



## Air-Cooled Liquid Chillers with Integrated Hydronic Module

### AQUASNAP

PRO-DIALOG PLUS



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Quality Management System Approval

## 30RA 040-240 "B"

**Nominal cooling capacity 39-245 kW**

The new generation of Aquasnap liquid chillers features the latest technological innovations: Scroll compressors, low-noise fans made of a composite material, auto-adaptive microprocessor control, full optimisation for the ecological refrigerant HFC-407C. The Aquasnap includes a complete hydronic module as standard, simplifying the installation to straightforward operations like connection of the power supply and the chilled water supply and return piping. An auto-adaptive control algorithm ensures intelligent control of compressor operation in most comfort air conditioning applications, making a buffer tank unnecessary.

### Features

- Integrated hydronic module eliminates the need for a field-supplied pump assembly and does not require additional space. The module incorporates all components necessary for the operation of the system: removable screen filter, water pump with high available pressure, expansion tank, water flow switch, safety valve, pressure gauges, and purge valve. A throttle valve allows adjustment of the water flow in accordance with the characteristics of the installation.

All hydraulic components are protected against frost down to -20°C.

- Aquasnap is equipped with the revolutionary second-generation Flying Bird fan. This low-noise, two-speed fan is made of composite recyclable material and employs a multi-blade design and a rotating shroud, as used in the aeronautical industry. It is exceptionally quiet, and does not generate the low-frequency noise, irritating to the human ear. At part load or low outdoor temperatures the fan automatically switches to the low speed. As an option you can program fan operation at low speed, for example during the night, for quieter operation.

To reduce the operating noise even further, the fan is not fixed to the top unit panel, but supported by an extremely rigid tower chassis. This innovative structure prevents the transmission of vibrations to the unit casing and results in a more aesthetic flat top panel.

- The scroll compressors run extremely quietly and vibration-free. They are well-known for their durability and reliability. The motor is fully cooled by suction gas and permits up to 12 starts per hour. A safety valve allows reverse rotation due to incorrect wiring, without impairing compressor operation. In addition these compressors need no maintenance. The use of two compressors per circuit (except size 30RA 040) permits a reduction of the start-up current and of the power input at part load.

- The ecological refrigerant HFC-407C has no effect on the ozone layer, and is the replacement for R-22 in air conditioning applications with small and medium capacities. It has been extensively tested by Carrier for several years and offers the same reliability and even slightly superior performances to those of R-22.
- The evaporator is a welded, stainless steel plate heat exchanger, maximising the thermodynamic properties of HFC-407C and offering considerably increased performances as well as low water-side pressure drops. From size 30RA 090 upwards the units are equipped with a twin-circuit interlaced heat exchanger for safe operation at part load. When the unit is shut down, the heat exchanger is protected against freeze-up by a trace heater.
- The refrigerant circuit is designed to be completely leak-proof - for life. All pipes and the refrigeration components are welded, the capillaries, a source of leaks in the past, have been replaced. Pressure sensors, mounted directly on the pipes, take the place of the pressure switches.

From size 30RA 090 upwards, two independent refrigerant circuits ensure partial cooling capacity in all circumstances.

- The Aquasnap is designed for year-round operation and operates without the use of accessories down to -10°C outdoor temperature. A control algorithm intelligently manages operation of the fans.
- Electrical connections are simplified, and the standard Aquasnap equipment includes a main switch, and a single entry point of the three-phase without neutral power supply to the whole unit.
- Large removable panels and the hinged door of the control box ensure perfect accessibility and permit easy access to all components. Furthermore an opening allows adjustments to be made without interrupting the operation of the chiller. For the most important maintenance operations the unit top cover is easily removed (with the fan remaining in place), and total access from above is possible.

#### PRO-DIALOG Plus control

PRO-DIALOG Plus is an advanced numeric control system that combines complex intelligence with great operating simplicity. PRO-DIALOG Plus constantly monitors all machine parameters and safety devices, and precisely manages the operation of compressors and fans for optimum energy efficiency. It also controls the operation of the water pump.

#### A powerful control system

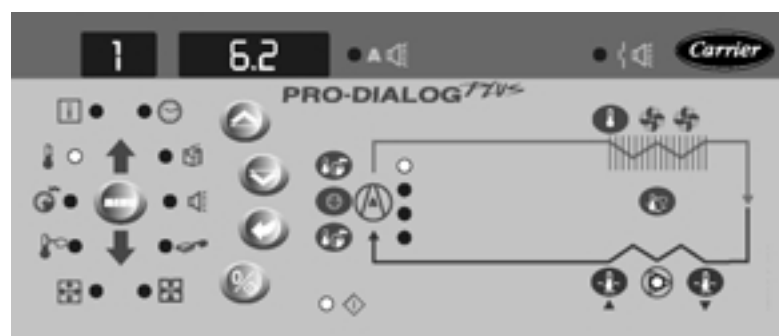
- The PID control algorithm with permanent compensation for the difference between entering and leaving water temperature and anticipation of load variations regulates compressor operation for intelligent leaving water temperature control.
- To optimise power consumption, PRO-DIALOG Plus automatically resets the chilled water temperature set-point in accordance with the outdoor air temperature or the return water temperature or uses a second set-point (example occupied/unoccupied).
- PRO-DIALOG Plus control is auto-adaptive for full compressor protection. The system permanently optimises compressor run times according to the application characteristics (water loop inertia), preventing excessive cycling. In most comfort air conditioning applications this feature makes a buffer tank unnecessary.

#### Clear and easy-to-use control system

- The operator interface is clear and user-friendly: LEDs and two numeric displays ensure immediate verification of all unit operating data.
- A simple push of a button, conveniently positioned on a synoptic chiller diagram gives you immediate display of the usual parameters: temperatures, pressures, set-point, compressor run times etc.
- 10 menus offer direct access to all machine controls, including a history of possible faults, for rapid and complete chiller fault diagnosis.

#### Extended communications capabilities

- PRO-DIALOG Plus allows remote control and monitoring of the chiller through a wired connection: start/stop, cooling/heating mode selection, power demand limit or dual set-point and customer safety lock. The system permits remote signalling of any possible anomaly for each refrigerant circuit.
- The internal clock permits programming of:
  - chiller start/stop
  - operation at the second set-point (e.g. unoccupied room)
  - operation of the chiller with the fan at low speed to reduce the noise level.
- Master/slave control of two chillers operating in parallel with operating time equalisation.
- RS 485 serial port for remote chiller control via communications bus.



PRO-DIALOG Plus operator interface

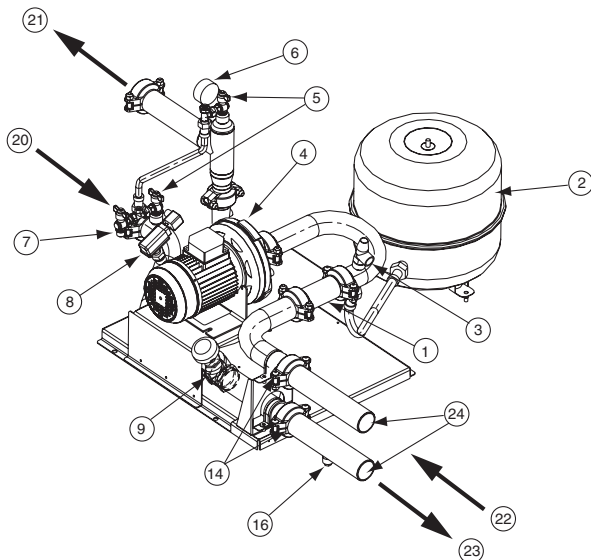
# Options and accessories

	Option	Accessory
Condenser anti-corrosion pre-treatment for marine applications	X	
Condenser post-assembly corrosion treatment for rural, urban and industrial applications	X	
Electronic compressor starter for reduction of start-up current (30RA 040-080)	X	
Operation down to -20°C outside temperature	X	
Low-temperature unit for glycol leaving temperatures from 0°C to -10°C	X	
Unit without hydronic module	X	
Hydronic module with dual pump	X	
Communications board with open JBus protocol	X	X

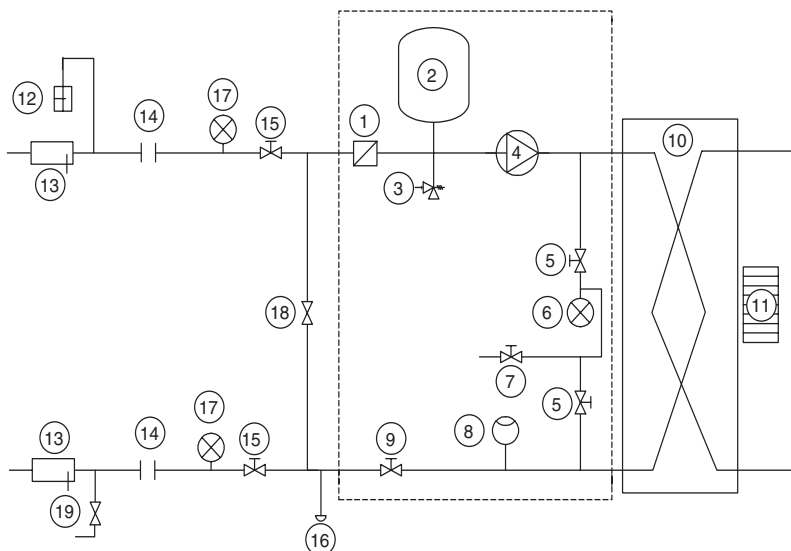
# Sound levels

	040	050	060	070	080	090	100	120	140	160	200	240
Sound power, dB(A) 10 <sup>-12</sup> W	82	82	82	86	87	85	85	85	89	90	91	92

According to Eurovent 8/1 (derived from ISO standard 3744 or ISO 9614-1).



Hydronic module (040 to 160)



Typical hydronic circuit diagram

### Legend

#### Components of unit and hydronic module

- 1 Victaulic screen filter
- 2 Expansion tank
- 3 Safety valve
- 4 Available pressure pump
- 5 Purge valve and pressure tap (see Installation Manual)
- 6 Pressure gauge to measure the plate heat exchanger pressure drop (to be isolated with valve No. 5 if not used)
- 7 System air vent
- 8 Flow switch
- 9 Flow control valve
- 10 Plate heat exchanger
- 11 Evaporator defrost heater

#### Installation components

- 12 Air vent
- 13 Thermometer sleeve
- 14 Flexible connection
- 15 Check valve
- 16 System water drain plug (on connection pipe supplied in the unit)
- 17 Pressure gauge
- 18 Freeze-up protection bypass valve (when valves No. 15 are closed during winter)
- 19 Charge valve
- 20 Plate heat exchanger outlet
- 21 Plate heat exchanger inlet
- 22 Water inlet
- 23 Water outlet
- 24 Customer connection sleeves for welded or screw connection (supplied)

--- Hydronic module (units with hydronic module)

**Note: Units without hydronic module (option) are equipped with a flow switch and an internal piping heater.**

# Physical data

<b>30RA</b>		<b>040</b>	<b>050</b>	<b>060</b>	<b>070</b>	<b>080</b>	<b>090</b>	<b>100</b>	<b>120</b>	<b>140</b>	<b>160</b>	<b>200</b>	<b>240</b>
<b>Nominal cooling capacity*</b>	kW	39.4	49.0	57.0	67.0	79.0	89.0	97.0	115.0	135.0	157.0	202.0	245.0
<b>Operating weight with hydronic module</b>	kg												
Single pump		526	584	597	611	631	1093	1106	1205	1212	1248	2133	2305
Dual pump		606	664	677	691	708	1170	1183	1305	1312	1348	2221	2393
Operating weight without hydronic module		502	560	573	587	605	1062	1075	1167	1174	1210	1986	2158
<b>Refrigerant charge</b>	kg	<b>R-407C</b>											
Circuit A		10	13	15	12.5	18	10	10	15	12.5	18	21	28
Circuit B		-	-	-	-	-	13	14	15	12.5	18	28	28
<b>Compressors</b>		<b>Hermetic scroll compressor, 48.3 r/s</b>											
Quantity, circuit A		1	2	2	2	2	1	1	2	2	2	2	3
Quantity, circuit B		-	-	-	-	-	2	2	2	2	2	3	3
No. of capacity steps		1	2	2	2	2	3	3	4	4	4	5	6
Minimum capacity	%	100	46	42	50	50	25	25	21	25	25	20	16.6
<b>Control type</b>		<b>PRO-DIALOG Plus</b>											
<b>Condensers</b>		<b>Grooved copper tubes, aluminium fins</b>											
Fans		<b>Axial Flying Bird fans with rotating shroud</b>											
Quantity		1	1	1	1	1	2	2	2	2	2	4	4
Total air flow (high speed)	l/s	3945	3780	4220	5150	5800	7725	8165	8840	10300	11600	17343	20908
Speed (high/low speed)	r/s	11.5/5.8	11.5/5.8	11.5/5.8	15.6/7.8	15.6/7.8	11.5/5.8	11.5/5.8	11.5/5.8	15.6/7.8	15.6/7.8	11.5/5.8	15.6/7.8
<b>Evaporator</b>		<b>Direct-expansion welded plate heat exchanger</b>											
Water volume	l	3.6	4.6	5.9	6.5	7.6	7.2	8.2	9.8	11.4	13.0	22.0	26.0
Max. water-side operating pressure	kPa												
Option without hydronic module		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Unit with hydronic module		300	300	300	300	300	300	300	300	300	300	400	400
<b>Hydronic module</b>		<b>Monocell composite pump</b>											
Pump (single centrifugal, 48.3 r/s)													Monocell pump
Quantity		1	1	1	1	1	1	1	1	1	1	1	1
Expansion tank volume	l	12	12	12	12	12	35	35	35	35	35	50	50
Expansion tank pressure	kPa	100	100	100	100	100	150	150	150	150	150	150	150
<b>Water connections</b>		<b>Threaded male gas connections</b>											
<b>(with and without hydronic module)</b>		<b>Victaulic (connection sleeves supplied)</b>											
Diameter	in	2	2	2	2	2	2	2	2-1/2	2-1/2	2-1/2	3	3
Outside tube diameter	mm	60.3	60.3	60.3	60.3	60.3	60.3	60.3	76.1	76.1	76.1	88.9	88.9

\* Nominal conditions: evaporator entering/leaving water temperature 12°C/7°C, outdoor air temperature 35°C.

# Electrical data

<b>30RA (without hydronic module)</b>		<b>040</b>	<b>050</b>	<b>060</b>	<b>070</b>	<b>080</b>	<b>090</b>	<b>100</b>	<b>120</b>	<b>140</b>	<b>160</b>	<b>200</b>	<b>240</b>
<b>Power circuit</b>													
Nominal power supply	V-ph-Hz	400-3-50											
Voltage range	V	360-440											
<b>Control circuit supply</b>		The control circuit is supplied via the unit-mounted transformer											
<b>Maximum unit power input*</b>	kW	20.3	24.6	30.1	35.2	39.9	44.1	49.6	60.5	70.6	79.6	104.2	124.9
<b>Nominal unit current draw**</b>	A	27.9	34.7	41.1	47.0	54.3	62.7	69.1	82.3	94.1	108.6	140.2	168.7
<b>Maximum unit current draw at 360 V***</b>	A	36.9	45.6	54.9	62.7	72.4	82.6	91.9	109.8	125.4	144.8	185.4	222.9
<b>Maximum unit current draw at 400 V****</b>	A	33.6	41.4	49.7	56.9	65.6	75.1	83.4	99.5	113.9	131.3	168.6	202.8
<b>Maximum start-up current</b>													
Standard unit†	A	158.4	151.0	168.9	176.1	190.4	199.8	208.1	218.6	233.0	256.1	293.4	327.6
With electronic starter control‡	A	99.0	101.0	113.0	120.0	128.0	-	-	-	-	-	-	-
<b>Holding current for three-phase short circuits</b>		kA	6	6	6	6	6	10	10	10	10	10	19

\* Power input of the compressor(s) + fan(s) at maximum unit operating conditions: entering/leaving water temperature = 15°C/10°C, maximum condensing temperature of 67.8°C and 400 V nominal voltage (values given on the unit name plate).

\*\* Nominal unit current draw at the following conditions: evaporator entering/leaving water temperature 12°C/7°C, outdoor air temperature 35°C. The current values are given at 400 V nominal voltage (values given on the unit name plate).

\*\*\* Maximum unit operating current at maximum unit power input and 360 V.

\*\*\*\* Maximum unit operating current at maximum unit power input and 400 V (values given on the unit name plate).

† Maximum instantaneous starting current at 400 V nominal voltage and with compressor in across-the-line start (maximum operating current of the smallest compressors + fan current + locked rotor current of the largest compressor).

‡ Maximum instantaneous starting current at 400 V nominal voltage and with compressor with electronic starter (maximum operating current of the smallest compressor(s) + fan current + reduced start-up current of the largest compressor).

<b>Hydronic module</b>		<b>040</b>	<b>050</b>	<b>060</b>	<b>070</b>	<b>080</b>	<b>090</b>	<b>100</b>	<b>120</b>	<b>140</b>	<b>160</b>	<b>200</b>	<b>240</b>
<b>Single pump</b>													
Shaft power	kW	0.75	0.75	0.75	0.75	1.1	1.1	1.1	1.85	1.85	1.85	5.5	5.5
Power input*	kW	1.1	1.1	1.1	1.1	1.4	1.4	1.4	2.5	2.5	2.5	6.6	6.6
Maximum current draw at 400 V**	A	2.1	2.1	2.1	2.1	3.1	3.1	3.1	5	5	5	10.9	10.9
<b>Dual pump</b>													
Shaft power	kW	2.2	2.2	2.2	2.2	2.2	2.2	2.2	3	3	3	5.5	5.5
Power input*	kW	2.7	2.7	2.7	2.7	2.7	2.7	2.7	4	4	4	6.6	6.6
Maximum current draw at 400 V**	A	4.7	4.7	4.7	4.7	4.7	4.7	4.7	6.6	6.6	6.6	10.9	10.9

Note: The water pump power input values are given for guidance only.

\* To obtain the maximum power input for a unit with hydronic module add the maximum unit power input from the top table to the pump power input (\*) from the table above.

\*\* To obtain the maximum unit operating current draw for a unit with hydronic module add the maximum unit current draw from the top table to the pump current draw from the table above.

## Electrical data notes:

- 30RA 040-240 units have a single power connection point located at the main switch.
- The control box includes the following standard features:**
  - a main disconnect switch, starter and motor protection devices for each compressor, the fan, the optional pumps
  - the control devices
- Field connections:**

All connections to the system and the electrical installations must be in full accordance with all applicable local codes.
- The Carrier 30RA units are designed and built to ensure conformance with these codes. The recommendations of European standard EN 60204-1 (machine safety - electrical machine components - part 1: general regulations - corresponds to IEC 60204-1) are specifically taken into account, when designing the electrical equipment.

### Notes:

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204-1 is the best means of ensuring compliance with the Machines Directive § 1.5.1.
- Annex B of EN 60204-1 describes the electrical characteristics used for the operation of the machines.

1. The operating environment for the 30RA units is specified below:

• Environment\* - Environment as classified in EN 60721 (corresponds to IEC 60721):

- outdoor installation\*
- ambient temperature range: -10°C to +45°C ± 1K, class 4K3\*
- altitude: ≤ 2000 m
- presence of hard solids, class 4S2 (no significant dust present)
- presence of corrosive and polluting substances, class 4C2 (negligible)
- vibration and shock, class 4M2

• Competence of personnel, class BA4\* (trained personnel - IEC 60364)

2. Power supply frequency variation: ± 2 Hz.

3. The neutral (N) conductor must not be connected directly to the unit (if necessary use transformers)

4. Over-current protection of the power supply conductors is not provided with the unit.

5. The factory-installed disconnect switches/circuit breakers are of a type that is suitable to interrupt the power in accordance with EN60947-3 (corresponds to IEC 60947-3).

6. The units are designed for connection to TN networks (IEC 60364). For IT networks the earth connection must not be at the network earth. Provide a local earth, consult competent local organisations to complete the electrical installation.

**NOTE:** If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

\* The required protection level for this class is IP43BW (according to reference document IEC 60529). All 30RA units are protected to IP44CW and fulfil this protection condition.