



**AIR - COOLED
WATER CHILLERS WITH AXIAL FANS
FROM 5 KW TO 15 KW
SIAL R**





Air Conditioners

SIAL R

**AIR COOLED WATER CHILLER
FROM 5 KW TO 15 KW**



www.frostitaly.it

138

General Features

Air-cooled water chiller units for outdoor installation, with axial fans. They are projected to obtain a noiseless, efficient operation and reliable working, easy to install and of reduced maintenance.
All the units are completely factory tested before dispatch.

Technical Features

- **Frame:** Self-supporting galvanized steel frame protected with polyester powder painting RAL 7037PB. Steel screws and bolts. The compressor is situated in a sound proof vane and separated from the air box.
- **Compressors:** hermetic blades rotary single or three phase, for models 5,7,9m, hermetic three phase scroll type for models 9, 12,15, equipped with internal thermo protection and crankcase heater, situated in a sound proof box.
- **Fans:** axial type, directly coupled to the electric motor, single phase, 6 poles, equipped with a current speed control in order to optimize the condensation (or heat pump evaporation); the device reduces the absorbed power and the noise during partial loads. The fans are fitted with a safety guard on discharge air flow.
- **Air side heating exchanger:** it consists of an aluminum finned coil and copper tubes.
- **Water side heating exchanger:** stainless steel AISI 316 brazed-welded plates exchanger with external insulation.
- **Refrigerant circuit:** made of pickled copper, it includes lamination devices, dehydrator filter, high and low pressure switches, sight glass and humidity indicator, service connections, liquid line shut off faucet and solenoid valve, inversion valve, no return valves, liquid receiver and accumulator, security valve.
- **Electrical board:** it includes automatic main circuit breaker with safety door interlock, automatic control circuit breaker, compressor and fan contactor, and terminal board for the unit-microprocessor interface.
All wires and clamps are numbered according to standard EN60204.
- **Microprocessor:** it controls automatically the regulation of the water temperature, the compressor timing, and the alarms. It visualizes on the display the running condition of the unit, the inlet temperature of the device, and the alarms' code.
- **Complete Hydraulic kit:** **Pump** It gives to the water the pressure head necessary to pass through the hydraulic circuit and reach the terminals. **Tank** Made in high-quality carbon steel, insulated with injected rigid polyurethane with low thermal conductivity to minimize dispersions.

AIR COOLED WATER CHILLERS

ORION VR MC

ORION VR HT

ORION R MC

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Model Number Nomenclature

SIAL

X



5, 7, 9m, 9, 12, 15
Size

Y



R, H, CR, CH
Version*

*

Only cooling

Heat pump

Only cooling with radial fan

Heat pump with radial fan



Main components

Compressor: they are rotary blades type on the smaller sizes or scroll on the bigger.



Fan: axial fan type provided with nozzle and protection grill. It allows an optimal air flow through the finned coil with minimal noise level and power consumption.



Water-cooler exchanger: plates type. Suitable for modern refrigerants. For high efficiency and reliability.



Air-cooler exchanger: finned coil directly designed by Frost Italy. Allows the maximum efficiency with minimal amount of space.



Microprocessor: it controls all device functions.



Thermostatic expansion valve: it laminates the condensed refrigerant, On models 5 and 7 are installed strainers.



Pressure differential switch water side: it works as flow control, it operate when the flow water reach the minimum level.



Fans speed control : it controls the condensation (or evaporation in heat pump), it reduces the active power absorbed and the noise.



Pump : it gives to the water the pressure head necessary to pass through the hydraulic circuit and reach the terminals.



Storage tank : (STANDARD on the models 12,15, models 5-7-9 SM don't have storage tank) capacity 33 litres, for smaller sizes tank function is achieved by microprocessor.



Accessories

Compressors soft starters: enables the gradual start of compressors by limiting the initial starting current.

Control system and remote assistance: it allows the assistance and the unit control by means of web browser. Web server remote connection through corporate network. In case of alarm an alert can be sent via SMS or e-mail. For simultaneous control till 6 or 18 units.



Capacitor bank for compressor: the tools brings the consumption of the unit to $\cos\phi=0,95$ by decreasing the absorbed reactive power

Refrigerant gauges: installed on the unit, they show the operative pressures of the cooling circuit on high and low pressure side.



Electronic expansion valve: for the condensed refrigerant rolling. In comparison with the thermostatic valve it enables fast response time according to the load variation by enhancing the unit performances.



Compressor faucet valves: they isolate the compressors from the cooling circuit by enhancing the maintenance operations.



Operating kit up to -25°C external air temperature: it allows to the chiller to operate with low external temperatures increasing the working limits.



Accessories

De-superheaters: permits to recover till 25% of condensing heating for other purposes.



Total heat recovery: heat exchanger that allows the condensation heat recovery for others uses.



Liquid receiver: permits the correct refrigerant supply to the thermal expansion valve during external temperature variations.

Expansion vessel: absorbs liquid volume variations caused by working temperature variations. In epoxy powder coated steel, long-lasting duration with steady membrane made in SBR rubber.



Differential by-pass valve: recommended for hydronic circuits working with sensitive flow variation. It permits to limit the differential pressure generated by the pump.



Inlet water filter: retains impurities of the water circuit which can damage the pumping unit and the exchanger.



Flow switch: mounted on the exit of the exchanger (user side) detects the water flow lack by an alarm to the control system.



Metallic grill: finned coil metal grill for accidental impacts protection.



Special treatment: In case the units are to be located near the seaside or in aggressive environment we recommend to protect the exchanger with suitable anti-corrosion treatments:

- Copper finned coils cu/cu
- Treated finned coils

EC fans: With BLDC brushless motor, with internal protection and fan speed control integrated. Internal electrical insulated with protection class I, IP 54, according to norm EN 61800-5-1. The impellers are housed in aerodynamically shaped enclosures to increase the efficiency and decrease the noise level, complete with fan guards.

Rubber anti-vibration dampers: they reduce the vibrations transmission produced by the device.



Spring anti-vibration dampers: they are more effective than rubber dampers, reduce the vibrations transmission produced by the device.



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CHILLERS**

ORION VR
MC

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Technical Features

| Model | | 5 | 7 | 9m | 9 | 12 | 15 |
|-------------------------------------|------------------------|---------------|-------|-------|---------------|-------|-------|
| Cooling Capacity | kW | 5,3 | 6,8 | 8,3 | 8,4 | 12,2 | 14,2 |
| EER | | 2,79 | 2,96 | 2,96 | 2,89 | 2,77 | 2,68 |
| N° compressors / circuits | | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 | 1/1 |
| N° capacity steps | | 1 | 1 | 1 | 1 | 1 | 1 |
| Compressors type | | Blades rotary | | | Scroll | | |
| Refrigerant type | | R410A | | | | | |
| N° fans | | 1 | 1 | 1 | 1 | 2 | 2 |
| Fans flow rate | m³/h | 2.200 | 2.200 | 3.300 | 3.300 | 6.500 | 6.300 |
| Flow water | m³/h | 0,91 | 1,17 | 1,43 | 1,44 | 2,10 | 2,44 |
| Water pressure drop | kPa | 6 | 7 | 6 | 6 | 40 | 33 |
| Nominal absorbed power | kW | 1,9 | 2,3 | 2,8 | 2,9 | 4,4 | 5,3 |
| Nominal absorbed current | A | 9 | 11 | 14 | 7 | 9 | 11 |
| Maximum peak current | A | 58 | 73 | 85 | 49 | 65 | 68 |
| Sound Pressure Level ⁽¹⁾ | dB(A) | 45 | 45 | 48 | 48 | 51 | 51 |
| Electrical supply | V/Hz/Ph | 230/50/1+N+PE | | | 400/50/3+N+PE | | |
| Shipping weight | kg | 115 | 115 | 120 | 120 | 185 | 185 |

References Conditions

Nominal conditions:

Air ambient temperature T=35°C

Water temperature T=12/7°C

(1) Full sound pressure level measured at 5m from the unit in free field (ISO3744)

| Operation Limits | Cooling | | |
|--|---------|-----|-----|
| | | Min | Max |
| *Inlet water temperature | (°C) | 9 | 23 |
| Outlet water temperature | (°C) | 4 | 18 |
| Ambient air temperature | (°C) | 5 | 40 |
| Ambient air temperature with kit -25°C | (°C) | -25 | 40 |
| * Without ethylene glycol | | | |

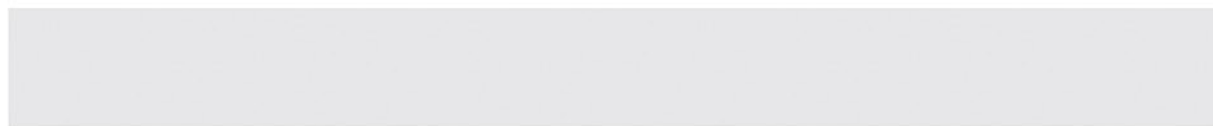
Fouling Factor Correction

Unit performances reported in the table are given for the condition of clean exchanger (fouling factor=0). For different fouling factors values, unit performances should be corrected with the correction factors shown above.

| Evaporator fouling factors ($m^2 \text{ } ^\circ\text{C/W}$) | F1 | F2 |
|--|------|------|
| 0 (Clean evaporator) | 1 | 1 |
| 0.44×10^{-4} | 0,98 | 0,99 |
| 0.88×10^{-4} | 0,96 | 0,99 |
| 1.76×10^{-4} | 0,93 | 0,98 |
| F1 = capacity correction factors F2 = compressor power input correction factors | | |



| Ethylene glycol percent by weight (%) | 10 | 20 | 30 | 40 | 50 |
|---------------------------------------|-------|-------|-------|-------|-------|
| Freezing point | -3.6 | -8.7 | -15.3 | -23.5 | -35.5 |
| Cooling capacity corr. Factor | 0,986 | 0,980 | 0,973 | 0,966 | 0,960 |
| Power input corr. Factor | 1,000 | 0,995 | 0,990 | 0,985 | 0,975 |
| Mixture flow corr. Factor | 1,023 | 1,054 | 1,092 | 1,140 | 1,200 |
| Pressure drop corr. Factor | 1,061 | 1,114 | 1,190 | 1,244 | 1,310 |



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ELEVATION CORRECTION FACTOR CHILLER AIR TO WATER

| ELEVATION [m] | COOLING CAPACITY CORRECTION FACTOR | ELECTRIC POWER CORRECTION FACTOR |
|---------------|------------------------------------|----------------------------------|
| 0 | 1 | 1 |
| 600 | 0,987 | 1,010 |
| 1.200 | 0,973 | 1,020 |
| 1.800 | 0,958 | 1,030 |
| 2.400 | 0,943 | 1,040 |

Cooling Performances

| Model | ta | 25 | | 30 | | 32 | | 35 | | 40 | |
|----------------|----|------|-----|------|-----|------|-----|-------------|------------|------|-----|
| | tu | Pf | Pa | Pf | Pa | Pf | Pa | Pf | Pa | Pf | Pa |
| SIAL 5 | 5 | 5,6 | 1,6 | 5,3 | 1,7 | 5,1 | 1,8 | 4,9 | 1,9 | 4,5 | 2,2 |
| | 6 | 5,8 | 1,5 | 5,5 | 1,7 | 5,3 | 1,8 | 5,1 | 1,9 | 4,7 | 2,2 |
| | 7 | 6,0 | 1,5 | 5,7 | 1,7 | 5,5 | 1,8 | 5,3 | 1,9 | 4,9 | 2,1 |
| | 8 | 6,2 | 1,5 | 5,9 | 1,7 | 5,7 | 1,8 | 5,5 | 1,9 | 5,1 | 2,1 |
| | 9 | 6,5 | 1,5 | 6,1 | 1,7 | 5,9 | 1,8 | 5,7 | 1,9 | 5,3 | 2,1 |
| | 10 | 6,7 | 1,7 | 6,3 | 1,7 | 6,2 | 1,8 | 5,9 | 1,9 | 5,5 | 2,1 |
| SIAL 7 | 5 | 7,3 | 1,8 | 6,8 | 2,0 | 6,6 | 2,1 | 6,3 | 2,3 | 5,8 | 2,6 |
| | 6 | 7,5 | 1,8 | 7,1 | 2,0 | 6,9 | 2,1 | 6,6 | 2,3 | 6,0 | 2,6 |
| | 7 | 7,8 | 1,8 | 7,3 | 2,0 | 7,1 | 2,1 | 6,8 | 2,3 | 6,3 | 2,6 |
| | 8 | 8,1 | 1,8 | 7,6 | 2,0 | 7,4 | 2,1 | 7,1 | 2,3 | 6,5 | 2,6 |
| | 9 | 8,4 | 1,8 | 7,9 | 2,0 | 7,7 | 2,1 | 7,4 | 2,3 | 6,8 | 2,6 |
| | 10 | 8,7 | 1,8 | 8,2 | 2,0 | 8,0 | 2,1 | 7,6 | 2,3 | 7,0 | 2,6 |
| SIAL 9m | 5 | 7,8 | 2,2 | 7,3 | 2,4 | 7,1 | 2,6 | 6,8 | 2,7 | 6,2 | 3,1 |
| | 6 | 8,1 | 2,2 | 7,6 | 2,4 | 7,4 | 2,5 | 7,0 | 2,7 | 6,4 | 3,1 |
| | 7 | 8,5 | 2,2 | 7,9 | 2,4 | 7,7 | 2,5 | 7,3 | 2,7 | 6,7 | 3,1 |
| | 8 | 8,8 | 2,2 | 8,2 | 2,4 | 8,0 | 2,5 | 7,6 | 2,7 | 7,0 | 3,1 |
| | 9 | 9,1 | 2,2 | 8,5 | 2,4 | 8,3 | 2,5 | 7,9 | 2,7 | 7,2 | 3,1 |
| | 10 | 9,4 | 2,2 | 8,8 | 2,4 | 8,6 | 2,5 | 8,2 | 2,7 | 7,5 | 3,0 |
| SIAL 9 | 5 | 7,9 | 2,2 | 7,4 | 2,4 | 7,2 | 2,6 | 6,8 | 2,7 | 6,2 | 3,1 |
| | 6 | 8,2 | 2,2 | 7,7 | 2,4 | 7,4 | 2,6 | 7,1 | 2,7 | 6,5 | 3,1 |
| | 7 | 8,5 | 2,2 | 8,0 | 2,4 | 7,8 | 2,5 | 7,4 | 2,7 | 6,8 | 3,1 |
| | 8 | 8,9 | 2,2 | 8,3 | 2,4 | 8,1 | 2,5 | 7,7 | 2,7 | 7,0 | 3,0 |
| | 9 | 9,2 | 2,2 | 8,6 | 2,4 | 8,4 | 2,5 | 8,0 | 2,7 | 7,3 | 3,0 |
| | 10 | 9,6 | 2,2 | 9,0 | 2,4 | 8,7 | 2,5 | 8,3 | 2,7 | 7,6 | 3,0 |
| SIAL 12 | 5 | 13,2 | 3,6 | 12,2 | 4,0 | 11,8 | 4,2 | 11,2 | 4,4 | 10,4 | 4,9 |
| | 6 | 13,6 | 3,6 | 12,7 | 4,0 | 12,3 | 4,2 | 11,7 | 4,4 | 10,8 | 4,9 |
| | 7 | 14,2 | 3,6 | 13,2 | 4,0 | 12,8 | 4,2 | 12,2 | 4,4 | 11,2 | 4,9 |
| | 8 | 14,7 | 3,6 | 13,6 | 4,0 | 13,2 | 4,2 | 12,7 | 4,4 | 11,7 | 4,9 |
| | 9 | 15,3 | 3,6 | 14,2 | 4,0 | 13,7 | 4,1 | 13,2 | 4,4 | 12,2 | 4,9 |
| | 10 | 15,8 | 3,6 | 14,8 | 4,0 | 14,3 | 4,1 | 13,6 | 4,4 | 12,7 | 4,9 |
| SIAL 15 | 5 | 15,5 | 4,3 | 14,2 | 4,7 | 13,8 | 4,9 | 13,2 | 5,3 | 12,1 | 5,9 |
| | 6 | 16,0 | 4,3 | 14,8 | 4,7 | 14,3 | 4,9 | 13,6 | 5,3 | 12,6 | 5,9 |
| | 7 | 16,7 | 4,3 | 15,4 | 4,7 | 14,9 | 4,9 | 14,2 | 5,3 | 13,1 | 5,9 |
| | 8 | 17,3 | 4,2 | 16,0 | 4,7 | 15,5 | 4,9 | 14,8 | 5,3 | 13,6 | 5,9 |
| | 9 | 18,0 | 4,2 | 16,6 | 4,7 | 16,1 | 4,9 | 15,4 | 5,3 | 14,2 | 5,9 |
| | 10 | 18,7 | 4,2 | 17,3 | 4,7 | 16,7 | 4,9 | 15,9 | 5,2 | 14,8 | 5,9 |

COMPLETE HYDRAULIC KIT

Mounted inside the frame permits space saving and easy installation, provided with:

Circulation pump: it gives to the water the pressure head necessary to pass through the hydraulic circuit and reach the terminals.

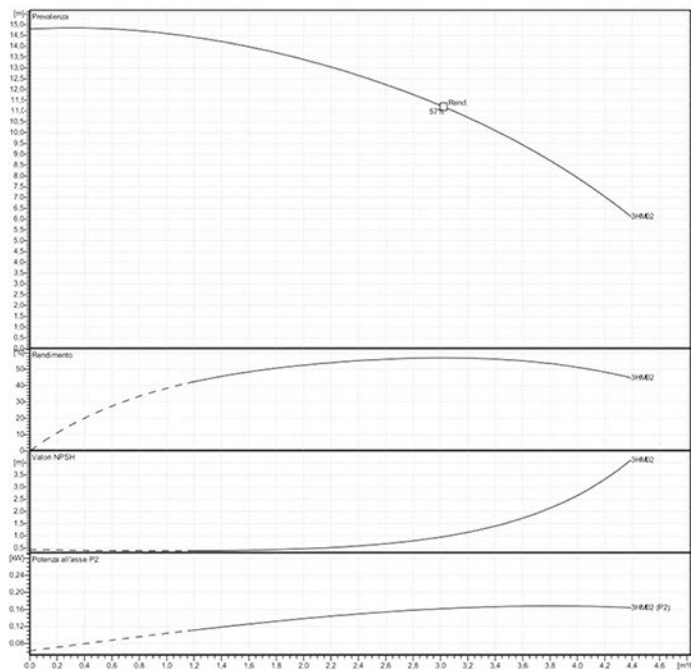
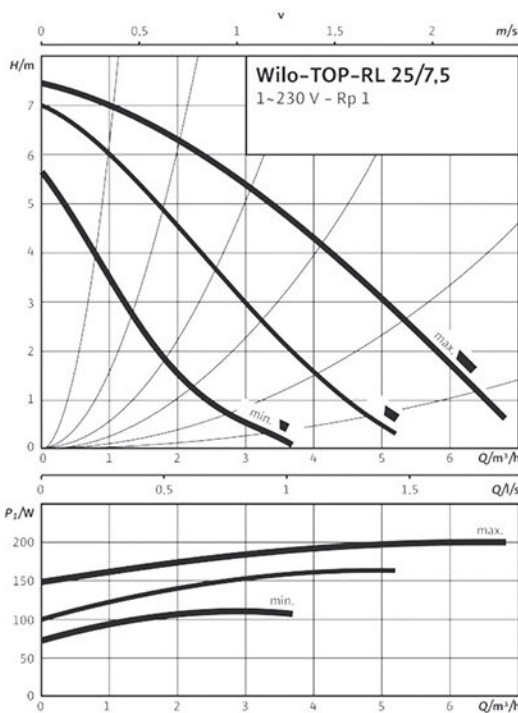
Air bleed valve: it permits to release the air in the plant to obtain optimal thermal exchange.

Safety valve: it avoids the working pressure exceeding over the set point.

Storage tank: it serves as thermal flywheel for the plant. Polyurethane insulation minimizes the heat losses.

PRESSURE HEAD PUMP GRAPHIC

Size 5 - 7 - 9m - 9



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Size 12 - 15

Technical Features

| Model | | 5 | 7 | 9m | 9 | 12 | 15 |
|---------------------------|-----------------|---------------|-------|-------|-------|------|------|
| Nominal flow rate | m3/h | 0,91 | 1,17 | 1,43 | 1,44 | 2,10 | 2,44 |
| Nominal head | kPa | 60 | 58 | 55 | 55 | 190 | 168 |
| Net static pressure pump | kPa | 54 | 51 | 49 | 49 | 150 | 135 |
| Absorbed electrical power | kW | 0,165 | 0,165 | 0,165 | 0,165 | 0,50 | 0,50 |
| Nominal current | A | 0,80 | 0,80 | 0,80 | 0,80 | 3,46 | 3,46 |
| Power supply | V/Hz/ Ph | 230/50/1+N+PE | | | | | |
| Storage volume | l | 16 | 16 | 16 | 16 | 33 | 33 |
| Safety valve | bar | 3 | 3 | 3 | 3 | 3 | 3 |

FREE COOLING KIT

Composed by a finned coil with cooper coil and aluminum fins, with servo-controlled 3-way valve. The controller regulates the valve position by supplying the Free Cooling coil when the climate conditions allow it. The water conditioning is cooled by the external air decreasing the use of the cooling circuit.

The Compressors start to partialize till to stop when the free cooling is active and when the water temperature coming from the FC coil is close to the set point.

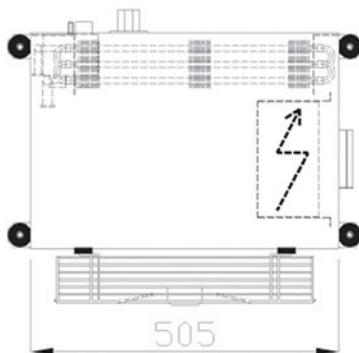
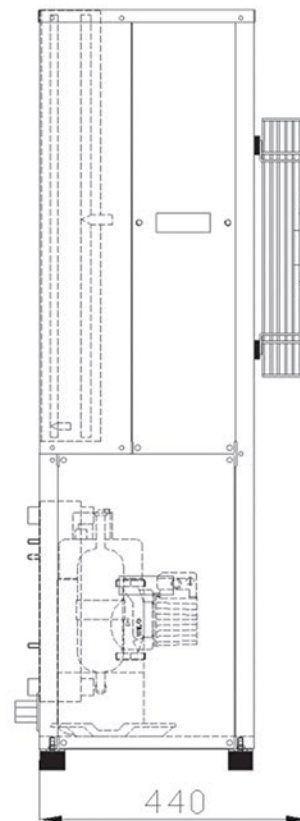
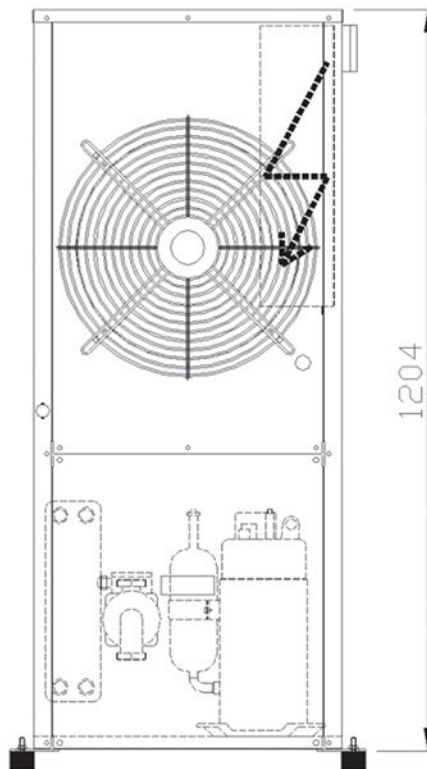
In this case we got the complete free cooling and the water temperature control comes by means of continuous regulation of the fans rotation speed.

In order to optimize spaces, capacity and noise pollution, unit dimensions could be different by the standard model.



DIMENSIONAL DRAWING

Sial R 5-7-9m-9



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