

# RAC

## AIR COOLED CHILLERS WITH BRUSHLESS OIL-FREE COMPRESSORS

COOLING CAPACITY FROM 359 TO 1398 kW - 1 OR 2 COOLING CIRCUITS

RAC 411 Ka



Above picture is only indicative and is not binding.



The units of **RAC Ka series** are particularly indicated for liquid cooling in the air conditioning and industrial process plants, where high efficiency at partial loads and maximum quietness must be granted. These groups have a compact design and a lower weight if compared to the traditional chillers of similar capacity. These units are completely assembled and tested in the factory and supplied with refrigerant charge. Therefore, once on site, the units only need to be positioned and electrically and hydraulically connected.

Following versions are available:

- **RAC Ka Standard:** For condensing section, the use of 6-pole axial fans (990 rpm) with inverter regulation together with performing condensing coils allows to have a good energy efficiency (EER) and low sound levels.
- **RAC HE Ka High-efficiency:** Thanks to the low condensing levels at the same external air temperature and the use of ECO system on compressor, it is possible to reach remarkable EER values. This range is provided with variable speed EC Brushless fans.
- **RAC U Ka Ultra silenced:** Thanks to wide heat exchange surface, the condensing coils allow the unit operation at a reduced air flow, with a consequent reduction on the sound level of the external fan section.

### Operation limits:

AIR: from -8°C to +45°C with fans regulated by inverter  
 AIR: from -20°C to +42°C with EC brushless fans (option)  
 WATER (out from evaporator): from 4 to 25°C

### Operation limit for free-cooling silenced version:

AIR: from -8°C to +42°C with fans regulated by inverter  
 AIR: from -20°C to +42°C with EC brushless fans (option)  
 WATER (out from evaporator): from 4 to 25°C

For free-cooling operation, the minimum external temperature is depending on the glycol percentage of the water circuit.

### MAIN COMPONENTS

The **frame** is made of galvanized carbon steel structural, treated with high-thickness epoxy powders paint of colour RAL 7035. It is strongly fixed by self-blocking galvanized nuts and bolts, so to absorb any mechanical stress due to handling and transport.

The two-stage oil-free centrifugal **compressor** (with no mechanical bearings)

is provided with in-built electronic control, pressure and temperature sensors, direct cooling system and inverter for capacity regulation.

Each compressor is complete with rubber anti-vibration dampers, shut off valve on suction side, shut-off valves on discharge side with in-built non return valve, filter on suction side, two-stage hot gas by-pass for inrush phases, sight glass on liquid refrigerant line and shut-off valve for the controlled and direct cooling of compressor.

Its peculiarity allows the continuous regulation of the cooling capacity, changing the speed of the two-stage compression device, with all the advantages of a direct current brushless motor, in which the electrical absorption reduces in a more proportional way than the loading decrease. The result is remarkably high seasonal efficiency values (ESEER).

Suitably designed **evaporator** so to guarantee high level of E.E.R., E.S.E.E.R. and I.P.L.V. The water-refrigerant exchanger is of flooded type, with a single refrigerant passage (shell side) and water multi-passage internal piping, able to operate with a small difference between the evaporating and the outlet fluid temperature, with very low pressure drops and overheating values. The exchanger is completely insulated with close cell and fire-retardant material of 10 mm thickness, protected with anti-scratch coating. The evaporator is provided with level switch and sight glass for flooding control and water differential switch.

Only for HE version, an economizer system (ECO) is in-built in the evaporator so to achieve a further increase on cooling capacity and ensure the non-return of liquid to the compressor.

**Condensing coils:** Finned pack exchanger with pure electrolytic copper pipes and louvered aluminium fins of suitable spacing so to avoid any obstruction to the air flow. On request, anti-corrosion treatments are also available (double layer epoxy treatment or copper-copper pipes). The frame is made of anodized aluminium of suitable thickness so to ensure the coil stiffness and, at the same time, resistance against external corrosion.

**Free-cooling coil (only for F.S Ka version):** Additional free-cooling water coil with copper tube and aluminium fins, for production of chilled water by means of the very low external air temperatures. This allows a remarkable reduction of the compressors working hours with a consequent energy saving, also considering that each circuit is completely independent. It is complete with 3-way mixing valve with 0-10V control.

Low rpm **axial fans**, provided with protection grid, directly coupled to high efficiency motor with external rotor and condensing control by V/F inverter system.

For operation down to -20°C external air, EC brushless fans will be provided (option EC). In this case the advantage at partial loads could be even 55%, if compared to a traditional control system.

**Cooling circuit:** Each circuit, realized with copper pipes, is mainly composed of: electronic thermostatic valve with in-built microprocessor and display for regulation of the refrigerant flow, also when the compressor is working at partial loads, and acting as solenoid valve when completely closed, shut-off valves on compressor's discharge side and one shut-off valve on suction line, non return valve on discharge side, shut-off valve on liquid line, dehydrating filter with replaceable cartridge, sight glass, hot gas by-pass line with tandem or trio compressors, liquid bleeding line for internal cooling of compressors, high and low pressure safety valve, high and low pressure gauges, high and low pressure transducers, high and low pressure switches.

**Electrical board:** It is included in a cabinet suitable for outdoor installation (IP 54) and it is provided with: main switch of lock-door type remote control

switches, amps and overload protections, isolating transformers for low voltage auxiliary circuits, numbered wires, passive filters to avoid harmonics and disturbances due to the electrical power supply, active filters to prevent electromagnetic interferences (EMI), according to EN 61000-6 and IEEE 519, alphanumeric backlit user display, microprocessor electronic board, thermostat for control of the inside temperature, in case of operation or positioning at external temperatures lower than 0°C, forced ventilation of the electrical board so to ensure operation of those devices under a continuous sun radiance. On request, a double electrical supply is available, separating the three-phase supply from the low tension single-phase supply of the control and auxiliary circuits.

**Microprocessor:** It is made of a IN/OUT electronic board, a LCD display, key board and LED signals.

This microprocessor allows the PID regulation of the evaporator outlet water temperature, the set of the operation parameters, the alarm management, the reading of the measured values (temperatures, working hours, etc) and the possibility to control them through a supervision system.

It is also possible to read and to set inputs and outputs, all the operating parameters of the unit and to display all the existing alarms.

### ACCESSORIES

- A Amperometer:** Electrical device for measuring the intensity of electrical current absorbed by the unit.
- DR Refrigerant leakage detector:** this device immediately detects eventual refrigerant leakages in the unit.
- EC EC Brushless fans:** Control of condensing temperature through the regulation of the air flow by means of EC Brushless axial fans, allowing the operation down to -20°C external temperature. The indicated limit of external air temperature are referred to the absence of wind, rain, snow or other atmospheric events affecting the heat exchange through the condensing coil.
- FA Anti-pollen filters on condensing coils:** interchangeable flat filters of metal mesh type, placed on the incoming air front surface of the coils.
- FL Mechanical flow switch on water side,** made of a paddle device for monitoring the proper water flow rate through the evaporator.
- GP Condensing coil protection grid:** metal protection grid against accidental impacts, made of 50x50 4-mesh wire.
- GP1 Protection grid for compressors section:** metal protection grid against accidental impacts.
- GSM SMS Data transmission card** for unit supervision through a mobile telephone line. In this way, you can completely and remotely supervising the unit through a mobile phone, receiving SMS for diagnostics.
- KWP Device for electrical power measurement,** for measuring and recording the active and reactive power.
- IH RS 485 serial interface:** electronic card to be connected to microprocessor, to allow communication between the units and a Modbus supervision system. It is possible to fully and remotely control the unit. For connection to other supervision systems, the protocol of the controlled parameters is available on request.
- IM Seawood packing:** fumigated seawood case and protection bag with hygroscopic salts, suitable for long sea transports.
- MV Buffer tank** of suitable capacity complete with expansion vessel, safety valve, water gauge, water charge and discharge valves, air purging valves.

## LIQUID CHILLERS - AIR COOLED

- P1 Single pump group - standard available pressure**, composed of single pump for user side complete of shut-off valves, water gauge, water charge and purging valves.
- P1H Single pump group - higher available pressure**, composed of single pump for user side complete of shut-off valves, water gauge, water charge and purging valves.
- PA Rubber-type vibration dampers:** Bell-shaped vibration dampers supports for insulating the unit (supplied in kit), made of base and bell in galvanized steel and natural rubber mixture.
- PM Spring-type vibration dampers:** spring-type vibration dampers support, for insulating the unit (supplied in kit), mainly indicated for installation in difficult and aggressive environments. Made of two steel plates containing a suitable quantity of harmonic steel springs.
- PQ Remote display** allowing to display the temperature and humidity values detected by probes, the alarm digital inputs, the outputs and the remote ON/OFF of the unit, to change and program of the parameters, the buzzer and the display of the present alarms.
- PV Quick start after electrical black-out:** this device allows the compressors re-start within 2 minutes from the return of power supply after electrical black-out.
- RA Anti-freeze heater on evaporator:** Electrical heater installed on the evaporator, in order to prevent freezing and provided with thermostat.
- RF Power factor correction system  $\cos\phi > 0,9$ :** Electrical device made of suitable condensers for compressors rephasing, ensuring a  $\cos\phi$  value  $\geq 0,9$ , so to reduce the power absorption from the electrical network.
- RL Compressors overload relays:** Electromechanical protection devices against compressor's overload.
- RM Condensing coil with pre-painted fins:** superficial treatment of the condensing coils with epoxy coating.
- RP Partial heat recovery** (about 20%) of the condensing heat, by means of a refrigerant/water plate exchanger (desuperheater), always in series to the compressors. It is requested when you need to produce sanitary water, by recovering condensing heat capacity.
- RR Copper/copper condensing coils:** special execution of the condensing coils with copper pipe and fins.
- V Voltmeter:** Electrical device measuring the electrical tension in the power supply of the unit.

# LIQUID CHILLERS - AIR COOLED

## Technical data sheet - RAC 351-752 Ka

RAC		351 Ka	411 Ka	451 Ka	512 Ka	562 Ka	602 Ka	642 Ka	682 Ka	752 Ka
<b>Cooling capacity</b>										
Cooling capacity		359,0	410,0	445,0	510,0	560,0	604,0	640,0	680,0	750,0
Absorbed power	kW	108,3	129,0	137,0	151,8	171,0	179,2	181,4	193,4	219,0
EER		3,31	3,18	3,25	3,36	3,27	3,37	3,53	3,52	3,42
ESEER European		4,98	4,84	5,01	5,07	5,07	5,08	5,11	5,09	5,11
<b>Centrifugal compressors two stage oil free</b>										
Quantity	n	1	1	1	2	2	2	2	2	2
Circuits	n	1	1	1	1	1	1	1	1	1
Nominal absorbed current	A	177,4	197,9	231,4	249,4	281,0	293,4	310,6	314,0	349,6
Maximum absorbed current	A	244,4	244,4	244,4	304,4	313,0	313,0	463,0	463,0	471,6
<b>Axial fans</b>										
Quantity	n	8	8	8	8	10	10	10	10	12
Motors power	kW	15,6	15,6	15,6	15,6	19,5	19,5	19,5	19,5	23,8
Total air flow	m <sup>3</sup> /h	171.200	168.320	155.200	148.800	210.400	194.000	194.000	186.000	232.800
Total air flow	l/s	47.556	46.756	43.111	41.333	58.444	53.889	53.889	51.667	64.667
Nominal absorbed current	A	31,2	31,2	31,2	31,2	39	39	39	39	47,4
<b>Flooded shell and tube evaporator</b>										
Quantity	n	1	1	1	1	1	1	1	1	1
Water flow rate	m <sup>3</sup> /h	61,6	70,4	76,4	87,6	96,1	103,7	109,9	116,7	128,8
Water flow rate	l/s	17,1	19,6	21,2	24,3	26,7	28,8	30,5	32,4	35,8
Pressure drop	kPa	29	24	22	18	76	58	66	72	71
Water volume	l	65	76	88	107	81	95	95	95	110
<b>P1 Pump group</b>										
Available pressure with P1	kPa	119	122	114	106	119	114	111	115	149
Motor power with P1	kW	5,5	5,5	7,5	7,5	7,5	7,5	7,5	7,5	11,0
Nominal absorbed current	A	12,1	12,1	14,2	14,2	13,7	13,7	13,7	13,7	22,0
<b>P1H Pump group</b>										
Available pressure with P1H	kPa	208	206	227	220	204	203	217	229	216
Motor power with P1	kW	7,5	7,5	11,0	11,0	11,0	11,0	15,0	15,0	15,0
Nominal absorbed current	A	13,7	13,7	22,0	22,0	22,0	22,0	28,5	28,5	28,5
<b>Sound power level ISO 3744</b>										
Sound power level	dB(A)	86,8	86,8	86,8	88,1	89,7	89,7	89,1	89,1	89,5
<b>Dimensions</b>										
Length	mm	4.750	4.750	4.750	4.750	5.720	5.720	5.720	5.720	6.690
Width	mm	2.300	2.300	2.300	2.300	2.300	2.300	2.300	2.300	2.300
Height	mm	2.560	2.560	2.560	2.560	2.560	2.560	2.560	2.560	2.560
Transport weight 3)	kg	3.780	3.920	4.120	4.230	4.770	4.830	4.860	4.980	5.230
<b>Power supply</b>										
Power supply	V / ph / Hz	400 V / 50 Hz / 3 Ph + T								
<b>NOTES</b>										
Nominal condition referred to: air 35 °C - chilled water 7/12 °C.										
3) Refrigerant charge included.										

# LIQUID CHILLERS - AIR COOLED

## Technical data sheet - RAC 812-1404 Ka

RAC		812 Ka	853 Ka	893 Ka	983 Ka	1083 Ka	1203 Ka	1283 Ka	1404 Ka
<b>Cooling capacity</b>									
Cooling capacity	kW	810,0	850,0	892,0	984,0	1.084,0	1.190,0	1.280,0	1.398,0
Absorbed power	kW	244,6	249,1	265,9	273,1	303,8	348,7	390,1	407,6
EER		3,31	3,41	3,35	3,60	3,57	3,41	3,28	3,43
ESEER European		5,09	5,22	5,14	5,23	5,23	5,21	5,15	5,07
<b>Centrifugal compressors two stage oil free</b>									
Quantity	n	2	3	3	3	3	3	3	4
Circuits	n	1	1	1	1	1	1	1	2
Nominal absorbed current	A	374,0	412,7	434,0	466,1	516,1	591,2	656,0	691,2
Maximum absorbed current	A	471,6	465,2	465,2	690,2	698,8	716,0	716,0	926,0
<b>Axial fans</b>									
Quantity	n	12	14	14	14	16	20	20	20
Motors power	kW	23,8	27,7	27,7	27,7	31,7	39,6	39,6	39,6
Total air flow	m <sup>3</sup> /h	223.200	294.560	271.600	260.400	297.600	420.800	372.000	372.000
Total air flow	l/s	62.000	81.822	75.444	72.333	82.667	116.889	103.333	103.333
Nominal absorbed current	A	47,4	55,3	55,3	55,3	63,2	79,0	79,0	79,0
<b>Flooded shell and tube evaporator</b>									
Quantity	n	1	1	1	1	1	1	1	2
Water flow rate	m <sup>3</sup> /h	139,1	145,9	153,1	168,9	186,1	204,3	219,7	240,0
Water flow rate	l/s	38,6	40,5	42,5	46,9	51,7	56,7	61,0	66,7
Pressure drop	kPa	82	59	64	78	68	82	76	91
Water volume	l	110	134	134	134	163	163	189	189
<b>P1 Pump group</b>									
Available pressure with P1	kPa	133	125	125	111	144	127	111	125
Motor power with P1	kW	11,0	11,0	11,0	11,0	15,0	15,0	15,0	18,5
Nominal absorbed current	A	22,0	22,0	22,0	22,0	28,5	28,5	28,5	34,2
<b>P1H Pump group</b>									
Available pressure with P1H	kPa	207	203	222	210	239	221	207	185
Motor power with P1H	kW	18,5	18,5	18,5	18,5	22,0	22,0	22,0	22,0
Nominal absorbed current	A	34,2	34,2	34,2	34,2	40,7	40,7	40,7	40,7
<b>Sound power level ISO 3744</b>									
Sound power level	dB(A)	89,5	90,0	90,0	90,1	90,6	91,7	91,7	92,3
<b>Dimensions</b>									
Length	mm	6.690	7.670	7.670	7.670	9.120	10.570	10.570	10.570
Width	mm	2.300	2.300	2.300	2.300	2.300	2.300	2.300	2.300
Height	mm	2.560	2.560	2.560	2.560	2.560	2.560	2.560	2.560
Transport weight 3)	kg	5.360	6.120	6.310	6.440	6.980	9.860	9.920	10.120
<b>Power supply</b>									
Power supply	V / ph / Hz	400 V / 50 Hz / 3 Ph + T							
<b>NOTES</b>									
Nominal condition referred to: air 35 °C - chilled water 7/12 °C.									
3) Refrigerant charge included.									