1 VERSIONS

The GA unit is available in the following versions:
- ACF, for residential/retail/industrial cooling systems with chilled water down to 3 °C.
- HR with heat recovery exchanger, for residential/retail/industrial cooling systems with chilled water down to 3 °C, plus recovery exchanger hot water up to 75 °C (e.g. DHW production).
- TK, for systems and process applications with chilled water down to 3 °C, in continuous operation all year round.
- HT for very hot climates, for residential/retail/industrial cooling systems with chilled water down to 5 °C, with outdoor air up to 50 °C.
- LB for negative temperatures, for cooling systems with chilled water down to -10 °C (glycol required).

ACF, TK, LB and HT models have 2 water fittings (chilled water inlet/outlet), model HR has 4 water fittings (chilled water and heat recovery exchanger hot water inlet/outlet).
Each version may be supplied with standard or low-noise fan.

2 SPECIFICATION OF SUPPLY

2.1 ACF

Water-ammonia absorption chiller, fed with natural gas or LPG, air-water version, for cold water production down to a delivery temperature of 3 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,82 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 360 kg
Dimensions: width 850 mm, depth 1240 mm, height 1445 mm

2.2 ACF S

Water-ammonia absorption chiller with low-noise fan, fed with natural gas or LPG, air-water version, for cold water production down to a delivery temperature of 3 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,87 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 360 kg
Dimensions: width 850 mm, depth 1240 mm, height 1513 mm

2.3 HR

Water-ammonia absorption chiller-heater, fed with natural gas or LPG, air-water version with heat recovery, for cold water production down to a delivery temperature of 3 °C and simultaneously hot water up to a delivery temperature of 75 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Recovery unit heat output (A35W40): 14,9 kW
Electrical power absorption nominal: 0,82 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 390 kg
Dimensions: width 850 mm, depth 1240 mm, height 1445 mm

2.4 HR S

Water-ammonia absorption chiller-heater with low-noise fan, fed with natural gas or LPG, air-water version with heat recovery, for cold water production down to a delivery temperature of 3 °C and simultaneously hot water up to a delivery temperature of 75 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Recovery unit heat output (A35W40): 14,9 kW
Electrical power absorption nominal: 0,87 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 390 kg
Dimensions: width 850 mm, depth 1240 mm, height 1513 mm

2.5 TK

Water-ammonia absorption chiller, fed with natural gas or LPG, air-water version for process applications, for cold water production down to a delivery temperature of 3 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,82 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1445 mm

2.6 TK S

Water-ammonia absorption chiller with low-noise fan, fed with natural gas or LPG, air-water version for use in process applications, for cold water production down to a delivery temperature of 3 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,7 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,87 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1513 mm

2.7 HT

Water-ammonia absorption chiller, fed with natural gas or LPG, air-water version for use in areas with high ambient temperature and humidity, for cold water production down to a delivery temperature of 5 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,1 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,82 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1445 mm

2.8 HT S

Water-ammonia absorption chiller with low-noise fan, fed with natural gas or LPG, air-water version for use in areas with high ambient temperature and humidity, for cold water production down to a delivery temperature of 5 °C, for outdoor installation.
Cooling output for each unit (A35W7): 17,1 kW

Heat input: 25,0 kW
Electrical power absorption nominal: 0,87 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1513 mm

2.9 LB

Water-ammonia absorption chiller, fed with natural gas or LPG, air-water version for refrigeration, for cold water production down to a delivery temperature of -10 °C, for outdoor installation.
Cooling output for each unit (A35W-5): 13,3 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,82 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1445 mm

2.10 LB S

Water-ammonia absorption chiller with low-noise fan, fed with natural gas or LPG, air-water version for refrigeration, for cold water production down to a delivery temperature of -10 °C, for outdoor installation.
Cooling output for each unit (A35W-5): 13,3 kW
Heat input: 25,0 kW
Electrical power absorption nominal: 0,87 kW
Power supply: 230 V - 50 Hz single-phase
Weight: 380 kg
Dimensions: width 850 mm, depth 1240 mm, height 1513 mm

3 FEATURES AND TECHNICAL DATA

3.1 FEATURES

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

3.1.1 Mechanical and thermo-hydraulic components

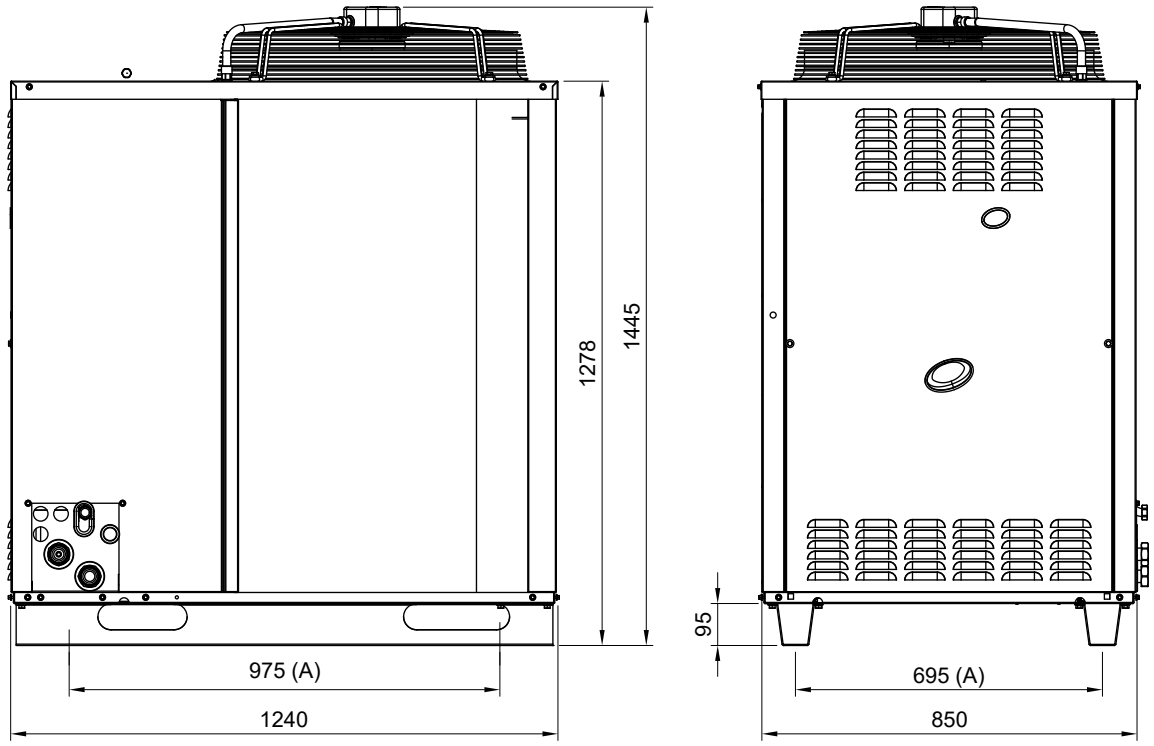
- Steel sealed circuit, externally treated with epoxy paint.
- Sealed combustion chamber (type C) suitable for outdoor installations.
- Metal mesh radiant burner, equipped with ignition electrodes and flame detection, managed by an electronic flame control box.
- Titanium stainless steel shell-and-tube water exchanger (evaporator), externally insulated.
- Air exchanger (condenser) with finned coil, with steel pipe and aluminium fins.
- Low power consumption refrigerant fluid oil pump.
- Variable-flow microprocessor-controlled helicoidal motor-fan.

3.1.2 Control and safety devices

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

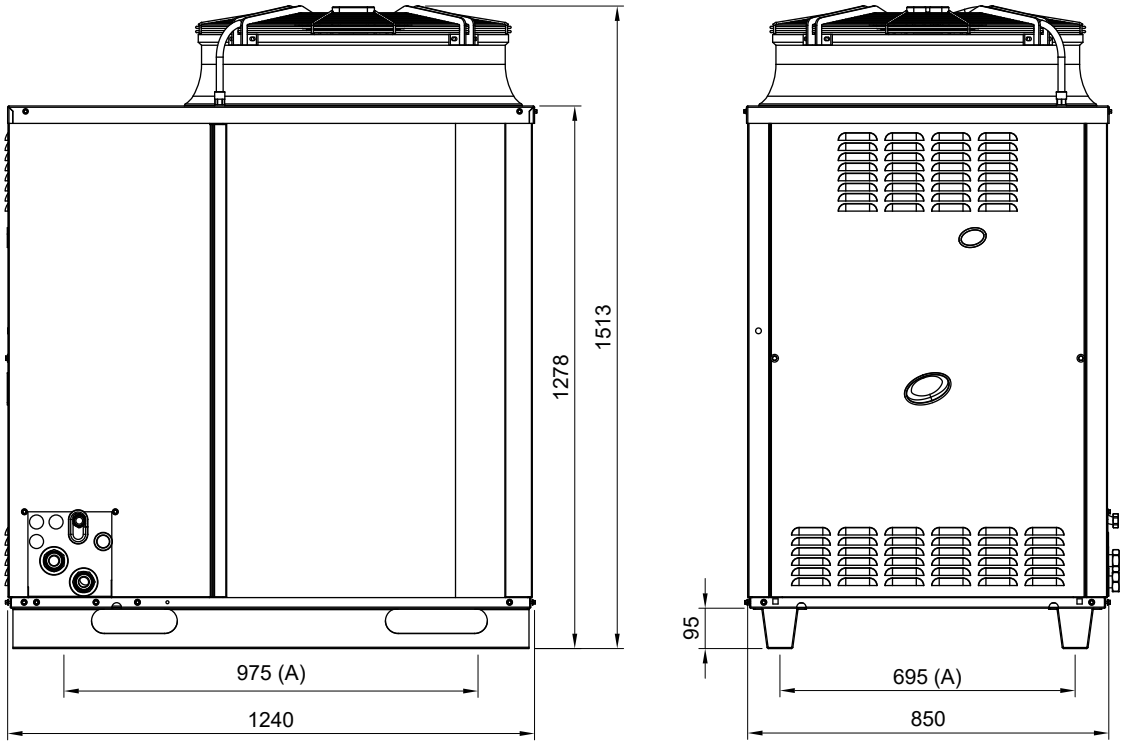
3.2 DIMENSIONS

Figure 3.1 *ACF standard version dimensions*



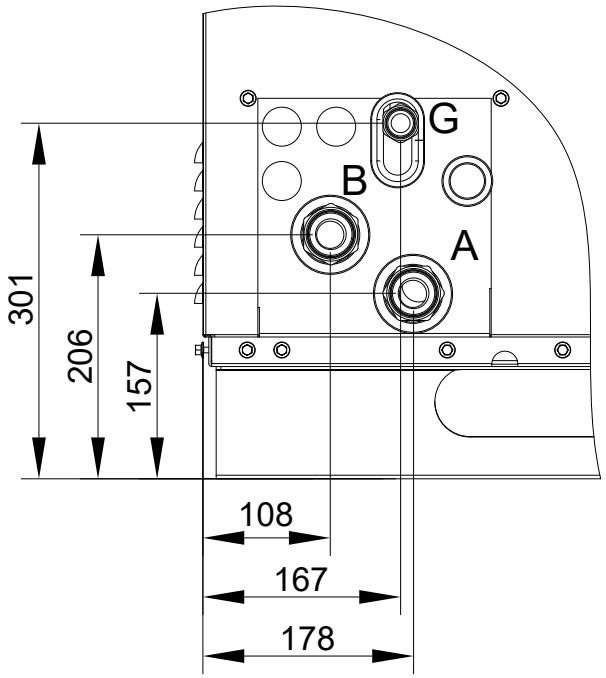
A Centre distance of holes for vibration damper supports

Figure 3.2 *ACF silenced version dimensions*



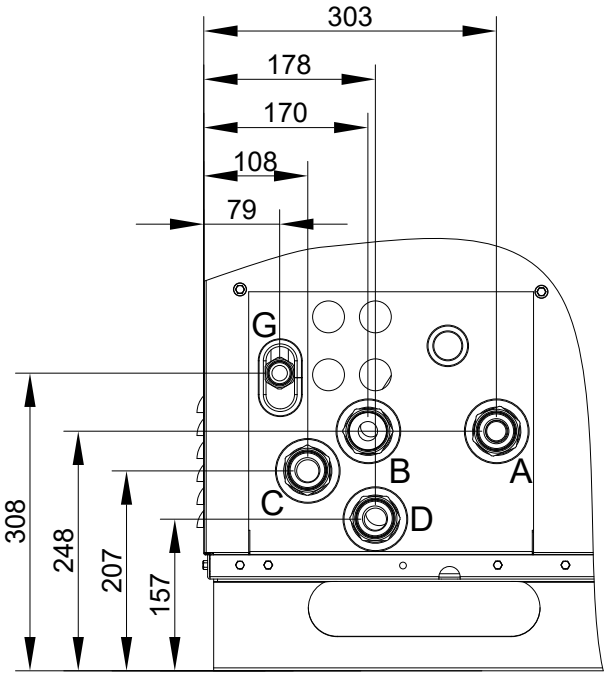
A Centre distance of holes for vibration damper supports

Figure 3.3 *ACF service plate with plumbing and gas connections*



A Water outlet connection Ø 1 1/4" F
B Water inlet connection Ø 1 1/4" F
G Gas connection Ø 3/4" F

Figure 3.4 *ACF HR service plate with plumbing and gas connections*



G Gas connection Ø 3/4" F

Chiller: chilled water

C Water inlet connection Ø 1 1/4" F
D Water outlet connection Ø 1 1/4" F

Recovery exchanger: hot water

A Water outlet connection Ø 1 1/4" F
B Water inlet connection Ø 1 1/4" F

3.3 CONTROLS

Control device

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

- ► DDC control
- ► external request

3.3.1 DDC Controller

The DDC control is able to manage one or more Robur appliances in ON/OFF mode (GAHP heat pumps, GA chillers) or modulating mode (AY boilers).
DDC functionality may be extended with auxiliary Robur devices RB100 and RB200 (e.g. service requests, DHW production, third party generator control, probe control, system valves or circulating pumps, ...).

For more details see Section C01.11.

3.3.2 External request

The appliance may also be controlled via generic enable devices (e.g. thermostat, timer, switch, contactor...) fitted with voltage-free NO contact. This system only provides elementary control (on/off, with fixed setpoint temperature), hence without the important functions of the DDC control. It is advisable to possibly limit its use to simple applications only and with a single appliance.

3.4 TECHNICAL DATA

Table 3.1 *GA technical data*

				ACF60-00	ACF60-00 HR	ACF60-00 TK	ACF60-00 HT	ACF60-00 LB
Cooling mode								
Cooling output for each unit	Outdoor temperature/Water outlet temperature	A35W7	kW	17,7			17,1	-
		A35W-5	kW	-				13,3
Heat input	nominal (1013 mbar - 15 °C)		kW	25,3				
	real		kW	25,0				
Cold water temperature (outlet)	minimum		°C	3 (1)			5	-10
	nominal		°C	7				-5
Cold water temperature (inlet)	maximum		°C	45				
	minimum		°C	8				-7
Cold water flow	maximum		l/h	3500				2900
	nominal		l/h	2770			2675	2600
	minimum		l/h	2500				2300
Internal pressure drop	at nominal water flow		bar	0,29 (2)				0,42 (2)
Outdoor temperature	nominal		°C	35				
	maximum		°C	45			50	45
	minimum		°C	0		-12	0	
Recovery circuit operation								
Recovery unit heat output	Outdoor temperature/Inlet temperature/1000 l/h water flow	A35W40	kW	-	21,0	-		
Hot water temperature (inlet)	nominal		°C	-	40	-		
Hot water temperature (outlet)	nominal		°C	-	58	-		
Hot water flow	maximum		l/h	-	2500	-		
	minimum		l/h	-	0	-		
	nominal		l/h	-	1000	-		
Total GUE (40 °C inlet temperature)	Outdoor temperature/Inlet temperature/1000 l/h water flow	A35W7	%	-	155	-		
Electrical specifications								
Power supply	voltage		V	230				
	type		-	single-phase				
	frequency		Hz	50				
Electrical power absorption	nominal		kW	0,82 (3)				
	nominal silenced		kW	0,87 (3)				
Degree of protection	IP		-	X5D				
Installation data								
Gas consumption	G20 natural gas (nominal)		m^3/h	2,68				
	G25 (nominal)		m^3/h	3,11				
	LPG G30/G31 (nominal)		kg/h	1,97				
sound power L_w (max)			dB(A)	79,6 (4)				
sound power L_w (max) silenced			dB(A)	75,0 (4)				
sound pressure L_p at 5 metres (max)			dB(A)	57,6 (5)				
sound pressure L_p at 5 m (maximum) silenced			dB(A)	53,0 (5)				
maximum water pressure in operation			bar	4,0				
Water content inside the appliance	hot side		l	-	3	-		
	cold side		l	3				
Water fitting	type		-	F				
	thread		"	1 1/4				
Gas connection	type		-	F				
	thread		"	3/4				
Dimensions	width		mm	850				
	depth		mm	1240				
	height		mm	1445				
	silenced height		mm	1513				
Weight	in operation		kg	360	390	380		
General information								
Refrigerating fluid	ammonia R717		kg	6,8	7,2	7,9	7,1	7,2
	water H_2O		kg	10,0	10,3	10,0	10,5	

(1) To be set (on demand) during the first start-up. Default Minimum Temperature = 4,5 °C.
(2) For flows other than nominal see Design Manual, Pressure losses Paragraph.
(3) ±10% according to the power supply voltage and tolerance on electrical motors consumption. Measured at outdoor temperature of 30 °C.
(4) Sound power values detected in compliance with the intensity measurement methodology set forth by standard EN ISO 9614.
(5) Maximum sound pressure levels in free field, with directivity factor 2, obtained from the sound power level in compliance with standard EN ISO 9614.

3.4.1 Pressure drops

3.4.1.1 ACF, HR, TK, HT

Table 3.2 *GA ACF, HR, TK, HT pressure drop*

Cold water flow	Heat transfer fluid temperature at outlet	
	3 °C	7 °C
	bar	bar
2600 l/h	0,27	0,26
2900 l/h	0,33	0,31
3500 l/h	0,48	0,46

The data refer to operation with no glycol in water.

3.4.1.2 LB

Table 3.3 *GA ACF LB pressure drop*

Cold water flow	Heat transfer fluid temperature at outlet		
	-10 °C	-5 °C	0 °C
	bar	bar	bar
2300 l/h	0,44	0,37	0,30
2600 l/h	0,52	0,42	0,35
2900 l/h	0,55	0,47	0,41

The data refer to operation with 40% glycol water.

3.4.1.3 HR recovery exchanger

Table 3.4 *GA ACF HR heat recover exchanger pressure drop*

Hot water flow	Heat transfer fluid temperatures at inlet		
	30 °C	40 °C	70 °C
	bar	bar	bar
500 l/h	0,01	0,01	0,01
1000 l/h	0,03	0,03	0,03
1500 l/h	0,06	0,06	0,06
2500 l/h	0,16	0,16	0,14

3.4.2 Performances

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

3.4.2.1 ACF

Table 3.5 *p. 6* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF60-00 unit.

Table 3.5 *GA ACF cooling output for each unit*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	kW	kW
30 °C	17,9	18,4
35 °C	17,7	17,2
40 °C	15,6	16,0
45 °C	11,9	14,8

Table 3.6 *p. 6* shows the GUE at full load and stable operation in cooling mode, depending on the cold water delivery temperature to the system and the outdoor temperature, referring to ACF60-00 unit.

Table 3.6 *GA ACF GUE*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	%	%
30 °C	72	73
35 °C	71	69
40 °C	62	64
45 °C	47	59

3.4.2.2 TK

Table 3.7 *p. 6* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF60-00 TK unit.

Table 3.7 *GA ACF TK cooling output for each unit*

Outdoor temperature	Water delivery temperature	
	4 °C	7 °C
	kW	kW
-10 °C	20,9	20,9
-5 °C	20,6	20,6
0 °C	20,4	20,4
5 °C	20,1	20,2
10 °C	19,9	19,9
15 °C	19,7	19,7
20 °C	19,3	19,7
25 °C	18,6	19,4
30 °C	16,9	18,8
31 °C	16,4	18,6
35 °C	13,8	17,7
40 °C	/	15,8

Table 3.8 *p. 6* shows the GUE at full load and stable operation in cooling mode, depending on the cold water delivery temperature to the system and the outdoor temperature, referring to ACF60-00 TK unit.

Table 3.8 *GA ACF TK GUE*

Outdoor temperature	Water delivery temperature	
	4 °C	7 °C
	%	%
-10 °C	84	84
-5 °C	82	83
0 °C	82	82
5 °C	80	81
10 °C	79	79
15 °C	79	79
20 °C	77	79
25 °C	74	78
30 °C	68	75
31 °C	66	74
35 °C	55	71
40 °C	/	63

3.4.2.3 HT

Table 3.9 *p. 6* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF60-00 HT unit.

Table 3.9 *GA ACF HT cooling output for each unit*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	kW	kW
30 °C	17,5	17,5
35 °C	17,1	17,1
40 °C	15,9	16,6
45 °C	/	15,2

Table 3.10 *p. 7* shows the GUE at full load and stable operation in cooling mode, depending on the cold water delivery temperature to the system and the outdoor temperature, referring to ACF60-00 HT unit.

Table 3.10 *GA ACF HT GUE*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	%	%
30 °C	70	70
35 °C	68	68
40 °C	64	66
45 °C	/	61

3.4.2.4 LB

Table 3.11 *p. 7* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF60-00 LB unit.

Table 3.11 *GA ACF LB cooling output for each unit*

Outdoor temperature	Water delivery temperature		
	-10 °C	-5 °C	0 °C
	kW	kW	kW
10 °C	15,2	15,3	15,6
15 °C	15,2	15,3	15,6
20 °C	14,8	15,2	15,6
25 °C	14,1	14,9	15,4
30 °C	13,2	14,2	15,2
35 °C	11,7	13,3	14,4
40 °C	9,6	11,8	13,3

Table 3.12 *p. 7* shows the GUE at full load and stable operation in cooling mode, depending on the cold water delivery temperature to the system and the outdoor temperature, referring to ACF60-00 LB unit.

Table 3.12 *GA ACF LB GUE*

Outdoor temperature	Water delivery temperature		
	-10 °C	-5 °C	0 °C
	%	%	%
10 °C	61	61	62
15 °C	61	61	62
20 °C	59	61	62
25 °C	56	60	62
30 °C	53	57	61
35 °C	47	53	57
40 °C	38	47	53

3.4.2.5 HR

Table 3.13 *p. 7* shows the unitary cooling load at full load and in stable operation, depending on cold water outlet temperature to the system and outdoor temperature, referring to ACF60-00 HR unit.

Table 3.13 *GA ACF HR cooling output for each unit*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	kW	kW
30 °C	17,7	18,2
35 °C	17,7	17,2
40 °C	16,8	16,1
45 °C	14,2	15,4

Tables 3.14 *p. 7* and 3.15 *p. 7* show the unitary recoverable heat output at full load and in stable operating mode, depending on the temperature of the fluid at the inlet to the heat recovery and the outdoor temperature for two reference water flow rates to the heat recovery, respectively 1000 l/h (Table 3.14 *p. 7*) and 500 l/h (Table 3.15 *p. 7*), referring to the ACF60-00 HR unit.
Consider that in the absence of a refrigeration request no recoverable heat output will be available.

Table 3.14 *Recoverable heat output for each GA ACF HR with 1000 l/h water flow*

Outdoor temperature	Heat transfer fluid temperature at inlet			
	20 °C	30 °C	40 °C	50 °C
	kW	kW	kW	kW
30 °C	31,3	25,1	19,1	13,2
35 °C	32,0	26,2	21,0	15,5
40 °C	/	28,0	23,0	17,5
45 °C	/	30,0	25,1	19,2

The figures refer to temperature on recovery exchanger inlet, with flow rate to recovery exchanger of 1000 l/h.

Table 3.15 *Recoverable heat output for each GA ACF HR with 500 l/h water flow*

Outdoor temperature	Heat transfer fluid temperature at inlet				
	10 °C	20 °C	30 °C	40 °C	50 °C
	kW	kW	kW	kW	kW
30 °C	27,5	23,0	18,1	13,5	9,3
35 °C	27,9	23,5	19,1	14,9	11,0
40 °C	28,2	24,4	20,1	16,3	12,8
45 °C	28,5	25,0	21,2	18,0	14,9

The figures refer to temperature on recovery exchanger inlet, with flow rate to recovery exchanger of 500 l/h.

The following Tables show the GUE at full load in cooling mode and simultaneous heat recovery in stable operation, depending on the cold water delivery temperature to the system and the outdoor temperature, for two reference water flow rates to the heat recovery exchanger, respectively 1000 l/h (Table 3.16 *p. 7*) and 500 l/h (Table 3.17 *p. 7*), referring to the ACF60-00 HR unit.

Table 3.16 *GA ACF HR GUE with heat recovery 1000 l/h return 40 °C*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	%	%
30 °C	147	149
35 °C	155	153
40 °C	159	156
45 °C	157	162

Table 3.17 *GA ACF HR GUE with heat recovery 500 l/h return 40 °C*

Outdoor temperature	Water delivery temperature	
	7 °C	10 °C
	%	%
30 °C	125	127
35 °C	131	128
40 °C	133	130
45 °C	129	133

4 DESIGN

Compliance with installation standards

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

- heating systems
- cooling systems
- gas systems
- flue gas exhaust
- flue gas condensate drain

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

4.1 APPLIANCE POSITIONING

Please refer to Section C01.02.

4.2 PLUMBING DESIGN

Please refer to Section C01.03.

4.3 WATER PUMP

The circulation pump (flow and head) must be selected and installed based on pressure drops of plumbing/primary circuit (piping + components + exchange terminals + appliance).
For appliance pressure drops, see Paragraph 3.4.1 *p. 6*, referring to the specific GA appliance used.

Please refer to Section C01.04 for the characteristics of the pumps available as Robur optional.

4.4 SYSTEM WATER QUALITY

Please refer to Section C01.05.

4.5 ANTIFREEZE PROTECTION

Please refer to Section C01.06.

4.6 FUEL GAS SUPPLY

Please refer to Section C01.08.

4.7 COMBUSTION PRODUCTS EXHAUST

The GA units have no flue gas exhaust.

4.8 ELECTRICAL AND CONTROL CONNECTIONS

Please refer to Section C01.10.

4.9 EXAMPLE DIAGRAMS

Please refer to Section C01.13.

4.10 ACOUSTIC

Please refer to Section C01.14.