	

Table 20 - Example of types of cable that may be used for CAN bus connection

For overall distances to cover of ≤200 m and networks with a maximum of 6 nodes (a typical example: up to 5 GAHP-AR units + 1 DDC), a simple shielded cable 3 x 18 AWG may be used.

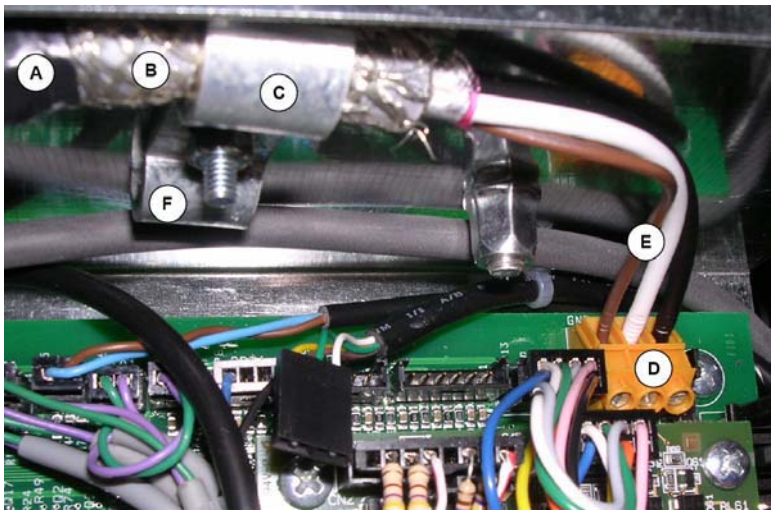
Having calculated the length that is required for the type of current installation, purchase the correct cable.

As shown in the table, the CAN connection requires a CAN bus cable with 3 wires. If the cable available has more than three colored wires, choose which colors to use and cut the other unnecessary ones.

The ROBUR NETBUS cable is available as an accessory – see "Optionals and Spare Parts", page 79.

Connection of the CAN BUS cable to the appliance

The CAN BUS cable is connected to the appropriate connector on the S61 electronic circuit board on the appliance, see Figure 5 on page 17 as well as the figure below. Proceed as indicted below.



KEY

- **A** Electrical tape to protect board/shielding
- **B** Shielding of CAN-BUS cable
- **C** Cable clamp
- **D** Connettore arancione di collegamento terminali cavi CAN-BUS
- **E** Wires of the CAN-BUS cable
- **F** Mounting point for 2nd segment of CAN BUS cable for INTERMEDIATE NODES.

Figure 24 - Example of a single CAN bus cable connected to the board (the appliance is a terminal node)

To connect a CAN bus cable to an appliance:

You will need: The appliance (or appliances) positioned in its (or their) final location.

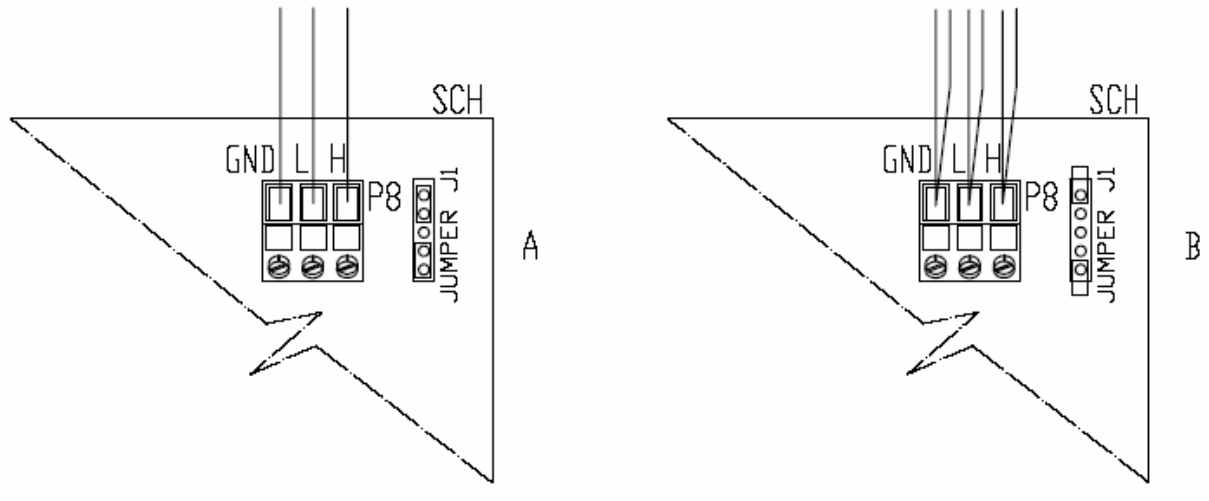
Before working on the electrical panel of the appliance, make sure that it is not connected to the power supply.

1. Remove the front panel of the appliance and the cover of the electrical panel.
2. Cut the ideal length of cable for the installation so that it will not undergo bending.
3. Having chosen one end of the length of cable, remove the sheath from a length of approximately 70-80 mm, taking care not to cut the shielding (metallic shield and/or aluminium sheet and, if present, the bare connector in contact with the shield) and the wires contained within.
4. If the diameter of the cable used is not large enough to be blocked inside the cable clamp (letter C of Figure 24 on page 59), make it larger by wrapping electrical tape over the protective outer covering in the area adjacent to the unsheathed part (approximate diameter required: 12-13 mm).
5. Pull back the shielding in the sheathe; apply electrician's tape to the end of the shielding as pulled back (letter A of Figure 24, page 59).
6. If the appliance is a **terminal node** of the network connect the three coloured wires to the orange connector, as shown in detail A; of Figure 25 on page 61. Respect the correct indications L, H, GND provided in Table 20 on page 59, on the figure and on the diagram at the base of the connector.
7. If the appliance is an **intermediate node** repeat the operations from step 3 to step 6 for the other length of cable required (so to will have two cable lengths everyone without the sheath). To interlace between they the threads with the same color and to connect them to the orange connector, as shown in detail B; of Figure 25 on page 61.
8. Fix the CAN bus cable (or two cables, according to the type of node being connected) to the cable fixing bracket in the upper part of the inside of the electrical panel so that the rolled-back sheathing makes solid contact with the metal bracket. The cables must be held firmly in place by the bracket if pulled.

To position the jumpers on the board according to the type of node being configured:

You will need: access to the electronic board.

- If the appliance is a **terminal node** on the network (i.e. 3 wires are inserted in the orange connector on the board): set the jumpers as shown in detail **A** of Figure 25.
- If the appliance is an **intermediate node** on the network (i.e. 6 wires are inserted in the orange connector on the board); set the jumpers as shown in detail **B** of Figure 25.



KEY

SCH	Elettronic circuit board
GND-	Common data
L	LOW signal data
H	HIGHT signal data
J1	Board CAN BUS Jumper
A	Detail for " terminal node" (3 wires; J1 = jumpers "closed")
B	Detail for " intermediate node" (6 wires; J1 = jumpers "opened)
P8	CAN PORT/connector

Figure 25 - Connection CAN PORT S61 electronic board.

After having carried out all the above operations, close the electrical panel and refit the front panel of the appliance.

Connection of the CAN bus cable to the DDC

The CAN bus cable has to be connected to the specific orange connector (P8) supplied with the DDC, illustrated in Figure below.

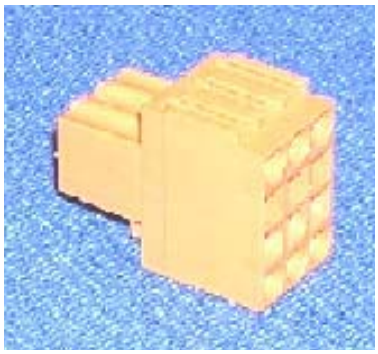
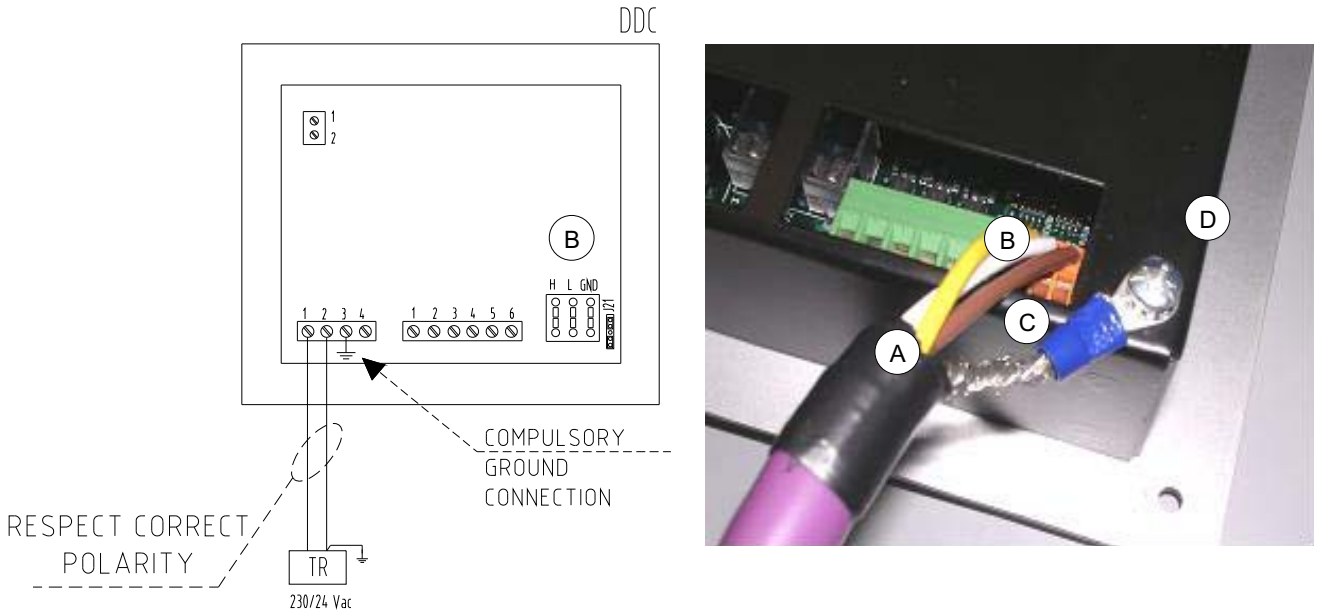


Figure 26 - Orange connector supplied with the DDC for connecting the wires of the CAN bus cable

☞ Before working on the DDC, make sure that it is off. The DDC, like the electronic board on the appliance, has jumpers that must be moved so that it can be configured as an intermediate or terminal node. The position of the jumpers on a new DDC is CLOSED, as illustrated in Figure 27, on page 62.



KEY

GND	Common data	A	Insulating tape protecting CAN bus cable shield
L	LOW data signal	B	CAN bus wires
H	HIGH data signal	C	CAN bus cable shield
J21	jumpers (CLOSED)	D	Eyelet terminal and screw for fixing to base of DDC

Figure 27 - Direct Digital Controller (DDC) – wiring diagram and partial rear view

To connect the CAN bus cable to a DDC

You will need: access to the rear cover of the DDC.

1. Position the jumpers on the DDC according to the type of node being configured. If necessary, open the rear cover of the DDC by unscrewing the 4 screws; after the jumpers have been correctly positioned close the cover again and retighten the 4 screws.
   The positions of the jumpers are illustrated in the following two figures:
   - If the DDC is an **intermediate node** of the network (there are 6 wires in the orange connector), position the jumpers on the DDC as illustrated in Figure 28: OPEN.

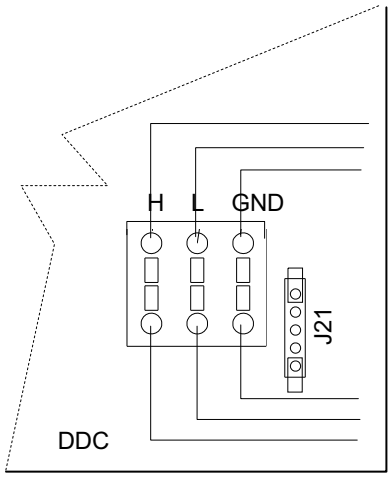


Figure 28 - Connection of 2 CAN bus cables to the DDC: the DDC IS AN INTERMEDIATE NODE. The diagram shows the positions of the wires of the CAN bus cable and the jumpers: OPEN

   - If the DDC is a **terminal node** of the network (i.e. there are 3 wires in the orange connector), position the jumpers on the DDC as illustrated in Figure 29: CLOSED.

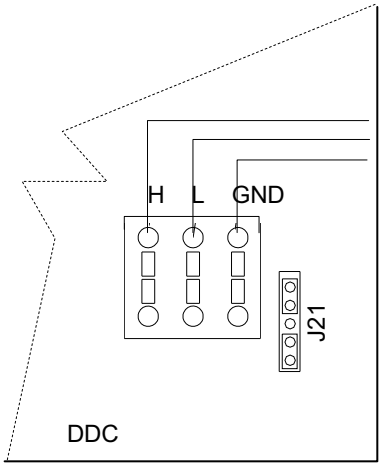


Figure 29 - Connection of 1 CAN bus cable to the DDC: the DDC IS A TERMINAL NODE. The diagram shows the positions of the wires of the CAN bus cable and the jumpers: CLOSED

2. Prepare the orange CAN bus connector, from the supplied sleeve.
3. Cut a length of cable, long enough to allow it to be installed without kinking.
4. Having chosen one end of the length of cable, remove the sheath from a length of approximately 3', taking care not to cut the wires contained inside, the shielding (metallic shield or aluminium sheet) and, if present, the bare connector in contact with the shield and the wires contained within.
5. Roll the shielding and connect it to a 4-mm eyelet terminal as illustrated in Figure 27 on page 62, points C and D. Then, proceed as follows.
6. Connect the three colored wires of the cable to the orange connector, following the diagram in Figure 29, page 63.
   Respect the correct indications L, H, GND provided in Table 20 on page 59, in Figure 29 and on the DDC board at the base of the connector.
   - If the DDC is an **intermediate node** of the network (see Figure 23, page 58): carry out also point 7;
   - If the DDC is a **terminal node** the network (see Figure 23, page 58), do not carry out point 7 and proceed directly to point 8.
7. **For intermediate nodes only**: repeat the operations from point 1 to point 4 for the other length of CAN bus cable necessary. Follow also point 5, but refer to Figure 28, page 63 instead of Figure 29 for the connection of the cable to the connector. Then proceed to point 8.
8. Insert the orange connector with the wires first into the opening in the cover of the DDC, then into the specific socket of the DDC, taking care to insert it correctly.
9. Use the fixing screw of the rear cover, located near the CAN bus socket, to fix the 4-mm eyelet (or 2 eyelets for intermediate nodes, see detail D, Figure 27 on page 62).

Connecting the DDC to the power supply

☞ The DDC requires a low voltage power supply (24 V) with a 230/24 V a.c., 60Hz safety transformer; the minimum power necessary is 20 VA.
For the connection use a cable with the minimum specifications 2 x 18 AWG.

Connect the DDC to the transformer via the 4-pole connector provide for this, following the diagram in Figure 27 on page 62. With the DDC cover opened (unscrew the 4 screws to remove cover), pass the cable through the opening in the cover before fixing the wires to the connector.

As in Figure 27, the connections to the terminals of the 4-pole connector are:

- TERMINAL 1: 24 V
- TERMINAL 2: 0 V (NOTE: connected internally to terminal 3, therefore grounded. If the transformer used already has a wire connected to ground, it must absolutely be connected to this terminal)
- TERMINAL 3: GROUND: connect to a safety ground socket, r ≤ 0,1Ω
- TERMINAL 4: Not used

The DDC is equipped with a backup battery, which allows data to be preserved even when the device is not powered electrically. The backup battery lasts approximately 7 years. To replace it, contact an authorised Robur Technical Assistance Centre (TAC).

After having carried out all of the above operations, close the rear cover of the DDC if opened, and tighten the 4 screws taking care to fasten the eyelet (or eyelets) of the CAN bus cable shield with the screw at the bottom right, as illustrated in Figure 27 on page 62.

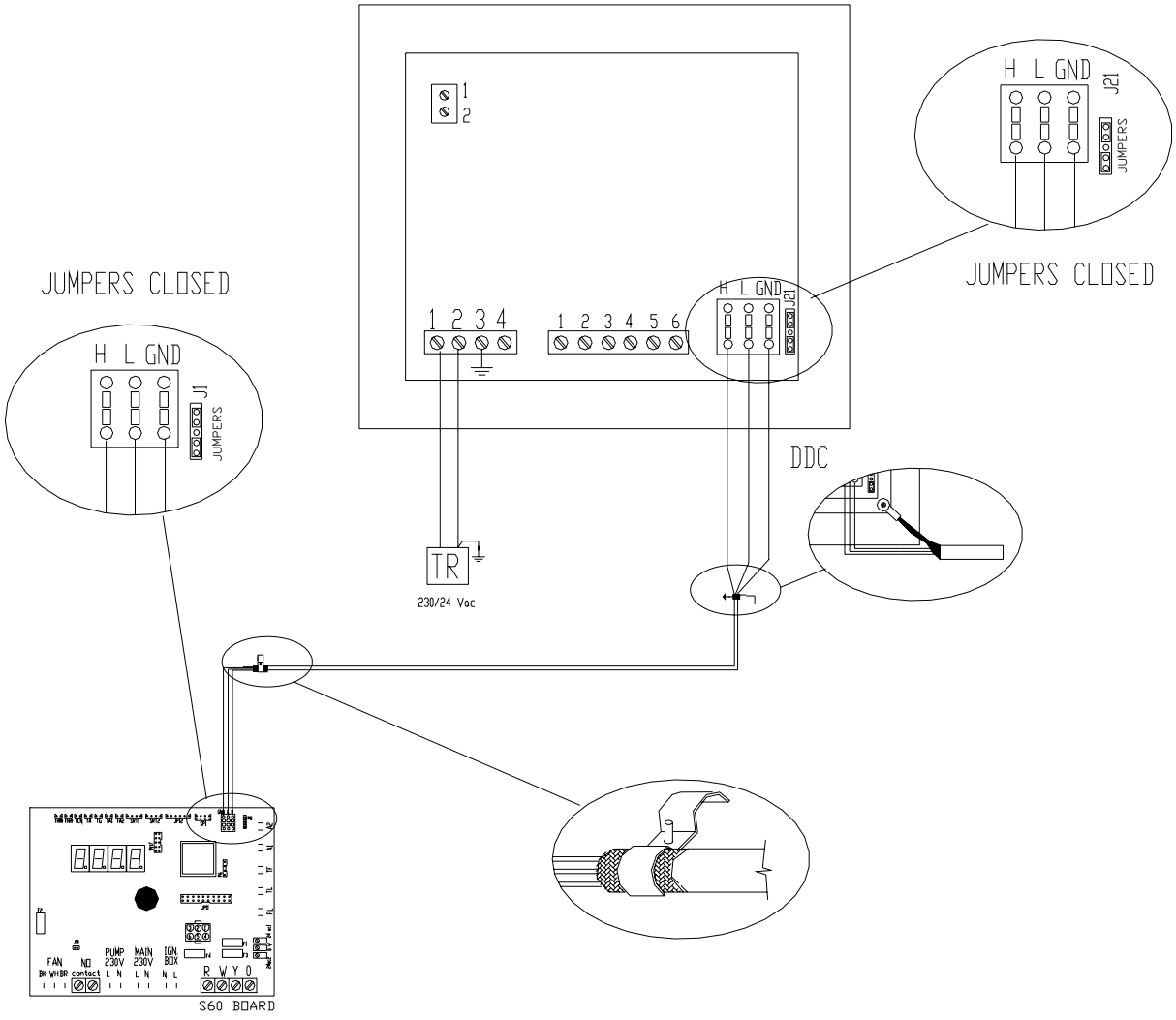


Figure 30 - Example of connection between 1 appliance and 1 DDC

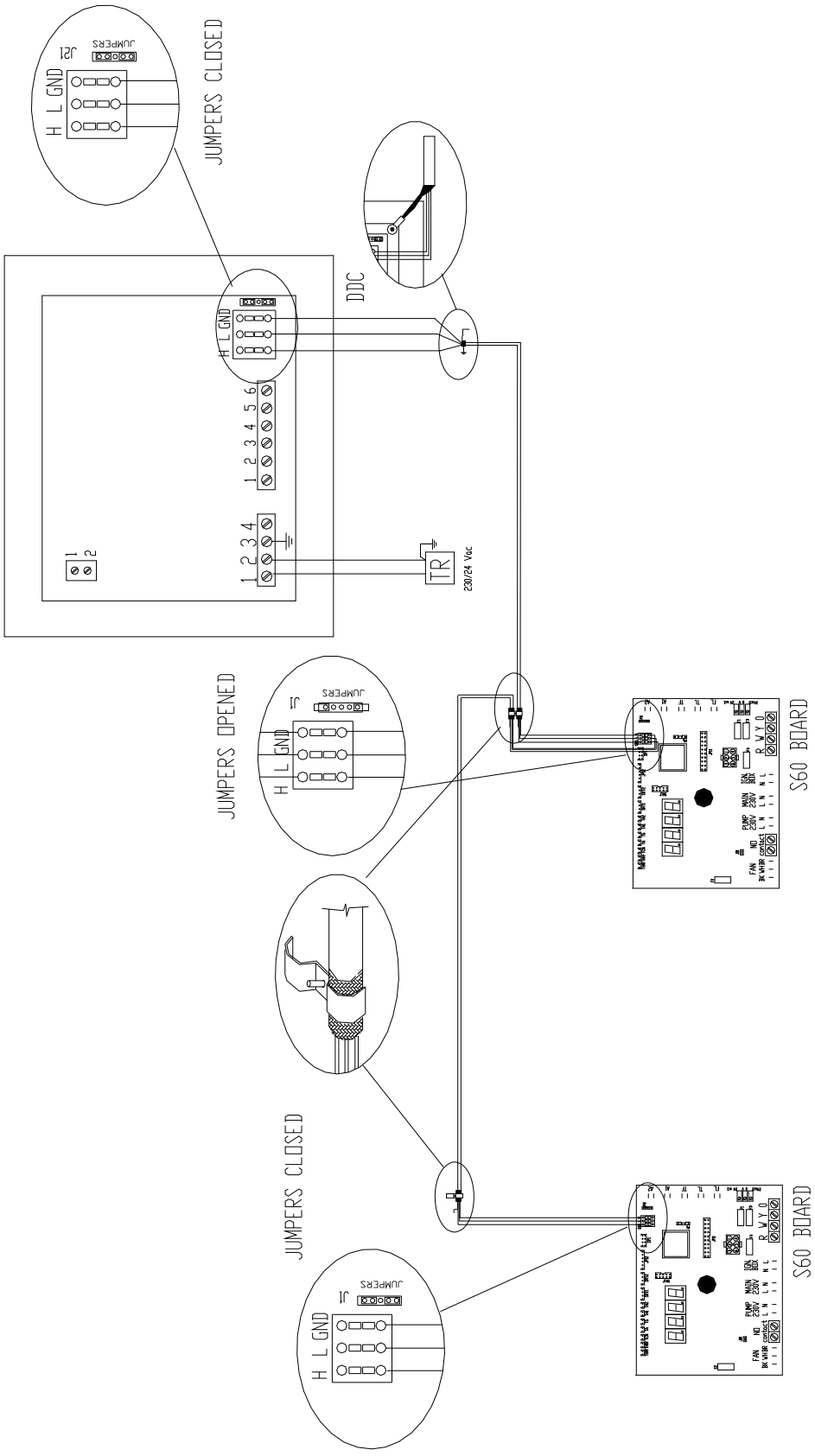


Figure 31 - Example of connection between 2 appliances and 1 DDC.

SECTION 5 FIRST START-UP AND MAINTENANCE

In this section you will find the following information about the appliance:

- Indications required by the authorized Robur Technical Assistance Centre (TAC) in order to carry out the entire procedure of first activation of the appliance (see Paragraph 5.1);

  The entire procedure for first activation of the appliance consists in carrying out the following (main) operating stages:
  - preliminary verification of plant compliance;
  - regulation of gas flow to the burners and switching on of the appliance;
  - regulation of the operating parameters of the appliance via on-board electronic board (or via a DDC, if the appliance is connected to a DDC).

- Indications regarding maintenance operations of the appliance (Paragraph 5.2): general observations and warnings; general indications regarding checks, controls and cleaning operations to perform.

At the end of the section you will find instructions for changing the type of gas (an operation for technical assistance).

☞ Before proceeding with the operations described in this section, the installation technician concerned is invited to read Paragraph 1.1 on page 3.
For a description of the appliance switching on and off procedures, refer to paragraph 2.1 on page 15.
If the appliance is connected to a DDC (and the DDC is in controller mode), for the phases of activation and deactivation of the appliance it is necessary to refer to the two books dedicated to the DDC itself.

5.1 PROCEDURE FOR FIRST START-UP

☞ The entire procedure for the first activation of the appliance must only be carried out by an authorised Robur Technical Assistance Centre (TAC).
The product's guarantee may be void if the procedure is not carried out by a Robur TAC.

Efficient operation and overall lifetime of the appliance depend on its correct use, i.e.:

- correct installation;
- correct use.

 On leaving the factory, the appliance is reliable and tested.

In order to correctly execute the whole procedure for the first start-up of the appliance, it is necessary to perform the following operations in the order shown below:

- initial verification of plant compliance;
- regulation of gas flow to the burners and switching on of the appliance;
- regulation of the plant operating parameters according to the user's requirements.

Preliminary verification of plant compliance

The Robur TAC technician must:

- check that the whole plant has been set up in accordance with its design, following the instructions supplied by the manufacturer and respecting current legislation.
  (The project must have been drawn up by a qualified self-employed professional person);
- check personally that all of the connections (hydraulic/gas and electrical) of the appliance (and of the Direct Digital Controller, if connected to the appliance) have been made correctly;
- check that the necessary conditions for plant compliance effectively exist (as per the declaration consigned to the user by the qualified firm that has carried out installation of the appliance).

☞ The Declaration of Compliance CERTIFIES that the plant 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 overseen the installation of the appliance.

- check that the water pressure and flow in the hydraulic circuit and the static gas supply network pressure are correct, as indicated by the manufacturer.

If all the conditions listed above exist, the TAC can proceed with the operations, performing the "first activation" of the appliance.

If any non-compliant elements arise during the first verification, the TAC may choose not to proceed with the operation of "first activation".

In this case, the Robur TAC technician must:

- advise the user/installation technician of any installation anomaly;
- inform the user/installation technician of any situation that is judged to be hazardous for the appliance and for people;
- inform the user/installation technician of any missing documentation relating to the plant;
- indicate, in relation to the reports made, any corrective measures to be taken on the plant which the installation technician will have to carry out in order to proceed with the operation of "first activation".

☞ It is the responsibility of the user/installation technician to carry out any corrective measures on the plant indicated by the TAC.
Following such corrective measures performed by the installation technician, the TAC will assess the plant again.
At this point, if, in the opinion of the TAC, safety and compliance conditions exist, the TAC must carry out the "first activation".

⚠ Plant situations that are hazardous for people and for the appliance
If one of the following hazardous situations arises, the TAC must not carry out the "first activation":

- appliance installed in a closed room;
- appliance installed too near combustible surfaces or in any case in conditions that do not permit access and maintenance operations in safety;
- control of switching on and off of the appliance not via the DDC or consent switch (CS) but via the internal disconnecting switch (GS) inside the general electrical panel;
- situations attributable to defects or failures of the appliance that took place during its transport or installation;
- smell of gas likely due to leaks from the plant itself and in any case all situations that are due to non-compliant plants, considered (after on-site evaluations) potentially hazardous.

☞ Anomalous plant situations.
If one of the following situations is met, the TAC may carry out the "first activation" at its discretion, but the appliance will be left off until conditions dictated by the manufacturer are restored:

- installations (potentially not hazardous) not carried out according to good workmanship practices, installations (potentially not hazardous) not complying with current national and local regulations;
- installations (potentially not hazardous) not carried out according to good workmanship practices, not complying with the instructions supplied by the manufacturer;
- installations that can lead to operating anomalies of the appliance.

Regulation of gas flow to the burner and activation

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

- Open the gas supply tap to the plant and ascertain that there is no smell of gas (indicating possible leaks).
- Close the gas tap and check the static gas mains pressure (as per the specific procedure "Regulation of gas flow" set out further on: from point 1 to point 6).
- Prepare the units of the appliance for the operation of regulation of gas (as per the specific procedure described further on: from point 7 to point 9).
- Start the appliance electrically, after:

- ascertaining one final time that there is no smell of gas;
- activating the external disconnecting switch of the mains power supply (“GS”, provided by the electrical system installation technician on a suitable panel) moving it to the "ON" position (point 10 of the specific procedure);

- Start up the DDC electrically, if provided (point 10 of the specific procedure; for this operation, see the specific manual for the installation technician – book 1);
- Carry out activation of the appliance via the on/off commands (or via the DDC, if connected);
  (point 11 of the specific procedure; if the appliance is connected to the DDC, for this operation consult the specific final user manual – book 2);
- Proceed with regulation of the gas pressure to the burner of the appliance (as in the specific procedure set out further on: from point 13 onwards).
- Check the dynamic gas mains pressure (if possible on the appliance that is furthest from the point where the plant is connected to the mains) by performing the following points in order:
  stop the appliance
  connect the manometer (points 1 and 2);
  start the appliance again (points 11 and 12);
  read the dynamic mains pressure on the manometer and check that this value satisfies the requirements of point 4 (see also the paragraph “GAS SUPPLY SYSTEM” on page 37).
- Carry out the regulation of the operating parameters of the plant.

In the first activation stage, on the display of the electronic board of the appliance (and/or on the display of the DDC, if connected), an operating code might be visualised.
If the operating code is generated by the electronic board of the appliance, see the list of codes in Table 27 on page 96. If the operating code is generated by the DDC, see the list of codes given in the "installation technician manual – book 1" of the DDC (supplied with it).

Successful first activation ONLY certifies the correct operation of the appliance (and of the DDC, if connected).
It DOES NOT CERTIFY that the plant conforms to current legislation.

Regulation of gas flow

In the phase of first activation of the appliance, regulation of gas flow to the burners of the units of the appliance must be carried out exclusively by an authorized Robur Technical Assistance Centre (TAC). In this phase, NEITHER the user NOR the installation technician is authorized to perform such operations; this could invalidate the guarantee of the appliance.

The appliance is supplied with all of its units already regulated for the type of gas for which the appliance itself is set up. The type of gas for which the appliance is set up can be identified from the adhesive label located on the internal air blower of the units.
During the first activation procedure it is in any case necessary to perform checking and regulation of pressure at the burner of all units of the appliance.
On each unit, proceed as follows, referring to the parameters indicated in Table 21 on page 72 and to the Figure 32 on page 72:

You will need: the appliance connected to the gas and electricity supply, switched off, with the gas valve closed and the front panel removed

Check the static gas mains pressure:

1. Unscrew the fixing screw of the gas pressure intake (detail B in Figure 32 on page 72).
2. Connect the manometer to the gas intake (mains pressure).
3. Open the gas valve.
4. Read the value of the static gas mains pressure on the manometer and check that the value read is correct:
   - 7 in_{WC} for natural gas (G20)
   - 11 in_{WC} for L.P. gas.
5. Close the gas valve.
6. Remove the manometer and retighten the fixing screw of the gas pressure intake.

Regulate the gas flow:

7. With gas valve closed, unscrew the fixing screw of the gas pressure outlet (detail C, Figure 32 on page 72).
8. Connect the manometer to the gas pressure outlet.
9. Open the gas valve.
10. Supply electrical power to the appliance (and to the DDC, if connected).
11. Start the appliance via the on/off commands (or via the DDC, if connected and in controller mode).
12. Wait for the burner to ignite. If ignition fails at the first attempt, the flame control unit makes three further attempts. If the burner fails to ignite at the fourth attempt, the flame control system is arrested. In this case, reset the flame control box via the electronic board (or the DDC, if connected) and repeat point 11 until successful ignition of the burner is achieved.

13. With the burner lit, check the pressure indicated by the manometer against the pressure indicated in Table 21, page 72.
14. If necessary, regulate the gas pressure:
    keep the burner lit and the manometer connected; remove the protective cap of screw A (detail A, Figure 32);
    turn screw A of the gas valve (detail A, Figure 32), clockwise to increase the pressure or anticlockwise to decrease it, until the pressure indicated in Table 21 is reached;
    at the end of the operation, replace the protective cap of screw A.
15. Switch off the appliance via the on/off commands (or via the DDC, if connected and in controller mode).
16. Remove the manometer and retighten the fixing screw of the gas pressure outlet (detail C, Figure 32).
17. Check for possible leaks on the gas network with a solution of soap and water.

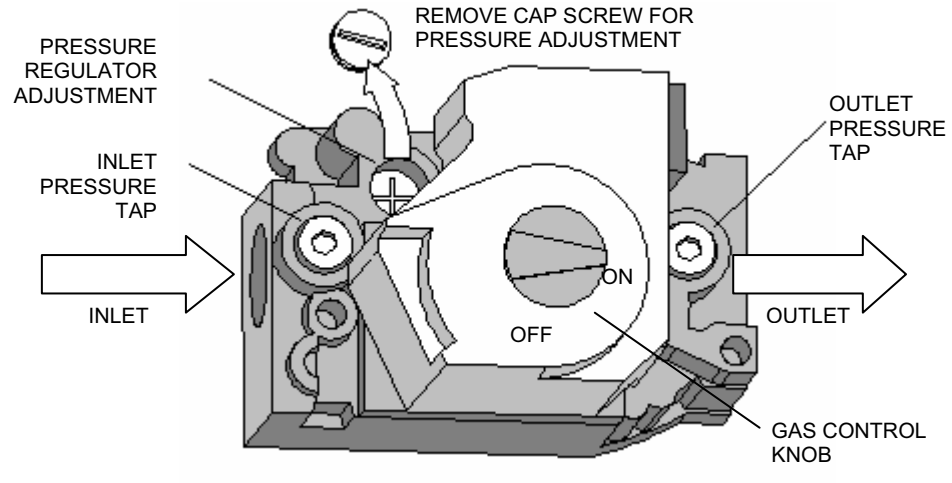


Figure 32 - Gas valve (SIT 830) of the appliance.

GAS TYPE	NATURAL GAS	LP GAS
MANIFOLD PRESSURE	2.8 WC INCHES	5.1 WC INCHES
NOZZLE DIAMETER	0.21”	0.14”

Table 21 - Gas pressure to the burner, air diaphragm and nozzle diameters

Regulation of plant operating parameters

Regulation of operating parameters of the plant occurs via the electronic board (see Paragraph 3.8 on page 44) or via the DDC (if connected).

If the appliance is connected to a Direct Digital Controller (DDC), for operations regarding the regulation of plant operating parameters according to the user’s requirements, refer to the DDC’s manual (final user manual – book 2) supplied with it.

5.2 MAINTENANCE

Correct maintenance prevents problems, guarantees maximum operating efficiency of the appliance and allows running costs to be reduced.

Before carrying out any operation on the appliance, switch it off via the appropriate on/off commands (or via the DDC, if connected and in controller mode) and wait for the shutdown cycle to terminate.
When the appliance is off, disconnect it from the gas and electricity mains via the external disconnecting switch (GS) and the gas valve.

Caution: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.
Verify proper operation after servicing.

Any operation that regards internal components of units of the appliance must be carried out by and authorized Robur Technical Assistance Centre (TAC), according to the instructions supplied by the manufacturer.

Ordinary scheduled maintenance

Perform the operations described below **at least once a year**. If the unit is subjected to particularly heavy use (for example in processing plants or in other conditions of continuous operation), these maintenance operations must be performed more often.

Maintenance operations that may be performed by the user:

- Cleaning the finned coil.
  If the installation environment is particularly dusty, it is advisable to fit a filter for the finned coil – see the "Optionals and Spare Parts" section, on page 79.

You will need: the appliance disconnected from gas and electricity supply

- with a brush, remove any dust and dirt that has accumulated on the outside of the finned coil, taking care not to damage the fins;
- check that all dirt has been removed;
- restore the supply of gas and electricity to the appliance: open the gas supply valve and put the external disconnecting switch (GS) in the "ON" position;
- start the appliance by means of the on/off operation commands (or via DDC, if connected and in controller mode).

Maintenance operations that the user may NOT carry out
(operations to be performed by a Robur TAC).

- Checking that the combustion circuit is fully functional:
- inspect and clean flue gas passage (see after);
- cleaning of the burner (see after)
- checking the ignition and flame detector system.

- Checking that the oil pressure pump is operating correctly:
- checking the oil level;
- checking the transmission belts (replacement every 5 years or 10,000 hours of operation).
- Checking cleanliness of the water filters and efficiency of internal water flow meter.

Inspection and cleaning of the flue gas passage:

You will need: the unit shut off

1. Turn off gas and electric supply to the unit.
2. Remove front panel.
3. Clean the base pan around the generator housing of any debris.
4. Look at the flue opening at the right of the generator housing and clear any debris that may be obstructing the opening (see Figure 23).
5. Look at the air intake chute for combustion air and clear any debris that may be obstructing the opening.
6. Reinstall front door.
7. Turn on gas and electric supply to the unit.
8. Start unit to check for correct operation.

Inspection and cleaning of the burner:

You will need: the unit shut off

Tools Needed:

- Fiber Bristle Brush
- Dust Mask (3M #8710 or equal)
- Safety Goggles
- Hand Tools

1. Shut off gas and electric supply to unit.
2. Remove front panel.
3. Remove bolts and nuts securing pre-mixer blower housing to burner tube flange.
4. Remove screws holding burner and insulation retaining straps.

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

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

Note: Be careful not to distort or damage the burner tube or the igniter and sensor assemblies in the generator housing.

6. Position burner tube with open end down.
7. Clean burner tube ports with fiber bristle brush and shake any debris out of the tube.
8. Inspect burner tube gasket that seals the burner tube to the generator housing and the burner flange gasket that seals burner to pre-mixer blower housing. Replace either gasket if damaged during burner removal process. (Burner tube gaskets – Kit No. 16009-716)
9. Replace burner tube in reverse order of removal.

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

10. Turn on gas and electric supply to unit.
11. Start unit and check for correct operation.

Extraordinary maintenance

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

- Adding water and antifreeze to the hydraulic plant

If it should be necessary to add water to the plant, add a suitable quantity, making sure that it contains the minimum quantity (see Paragraph 3.5 on page 39).

If necessary (see Paragraph 3.5 on page 39), add to the water in the plant (free from impurities) glycol antifreeze of the inhibited monoethylene type in a quantity in proportion to the MINIMUM winter temperature in the area of installation.

For the filling operation, proceed as described in Paragraph 3.5.

Bring the plant to the correct pressure, making sure that the water pressure is never less than 14.5 PSIg and does not exceed 29 PSIg.

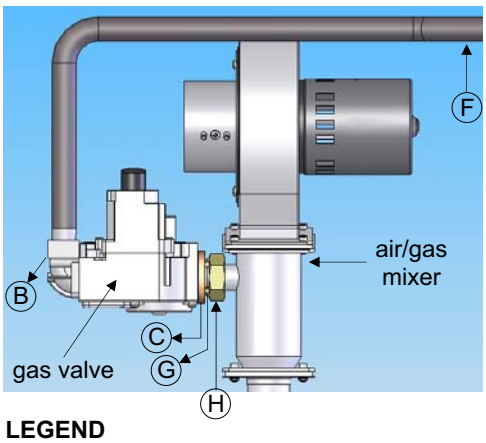
5.3 CHANGE OF GAS TYPE

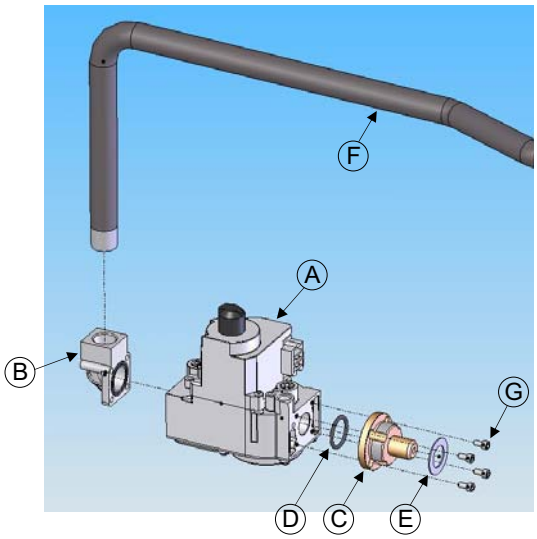
This operation must be carried out exclusively by an authorized Robur Technical Assistance Centre (TAC).

If the appliance is to operate with a type of gas (methane or L.P.G.) different from that indicated on the sticker located on the internal air blower of the individual units, it is necessary to switch off the appliance, remove the electrical and gas supplies and operate on it as follows (see Figure 33 on page 77):

You will need: the appliance switched off and disconnected from the gas/electricity mains

1. remove the front and left panel of the appliance;
2. unscrew the fixing screw of the gas supply pipe (F) above the electrical panel of the appliance;
3. unscrew the hexagonal nut (see details H) that connects the brass nozzle to the air/gas mixer; use a number 36 wrench for this purpose;
4. remove the nozzle by unscrewing the 4 screws (see detail G). Use a 9/64 hex key wrench.
5. replace the removed nozzle with one of the suitable diameter for the gas that is to be used (see detail C), positioning the new o-ring seal (supplied) between electro valve and nozzle; use a 9/64 hex key wrench to fix again the screws;
6. reconnect the brass nozzle to the mixer tightening the hexagonal nut, taking care to position the new circular seal (supplied with the kit) correctly;
7. retighten the fixing screw of the gas supply pipe (F) above the electrical panel of the appliance;
8. supply gas and electricity to the appliance, and reactivate the appliance;
9. regulate the gas pressure to the appliance so that it is the same as that indicated in Table 21, page 72 for the gas that is to be used, following the instructions given in “Regulation of gas flow” on page 71. Then replace the sticker indicating the type of gas for which the appliance was set up with one that indicates the new type of gas used;
10. complete the gas change operation by checking that all gas pipe connections, including those that are not directly affected by the current procedure, are correctly sealed (use a solution of soap and water or another suitable means for this purpose);
11. refit the front left panel and finally the front panel.





LEGEND

A 24 Vac GAS CONTROL VALVE
B GAS VALVE FLANGE
C GAS NOZZLE
D O-RING
E GASKET
F GAS SUPPLY PIPE
G BURNISHED SCREW (n. 4)
H HEXAGONAL NUT

Figure 33 - Operations for change of gas type.

SECTION 6 OPTIONALS AND SPARE PARTS

This SECTION contains a list of accessories available for installation and use of the appliance. To order them, contact Robur Corporation (phone: (812) 424.1800).

GAHP-AR OPTIONALS

OPTIONALS FOR THE HYDRAULIC SYSTEM INSTALLATION TECHNICIAN			
Name	**Description**	**Code**	**Notes**
FINNED COIL FILTER kit for unit	Blocks impurities present in air drawn in through the fan coil and makes it easier to clean	O-FLT004	Use one kit for each appliance.
ANTIVIBRATION MOUNT kit FOR BASE	Kit consisting of 4 anti-vibration feet, to be fixed in the holes already provided on the beams of the base	O-NTV003	For the position of the fixing holes, see Figure 3, on page 14.
HYDRAULIC SEPARATOR	Separator to balance hydraulic circuits; with automatic air discharge, outlet valve and insulation	O-SPR000	
GLYCOL ANTIFREEZE	GLYCOL ANTIFREEZE for hot/cold hydraulic plants	O-GLC001	10-litre can
OPTIONALS FOR ELECTRICAL SYSTEM INSTALLATION TECHNICIAN			
Name	**Description**	**Code**	**Notes**
DDC - Direct Digital Controller	Allows remote control of one or more appliances	O-CRM007	1 DDC for max. 16 GAHP-AR units on the same plant (see Figure 2 on page 8 for a picture of DDC)
Robur “NETBUS” CAN BUS cable	Cable for data communication networks: for network connection between DDC and appliance	O-CVO008	Max. length: 450 metres (see Table 20 on page 59).

Table 22 - GAHP-AR optionals

GAHP-AR SPARE PARTS

Below are the lists of the spare parts for GAHP-AR appliance. Each list comes after the respective exploded drawing, which pictures each part in the list with its progressive number.
Spare parts can be ordered from Robur Corporation.

Exploded drawing n.1: INSULATING, WATER PIPES AND ACCESSORIES

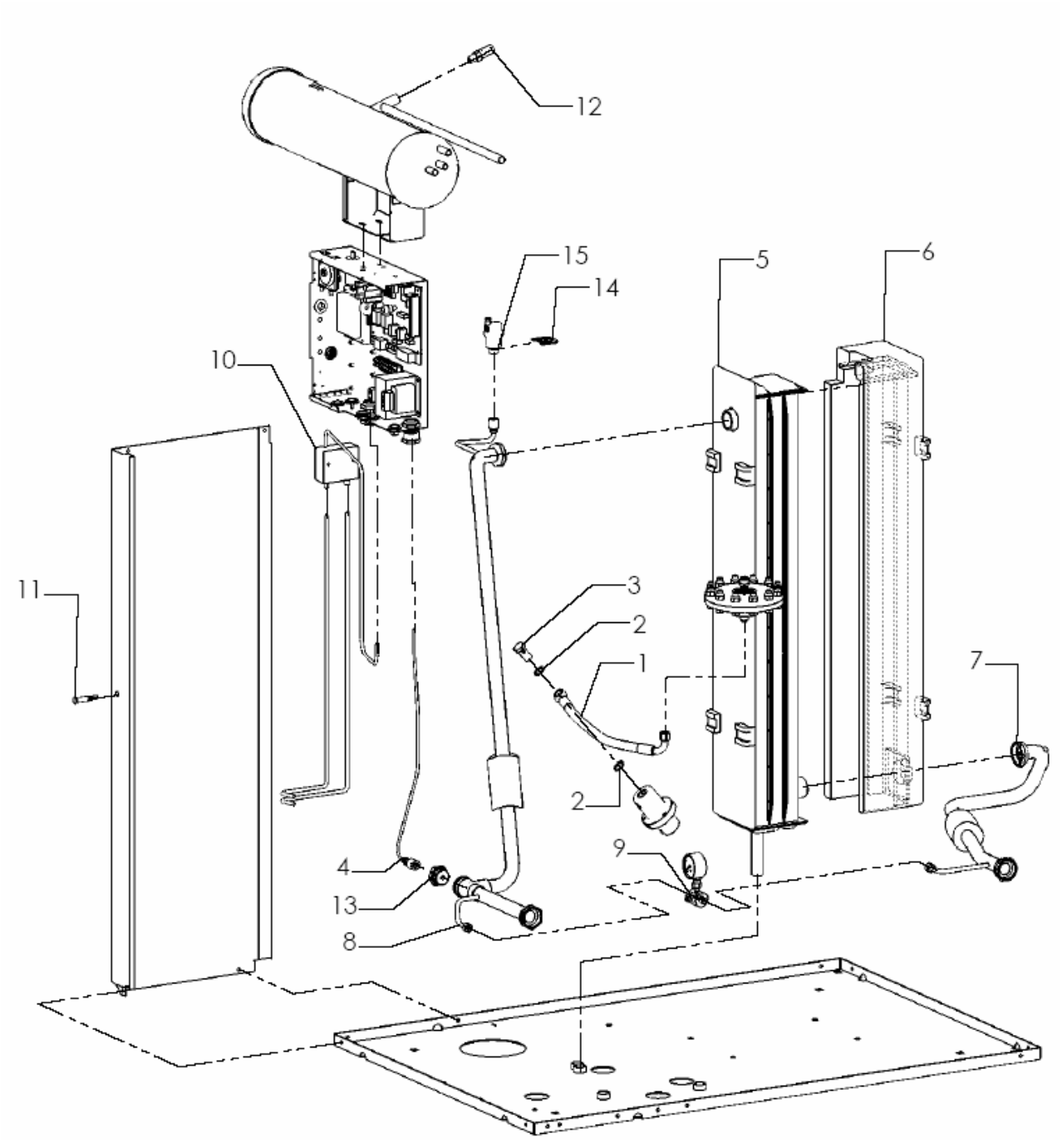


Figure 34 - Exploded drawing n.1 – see next table for the relative parts list.

Ref.	Code	Description	Q.ty
1	J-TBO358	PUMP HIGH PRESSURE PIPE	1
2	N-RND016	D.3/8"x1,5 COPPER WASHER	2
3	N-BLL000	PUMP GAS SCREW 3/8”	1
4	J-FLS009	WATER FLOWSWICH FOR S61	1
5	C-CBN091	ABSORBER FRONT-SIDE INSULATING	1
6	C-CBN092	ABSORBER REAR-SIDE INSULATING	1
7	R-TBO418	WATER DELIVERY PIPE	1
8	R-TBO420	WATER RETURN PIPE	1
9	K-MNM002	DIFFERENTIAL MANOMETER KIT	1
10	J-TRS007	IGNITER TRANSFORMER	1
11	E-LMP013	SIGNAL LIGHT 230V WITH FAST-ON	1
12	G-VLV032	PRESSURE RELIEF VALVE	1
13	R-GFS001	FLOWSWICH CLAMPING RING NUT	1
14	L-STF189	AIR BREATHER VALVE BRACKET	1
15	H-VLV000	AUTOMATIC AIR BREATHER VALVE	1

Table 23 - Exploded drawing n.1 spare parts

Exploded drawing n.2: ELECTRICAL BOX AND PUMP

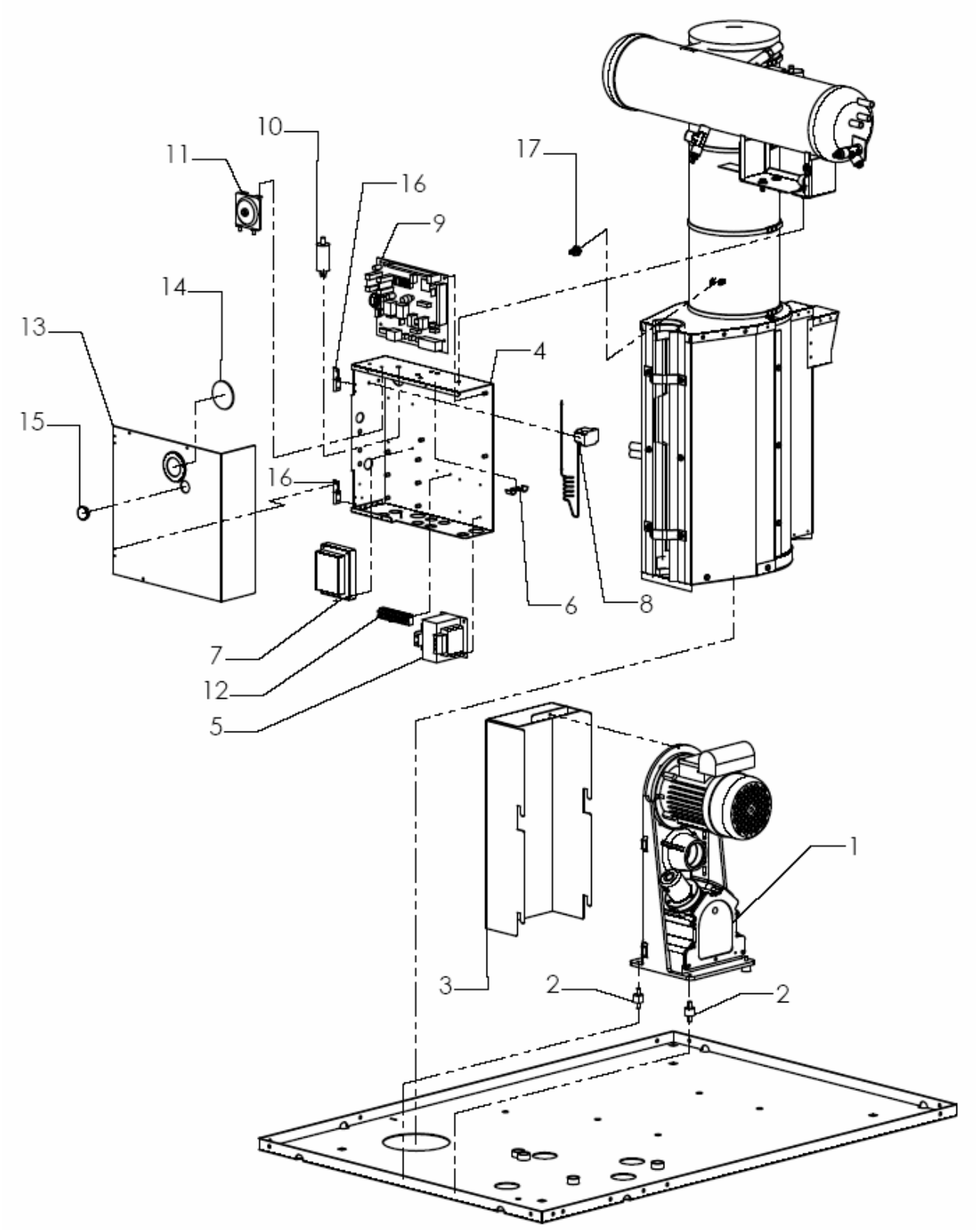
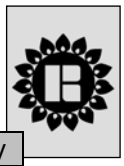


Figure 35 - Exploded drawing n.2 – see next table for the relative parts list.



Ref.	Code	Description	Q.ty
1	R-PMP009	60 Hz OIL PUMP	1
2	J-NTV000/B	MX20/15 VIBRATION DAMPING	2
3	J-CRT003	PUMP CARTER	1
4	L-BQD018	ELECTRIC PANEL BASE	1
5	E-TRS013	60 Hz 208-240/24V/40VA ELECTRICAL TRANSFORMER	2
6	L-STF149	GROUND CONNECTION BRACKET	1
7	E-CNT031	24 Vac, 60Hz, MICROPROCESSOR BASED HSI CONTROL	1
8	J-TLT020	COMBUSTION CHAMBER THERMOSTAT	1
9	E-SLT031	S61 CF24 ELECTRICAL BOARD	1
10	E-CND011	CONDENSER 12.5 µF 450 V	1
11	G-PRS000	AIR PRESSURE SWITCH ACF60.2 60 Hz	1
12	E-MRS020	9 STUD TERMINAL BOARD WITH REED	1
13	L-CQD011	ELECTRIC BOX COVER	1
14	C-12100960	INSPECTION HOLE GLASS	1
15	N-TPP019	D.25 PROTECTION CAP	1
16	N-CRN000	ELECTRIC BOX HINGE	2
17	J-TLT015	LIMIT THERMOSTAT FOR GENERATOR	1

Table 24 - Exploded drawing n.2 spare parts.

Exploded drawing n.3: COMBUSTION CHAMBER AND GAS SYSTEM

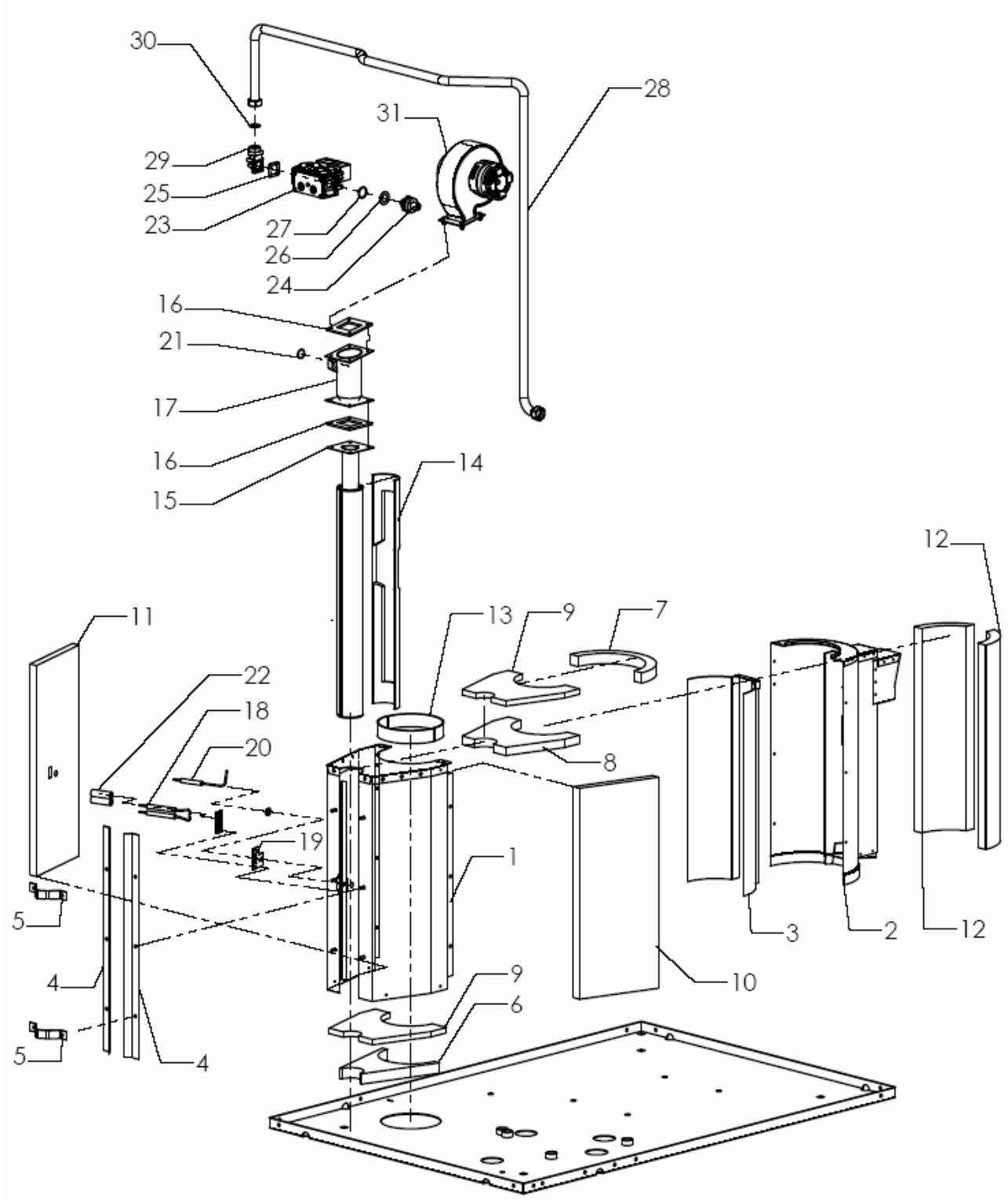


Figure 36 - Exploded drawing n.3 – see next table for the relative parts list.

Ref.	Code	Description	Q.ty
1	J-CCM026	FRONT COMBUSTION CHAMBER ASSY	1
2	S-CMR000	REAR COMBUSTION CHAMBER ASSY	1
3	H-CMR002	COMB. CHAMBER INTERNAL CONVEYOR	1
4	L-STF120	RETAINER BURNER	2
5	L-MFS000	BURNER TUBE CLIP	2
6	C-CBN040	FRONT BOTTOM INSULATION	1
7	C-CBN038	REAR UPPER INSULATION	1
8	C-CBN037	FRONT-TOP INSULATION	1
9	C-CBN042	COMBUST. CHAMBER BASE INSULATION	2
10	C-CBN080	RIGHT COMBUST. CHAMBER INSULATION	1
11	C-CBN081	LEFT COMBUST. CHAMBER INSULATION	1
12	C-CBN039	COMB. CHAMBER REAR-SIDE INSULATION	2
13	C-CBN041	COMB. CHAMBER/GENERATOR INSULATION	1
14	J-CBN029	BURNER INSULATION	1
15	J-BRC017	BOILER BURNER	1
16	J-GRN028	BURNER UNION TRIMMING	2
17	R-DFF009	INCLINED AIR-GAS MIXER	1
18	J-LTT047	SPARKLING ELECTRODE	1
19	C-GRN086	SENSOR FLAME ELECTRODE GASKET	1
20	J-LTT046	SENSOR FLAME ELECTRODE	1
21	N-GRG006	2075 NB 70 O-RING	1
22	J-CSL000	D.11/16 x 50 CERAMIC INSULATION	1
23	G-VLV052	24 VAC GAS CONTROL VALVE	1
24	B-GLL150	Ø 5.3 METHANE NOZZLE	1
	B-GLL153	Ø 3.6 GPL NOZZLE	1
25	C-GRN041	24x24 GAS PIPE GASKET	1
26	C-GRN040	1” GASKET	1
27	N-GRG000	3087 NBR NT 70 O-RING	1
28	R-TBO645	GAS TUBE COMPONENT	1
29	G-FLN019	90° ½“ NPT GAS VALVE FLANGE	1
30	C-GRN057	CENTELLEN 200 ¾” GASKET	1
31	K-SFF038	BLOWER KIT	1

Table 25 - Exploded drawing n.3 spare parts.

Exploded drawing n.4: PANELS KIT

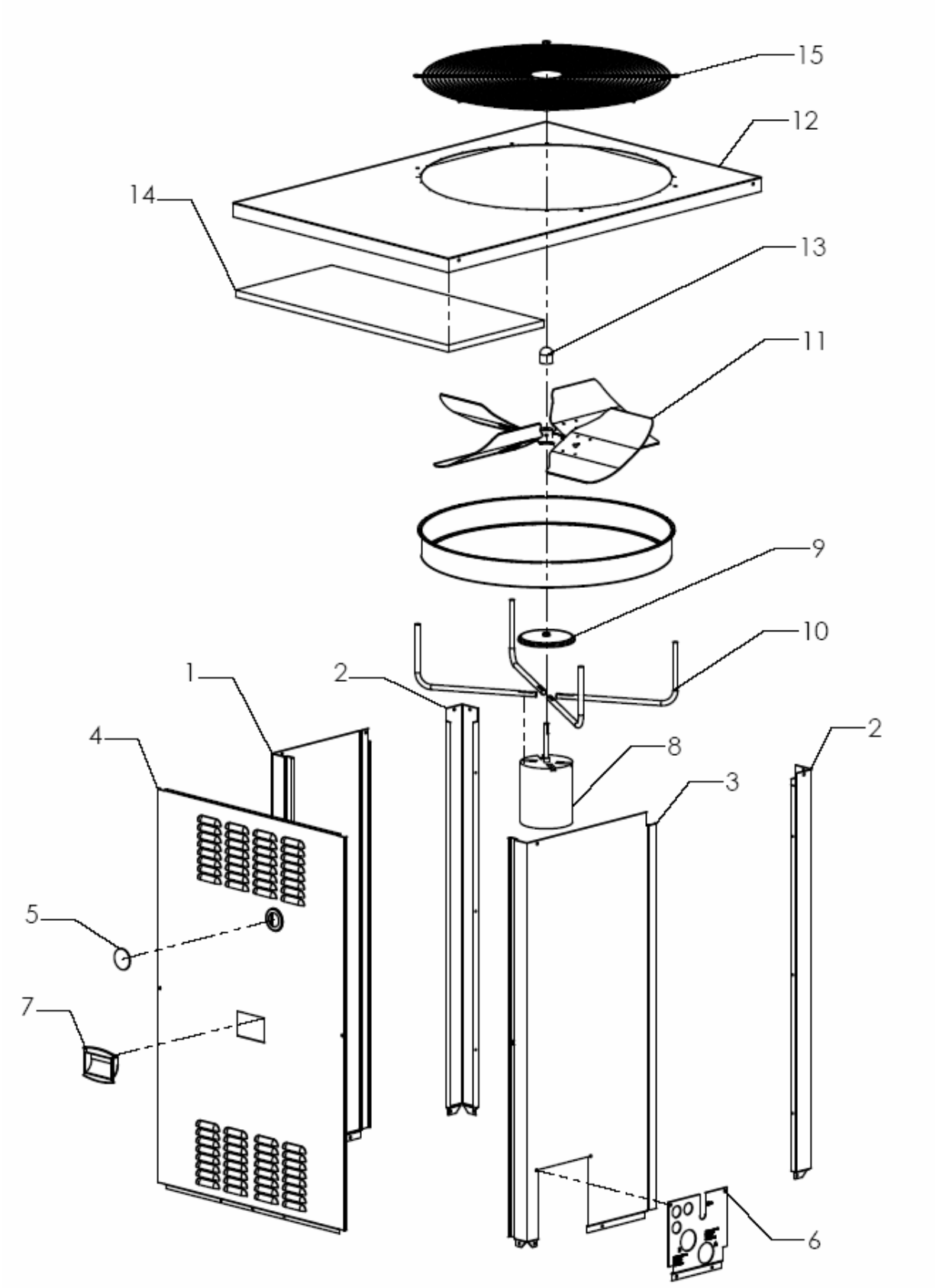


Figure 37 - Exploded drawing n.4 – see next table for the relative parts list.

Ref.	Code	Description	Q.ty
1	P-MNS035	PAINTED FRONT-LEFT COLUMN	1
2	P-MDS004	PAINTED BACK RIGHT-LEFT COLUMN	2
3	P-MND020	PAINTED FRONT-RIGHT COLUMN	1
4	P-PNF063	COMPLETE PAINTED FRONT PANEL	1
5	C-12100960	INSPECTION HOLE GLASS	1
6	L-PST068	SILK SCREENED SERVICE PLATE	1
7	N-MNG000	PANELS HANDLE	1
8	E-MTR056	60 Hz FAN MOTOR	1
9	V-PRT000	60 Hz MOTOR RAIN SHIELD	1
10	L-STF210	60 Hz FAN MOTOR BRACKET	4
11	V-VNT025	BLADE ASSEMBLY – FAN – 26” Ø – 60 Hz	1
12	P-CPR048	PAINTED SUPERIOR PANEL	1
13	N-TPP061	Ø33.4 H.25 VINYL CAP	1
14	C-CBN028	380X840 SUPERIOR PANEL INSULATION	1
15	J-GPR000	FAN GRID	1

Table 26 - Exploded drawing n.4 spare parts.

APPENDIX

IGNITION CONTROL BOX

When power is supplied to the unit (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 volts 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 air flow fault will appear. 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 air flow fault will occur if the air pressure switch contacts remain opened 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.

As soon as the ignition period ends, the flame sensor checks for flame presence. If the flame is detected, the gas valve and pre-mixer blower remain energized.

Should the burner fail to light, 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. In lockout, the gas valve will de-energize immediately and the pre-mixer blower will turn off. Ignition control box requests a reset operation to restart.

The thermostat (“W” terminal), air pressure switch and burner flame are constantly monitored to assure proper system operation. When the call for heat has ended (24volts 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 ignition box, see related procedure in paragraph “RESET OPERATIONS AND MANUAL DEFROSTING COMMAND”, on page 21.

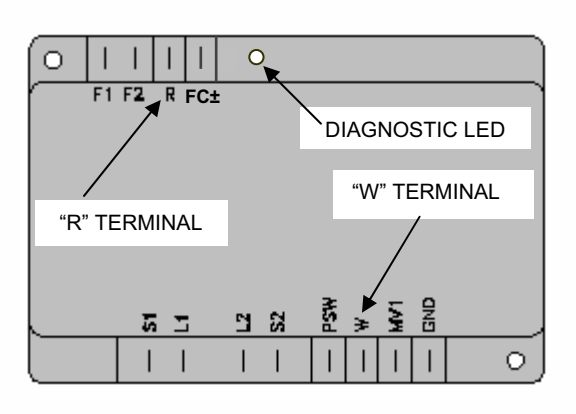


Figure 38 - Ignition control box.

WARNINGS AND ERRORS

If, during the operation of the appliance, the display of the electronic board of the appliance (or also of the display of the Direct Digital Controller, if connected) signals an operating code, it is necessary to:

- take note of the indications shown on the display;
- consult the (specific) list of the operating codes;

  For a list of the operating codes generated by the S61 electronic board, refer to Table 27 on page 96.
  If the appliance is connected to a DDC, a list of the operating codes generated by the DDC is provided in the DDC's manual (see "installation technician manual – book 1");

- follow the instructions given in it strictly (contacting the authorized Robur Technical Assistance Centre, "TAC", when required).

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

- verify that the on/off command controls (CS, W/Y: see Figure 18 on page 53) or that the DDC (if connected and in controller mode) are in such a position as to require the operation of the appliance;
- ensure that the external disconnecting switch fitted by the electrical installation technician on a suitable panel (GS: see Figure 17, Figure 19 and Figure 20 from page 53 to 55) is in the "ON" position;
- check that the gas supply valve is open;
- verify that there are no further indications given on the display.

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

- refrain from proceeding by trials and errors. Instead, ask an authorised Robur Technical Assistance Centre (TAC) to intervene, communicating the operating code reported;
- disconnect the appliance from the gas and electricity mains, interrupting the gas supply by means of the tap and the power supply by means of the external disconnecting switch "GS", and await the arrival of the TAC contacted.

For the operating codes generated by the S61 electronic board of the appliance, refer to the Table 27 on page 96, that follows.

For instructions regarding how to clear operating codes via the S61 board of the appliance, refer to paragraph 2.4 on page 21.

TABLE OF OPERATING CODES (firmware release 3.016)

The following operating codes can be generated by the electronic control board S61; they could be shown both on the same S61 and on the DDC, if present.

	␣ 601
	MANUAL RESET OF THERMOSTAT, GENERATOR LIMIT TEMPERATURE
CODE GENERATED BY:	High temperature detected by limit thermostat on body of generator (T> 330.8 °F).
RESET METHOD:	Reset limit thermostat manually: GAHP-AR operation will be restored automatically when the cause ceases. If code ␣ 601 persists, it becomes E 601.
	E 601
	MANUAL RESET OF THERMOSTAT, GENERATOR LIMIT TEMPERATURE
CODE GENERATED BY:	␣ 601code active for 1 hour, or ␣ 601 code generated 3 times in 2 hours of operation.
RESET METHOD:	Contact Robur TAC.
	␣ 602
	EXHAUST GAS THERMOSTAT - AUTOMATIC RESET
CODE GENERATED BY:	High temperature detected by exhaust gas thermostat (T> 473 °F).
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 14.4 °F (T< 458.6 °F).
	E 602
	EXHAUST GAS THERMOSTAT – MANUAL RESET
CODE GENERATED BY:	␣ 602 code active for 1 hour, or ␣ 602 code generated 3 times in 2 hours of operation.
RESET METHOD:	Reset may be performed through the board via menu 2, Parameter 1 (or from DDC). If code ␣ 602 and/or E 602 occur again, contact Robur TAC.
	␣ 603
	COLD WATER ANTIFREEZE THERMOSTAT
CODE GENERATED BY:	Low temperature detected by cold outlet water sensor, or sharp drop in temperatures detected by cold outlet or inlet water sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 3.6 °F.
	␣ 604
	INADEQUATE VENTILATION / CONDENSER OVERHEATING
CODE GENERATED BY:	(TCN - TA) values > limit set.
RESET METHOD:	Reset occurs automatically 20 minutes after the code is generated.

E 604	
INADEQUATE VENTILATION / CONDENSER OVERHEATING	
CODE GENERATED BY:	␣ 604 code generated 2 times in 2 hours of operation.
RESET METHOD:	Carry out appropriate checks. Reset may be performed through the S61 board via menu 2, Parameter 1. If the code persists, contact Robur TAC.
E 605	
HIGH AMBIENT TEMPERATURE	
CODE GENERATED BY:	HIGH temperature detected by ambient temperature sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 3.6 °F.
E 606	
LOW AMBIENT TEMPERATURE	
CODE GENERATED BY:	LOW temperature detected by ambient temperature sensor.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 3.6 °F.
␣ 607	
HIGH CONDENSER INLET TEMPERATURE	
CODE GENERATED BY:	High temperature detected by condenser inlet temperature sensor (T> limit set: menu 1, Parameter 66).
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases, with hysteresis of 90 °F.
E 607	
HIGH CONDENSER INLET TEMPERATURE	
CODE GENERATED BY:	␣ 607 code active for 1 hour, or ␣ 607 code generated 12 times in 2 hours of operation.
RESET METHOD:	Carry out appropriate checks. Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 608	
FLAME CONTROL UNIT ERROR	
CONDIZIONI DI INTERVENTO:	E612 code on GAHP-AR in and inlet temperature increasing by over 18 °F within 1 hour.
RESET METHOD:	Carry out appropriate checks. Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
␣ 610	
WATER CIRCUIT FLOWMETER: Insufficient water flow	
CODE GENERATED BY:	Insufficient water flow (the circulator is "on" and the water flowmeter remains "open").
RESET METHOD:	Reset occurs automatically when correct water flow is restored or if the circulation pump goes off.
E 610	
WATER CIRCUIT FLOWMETER: Insufficient water flow	
CODE GENERATED BY:	␣ 610 code generated 5 times since appliance was powered, or code ␣ 610 is active for 1 hour.
RESET METHOD:	Reset may be performed via S61 board, menu 2, parameter 1 (or via DDC). If the Code persists, contact Robur TAC.
␣ 611	
INSUFFICIENT ROTATION OF OIL PRESSURE PUMP	
CODE GENERATED BY:	Insufficient rotation of oil pressure pump.
RESET METHOD:	Reset occurs automatically 20 minutes after the code is generated.
E 611	
INSUFFICIENT ROTATION OF OIL PRESSURE PUMP	
CODE GENERATED BY:	␣ 611 code generated 2 times in 2 hours of operation.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
␣ 612	
FLAME CONTROL UNIT ARREST	
CODE GENERATED BY:	Burner ignition failure.
RESET METHOD:	Reset occurs automatically when the solenoid valve opens again (new ignition attempt).

E 612	
FLAME CONTROL UNIT ARREST	
CODE GENERATED BY:	Flame arrest signal.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 0 (or via DDC). If the code persists, contact Robur TAC.
E 616	
OUTLET WATER TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on outlet water temperature sensor.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 617	
COLD INLET WATER TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on inlet water temperature sensor.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 618	
CONDENSER OUTLET TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on condenser outlet temperature sensor
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 620	
CONDENSER INLET TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on condenser inlet temperature sensor.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 628	
GAS SOLENOID VALVE EXCITED WHEN THE FLAME CONTROL BOX IS LOCKED	
CODE GENERATED BY:	The flame control box is locked (E 612) but the gas solenoid valve is excited. In this case the flame control box is reset (E 612 resets)
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
␣ 629	
GAS ELECTROVALVE WITHOUT ELECTRICAL POWER	
CODE GENERATED WHEN:	Gas electrovalve is off for 5 seconds (with central flame control unit on).
RESET METHOD:	Reset occurs automatically if the gas electrovalve switches on again within 10 minutes (with central flame control unit on).
E 629	
GAS ELECTROVALVE WITHOUT ELECTRICAL POWER	
CODE GENERATED WHEN:	Code ␣ 629 is active for more than 10 minutes (with central flame control unit on).
RESET METHOD:	Carry out appropriate checks. Reset may be performed via S61 board, menu 2, parameter 1 (or via DDC). If the code persists, contact ROBUR TAC.
E 644	
EVAPORATOR TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Fault (interruption or short circuit) on evaporator temperature sensor.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
␣ 646	
HIGH HOT INLET WATER TEMPERATURE	
CODE GENERATED BY:	Hot inlet water temperature higher than upper operating limit of the appliance (if the appliance is in operation).
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases. If the code persists, contact Robur TAC.

	⊔ 647
	LOW HOT INLET WATER TEMPERATURE
CODE GENERATED BY:	Hot water temperature lower than lower operating limit of the appliance (if the appliance is in operation).
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases. If the code persists, contact Robur TAC.
	E 647
	LOW HOT INLET WATER TEMPERATURE
CODE GENERATED BY:	⊔ 647 code generated 3 times in 1 hour with the circulator on.
RESET METHOD:	In " Heating mode", reset occurs automatically when the condition that generated the code ceases. If the code persists, contact Robur TAC.
	⊔ 648
	HIGH HOT WATER DIFFERENTIAL TEMPERATURE
CODE GENERATED BY:	High hot water differential temperature.
RESET METHOD:	Reset occurs automatically 20 minutes after the code is generated. If the code persists, code E648 may occur (in this case, contact Robur TAC).
	E 648
	HIGH HOT WATER DIFFERENTIAL TEMPERATURE
CODE GENERATED BY:	⊔ 648 code is generated 2 times in 2 hours of operation.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
	E 649
	"AR10" SATELLITE BOARD NOT PRESENT
CODE GENERATED BY:	Satellite board not present.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.
	⊔ 651
	ANTIFREEZE FUNCTION ACTIVATED – COOLING MODULE
	Activation takes place only if the cold module is off and the antifreeze function is enabled (see menu 1, parameter 77).
CODE GENERATED WHEN:	Inlet or outlet water temperature of the cold module falls below 39.2°F (the code generated signals that the antifreeze function has been activated). In this case the antifreeze function activates the plant water circulator.
RESET METHOD:	Reset (deactivation of antifreeze function) occurs automatically when, with only the circulator on, the inlet and outlet water temperatures return to over 41°F (in this case the circulator switches off), or if the function itself is disabled.
	⊔ 652
	DEFROSTING FUNCTION ACTIVATED
CODE GENERATED BY:	Defrosting function activated. Defrosting is activated if at least one hour has passed since the last defrosting, if the flame control unit has been on for at least 20 minutes, and if ambient temperature, temperature of hot inlet water and of the evaporator require its execution.
RESET METHOD:	The code clears automatically when execution of defrosting ends.
	E 654
	INVERSION: OPPOSITE
CODE GENERATED BY:	With valve not active, the end-of-range micro-switch is actuated (i.e. is open electrically) on the other side to that expected by the board.
RESET METHOD:	Contact Robur TAC.
	E 655
	INVERSION: UNKNOWN
CODE GENERATED BY:	With valve not active, neither of the two end-of-range microswitches is actuated (i.e. are both closed electrically).
RESET METHOD:	Contact Robur TAC.

E 656	
INVERSION: UNCERTAIN	
CODE GENERATED BY:	With valve not active, both of the two end-of-range microswitches are actuated (i.e. are both open electrically).
RESET METHOD:	Contact Robur TAC.
␣ 678	
HIGH HOT OUTLET WATER TEMPERATURE	
CODE GENERATED BY:	High hot outlet water temperature.
RESET METHOD:	Reset occurs automatically when the condition that generated the code ceases.
␣ 679	
ANTIFREEZE FUNCTION ACTIVATED (heating mode)	
CODE GENERATED BY:	Antifreeze function activated (with function enabled: see menu 1, Parameter163; and only with machine off). Activation occurs when the hot Inlet or outlet water temperature falls below 39.2°F (in this case, the function signals that the plant water circulator has been switched on). If this temperature falls further to below 37.4 °F, the function also activates the flame control unit.
RESET METHOD:	The code clears automatically if, with only the circulator on, the hot Inlet or outlet water temperature returns to above 41.0 °F (in this case the circulator switches off); or, if also the flame control unit has switched on, when this temperature reaches 64.4 °F (in this case the flame control unit and then the circulator switch off).
␣ 680	
INCOMPLETE PARAMETERS	
CODE GENERATED BY:	Incomplete parameters.
RESET METHOD:	The code remains until operating parameters are entered and completed. Contact Robur TAC.
NB: If the board is replaced the Code E 80 may appear, meaning that the GAHP-AR characterization parameters have not been set	
E 80 / E 680	
INCORRECT PARAMETERS	
CODE GENERATED BY:	Invalid parameters or damage to parameter memory.
RESET METHOD:	Reset occurs automatically when correct parameters are entered. If the code persists, contact Robur TAC. If the parameters are incorrect, it is necessary to enter and complete the unit operating and characterization parameters. If the memory is damaged it is necessary to replace the board.
␣ 681 - ␣ 682	
INVALID BANK 1 DATA - INVALID BANK 2 DATA	
CODE GENERATED BY:	Invalid Bank 1 data - Invalid Bank 2 data.
RESET METHOD:	Reset occurs automatically 5 seconds after the code is generated.
E 681 - and 682	
INVALID BANK 1 DATA - INVALID BANK 2 DATA	
CODE GENERATED BY:	Invalid Bank 1 data - Invalid Bank 2 data.
RESET METHOD:	Reset may be performed via the board, menu 2, Parameter 1. If the code persists, contact Robur TAC.
␣ 683	
RY and RW CONTACTS ACTIVATED SIMULTANEOUSLY	
CODE GENERATED BY:	both RY and RW contacts are simultaneously closed.
RESET METHOD:	The code clears automatically when at least one of the two contacts opens.
E 684	
FAULTY CONNECTION TRANSFORMER OR 24 Vac FUSES	
CODE GENERATED BY:	Damage to one of the 2 24-0-24 Vac transformer fuses, or one of 24-0-24 Vac wires to the board not supplying current.
RESET METHOD:	Check fuses and 24-0-24 Vac electrical power connections on the board. Reset may be carried out via the S61 board, Parameter 1 (or via DDC). If the code persists or occurs again, contact Robur TAC.

E 685	
INCORRECT MODULE TYPES (from menu 6)	
CODE GENERATED BY:	The module type set (from menu 6) does not correspond to the one managed by the board.
RESET METHOD:	Reset occurs automatically when the correct parameters are entered. If the code persists, contact Robur TAC.
E 686 - and 687 - and 688 - and 689	
MEMORY TEST UNSUCCESSFUL	
CODE GENERATED BY:	Processor error.
RESET METHOD:	Contact Robur TAC.
E 690	
AMBIENT TEMPERATURE SENSOR DEFECTIVE	
CODE GENERATED BY:	Interruption or short circuit of ambient temperature sensor.
RESET METHOD:	Reset may be performed via S61 board, menu 2, Parameter 1 (or via DDC). If the code persists, contact Robur TAC.
E 691	
BOARD DEFECTIVE	
CODE GENERATED WHEN:	One of the following is absent: serial number of board, hardware version code or encryption key written during board test.
RESET METHOD:	Contact ROBUR TAC.

Table 27 - Operating codes generated by the electronic control board S61 (firmware release 3.016).

In the table, **TAC** = Robur authorized Technical Assistance Centre.

The following figure shows a reference scheme of the unit ignition system.

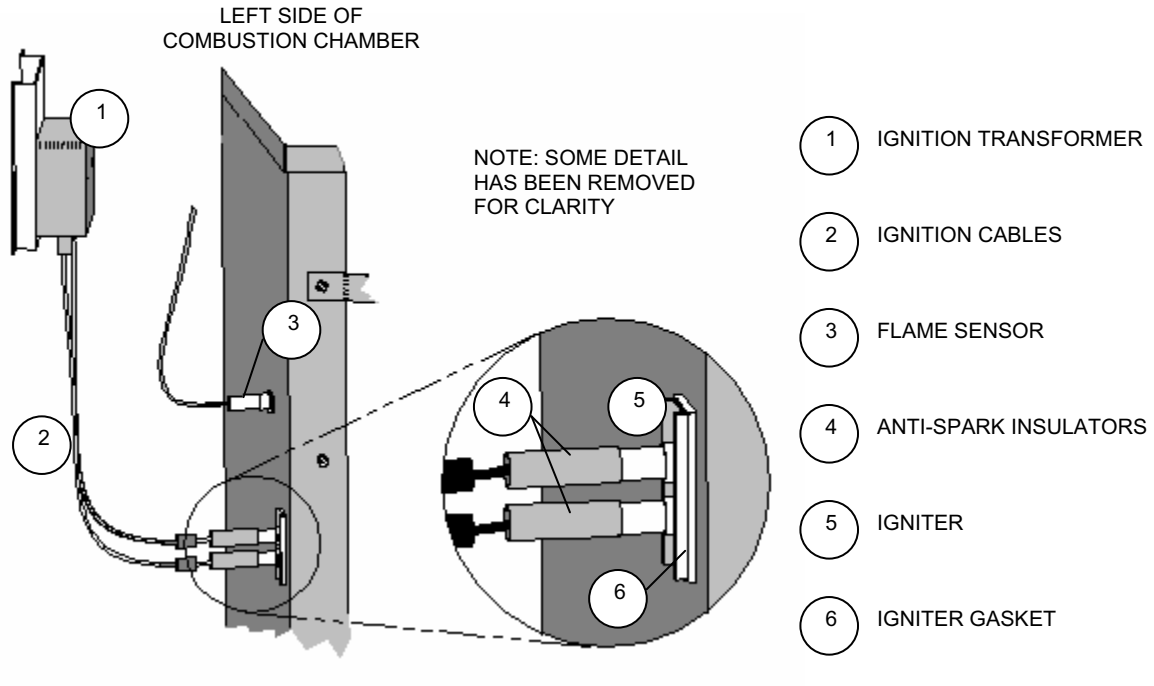


Figure 39 - Ignition transformer, igniter assembly and flame sensor.

Codice: D-LBR 364 Rev. E 10 MCM SDC 015 19/03/2010

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