RH

Open circuit cooling tower

Technical Documentation

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JACIR

With more than 60 years' experience, our company:

∞ Has invested in detailed research and development in order to propose technical solutions in accordance with environmental protection through unequalled realizations and patents.

∞ Is today the European leader thanks to its technology beyond market requirements.

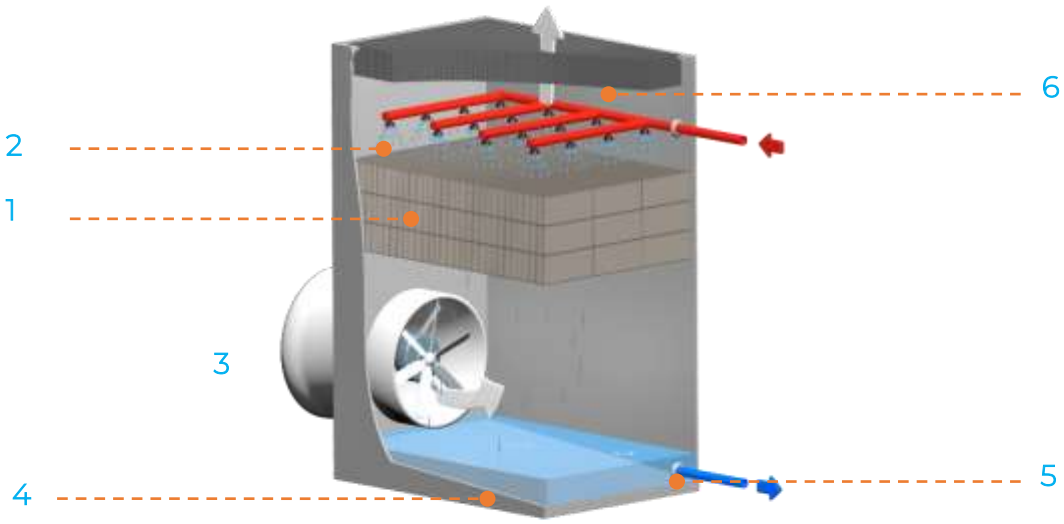
STRONG ADVANTAGES OF THE RH

∞ EXCHANGE SURFACE	High efficiency, with low fouling and low pressure drop characteristics, specially designed for water with high suspended solids content and self-cleaning. It can be used up to 100 °C as standard.
∞ ANTICORROSION COATING	Casing of the tower is made in galvanized or stainless-steel X-STEEL as an option, seamless.
∞ EASY MAINTENANCE	Large access doors, fan outside of the tower and at man chest, inclined and plane basin for a complete drain. Height inside the basin and under the infill is minimum 1425mm.
∞ FLEXIBILITY	Possible delivery in parts to assemble directly on site.
∞ DELIVERY IN MODULES	Easy handling and transport.
∞ SILENCE	Compared with induced draft towers, the RH are low sound towers in standard, can be improved according to the requirement.

Open circuit cooling tower principle RH

A cooling tower is a heat exchanger, which enables water to be cooled through direct contact with air. The heat transfer from the water to the air is carried out partly by sensible heat transfer, but mainly by latent heat transfer (evaporation of part of the water into the air), which makes it possible to reach cooling temperatures lower than ambient temperatures.

Operation:



The hot water to be cooled is pumped to the top of the tower through pipes. This water is divided and distributed over the heat exchange surface (1) by low pressure water distribution nozzles (2).

Blown by the fan (3), the fresh air enters into the lower section of the unit and escapes through the upper section after being heated and saturated by passing through the wetted heat exchange surface.

As a result of surface tension, due to the exchange surface, the water spreads in uniform way, falls down the whole height. The exchange surface is then increased.
The water, cooled thanks to forced ventilation, falls into the inclined basin (4) at the bottom of the tower.

Then the water is sucked through the strainer (5). Drift eliminators (6) located at air outlet reduces drifts losses.

Benefits of cooling towers compared with dry coolers:

Energy saving

- Chillers, condensers associated to a cooling tower will be cooled at a lower temperature and then will have a better cooling capacity. Their efficiency is higher.

- Seven to 10 times more air must be blown in a dry cooler, which means a lot of fans and electric motors. So, the electrical consumption is about 40% higher.

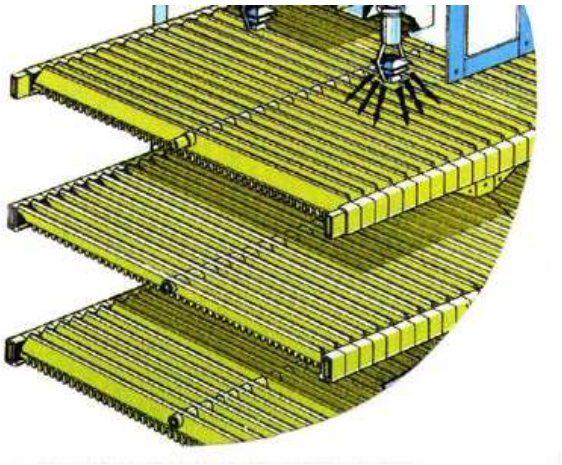
- A tower costs 30% to 50% of the price of a dry cooler for a same evacuated power.

- A 1°C increase of the ambient air has direct effect on the performance of a dry air cooler, while the efficiency of a cooling tower will not be as much affected as the wet bulb has not fluctuated in the same way.

Noise reduction

Jacir can supply much quieter tower than a dry cooler.

Exchange surface: X-STREAM



It is made of PP toothed blades. They equally spread the water along the blades, into drops down to the lower blades' layers. The cooling occurs during the drops fall between the blades' layers; therefore, this exchange surface is highly resistant to clogging. It can be used for water with solids content up to 400ppm. In the case of waters with high salts content, the X-STREAM is self-cleaning by thermal expansion.

Tower casing

Self-supporting rigid panels, with 2 or 4 folds on the four sides, (designed by Jacir) allows exceptional tightness, even with stainless-steel plates.
Towers are assembled with waterproof A2 stainless-steel rivets (uniform and high-capacity locking). There is no welding during assembly; a high covering seal ensures the close fit between the panels.
As standard model, the panels are in galvanized steel 2mm thick Zendzimir process 275gr/m² (galvanized plates are protected by the zinc oxidation on the surface).
Stainless-steel is optional, X-STEEL or 316L: RXH serie.

Inclined and plane basin

It has a high-water capacity in order to offer a high thermal inertia. For example, the maximum volume of a RH8029 is 12m³ minimum. The inclined and plane basin allows an easy and complete drain. No welding and no screws for panel assembly on surfaces in contact with the water.

On the utility panel of the basin are installed:

- An overflow connection,
- A drain connection,
- A float valve or electrical solenoid make-up water system as an option,
- A water outlet through a removable strainer (in stainless-steel) with a flange, oversized to eliminate cavitations, with a perforated steel plate,
- Large access door(s) for nozzles for basin (540 x 540mm),
- Options: electrical heater of 230V or 400V and waterproof thermostat with separate bulb. For automatic control of resistance, suitable contractors must be provided.

3 types of basins are available:

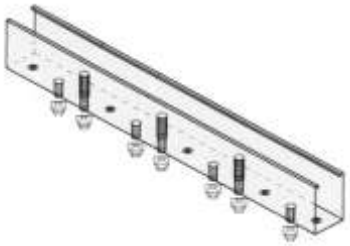
- Standard basin (B)
- High-water capacity basin (BGC)
- Collecting basin (water passing through) (BR)

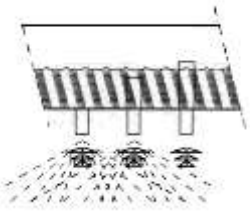
Accessibility

If there are sound baffles, plumeless tube coil or outlet air duct, large access doors (540 x 540mm) are provided. This access is used to remove easily the drift eliminators, nozzles, exchange surface and water distribution pipes. An additional middle casing is supplied as an option, fitted with access doors (540 X 540mm); it is located between the tube coil and the drift eliminators.

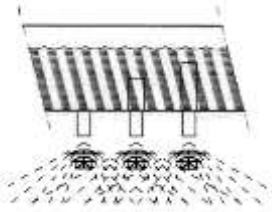
Water distribution

Water distribution is made of PP pipes (10 series) or of open-air steel channels (20 and above series). They are installed with PP nozzles especially designed to achieve an optimal distribution through the whole air section, and with large water nozzle to avoid clogging even in the case of high suspended content. These nozzles operate under low pressure (0 to 0.3 mWC), in order to low pumping head and to distribute large size drops, which prevents the drift from getting out of the cooling tower. In the case of distribution channels, Jacir has engineered a design to combine original high performance with major flow rate fluctuations: nozzles are fed by different water inlets in the channels.

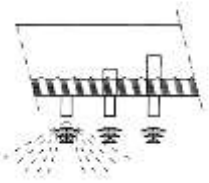




Minimum flow rate operating



Half flow rate operating



Full flow rate operating

Drift eliminators

Highly efficient, they prevent the water from being sprayed out of the tower. Ultraviolet resistant, they are easy to remove from the top in order to access to the distributors and to the exchange surface. They are made of PVC or PP blades, special type in the case of the plume suppression coil option is selected.

Fans

The centrifugal fans are specially designed and manufactured by Jacir. The impeller is a double side air inlet type. The air inlet ducts are removable to access to the impeller, and are made of polyester. Their shape noticeably improves the performances of the fans.
The bearings are self-aligning, lubricated in our factory and to be regularly lubricated. Each shaft is supported by two bearings. There is 1 motor for each fan.

The fan scroll side-plates are used to fix the motor support. This design prevents the belts from producing a slapping effect. Trapezoidal pulleys and V-belts transmission are used. Tension is applied to the belts by tipping the motor seat, for easy adjustment. The motor is located above the fan casing.

The fan is protected from corrosion by an ELASTAIR coating (thickness: 350-400 µm) ultra-violet proof. The impeller is treated and protected by a baked EPOXY coating.

A completely stainless-steel volute and impeller design can be selected as an option.

Standard motor

- Asynchronous three-phases motor,
- 1500 rpm,
- 230 / 400 V up to 5,5 kW,
- 400 / 690 V above 5,5 kW,
- Hz 50,
- IP55 (possible open sky operating),
- Direct connection to terminal box,

Sound attenuation (options) :
Special sound attenuation

Decrease of fan speed, polyester blades. In order to even improve the sound attenuation, the cooling tower casing can be coated with protected high density rock wool.

OPTIONS

- Internal ladders to ease cleaning,
- X-TRACT system: full and simple extraction of internals to be cleaned (cf SP_X-TRACT)
- Stainless steel X-STEEL or 316 L (1.4404),
- Electric heater with thermostat,
- Two - speed motor (Dahlander type –1500/750 rpm, separate wiring or PAM –1500/1000 rpm),
- Frequency controller,
- Water level control with solenoid valve (with electric-valve and input filter),
- Automated Inductive deconcentration (see DAi documentation),
- Discharge cone (increase of air outlet speed),
- Air filtration (fan covering + filters),
- Air pressure available for connection to the duct,
- Control panel,
- Equipment delivered in parts, ready to be assembled,
- Assembly on site by experimented technicians from our factory,
- Non freezing fan blade device,
- Anti-vibrations supports.

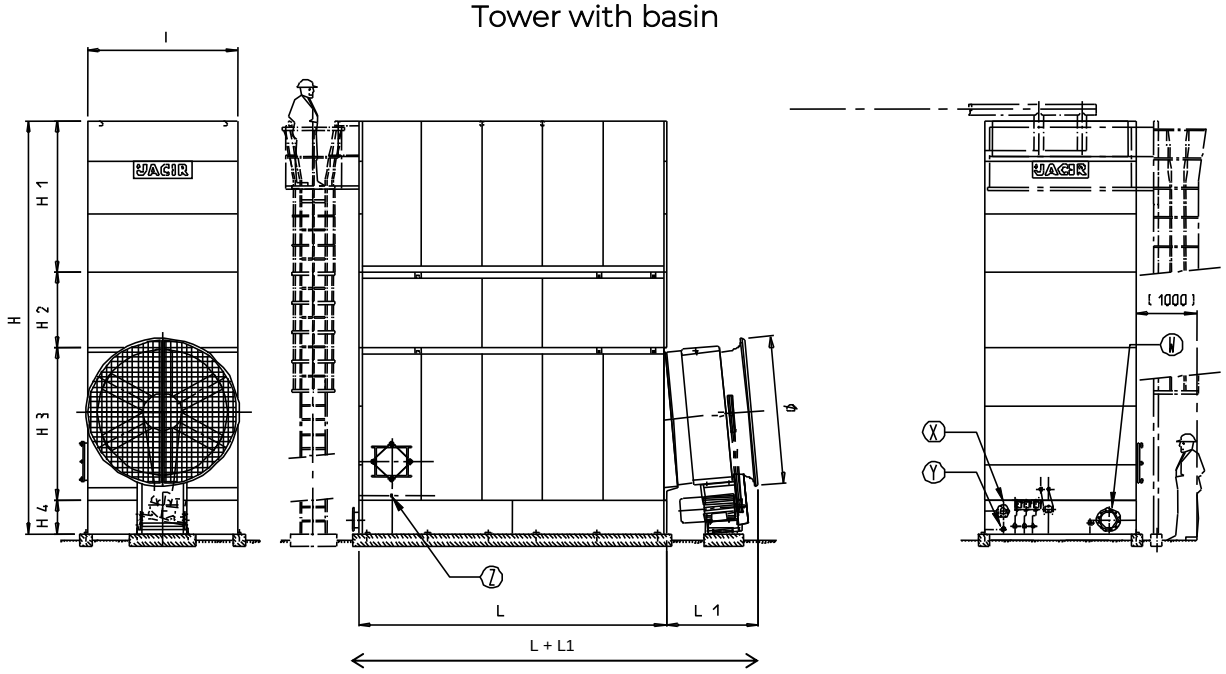
Technical characteristics

RH serie	Water flow rate (m3/h)	Dimensions (mm)				Weight (kg)				Water heater (kW)	ϕ fan (m)	Motor power (kW)				Sound level at 20 m (dB(A))*
						Empty		Full				Installed		Absorbed		
		L + L1	l	H without basin	H with basin	---	B	---	B			1 speed	2 speeds	1 speed	2 speeds	
RH 3017-47H140-110	51 à 153	4290	1800	5200	5200	2520	2700	3420	6200	10	1,40	11	11 / 3,7	9,5	9,5 / 4,2	63
RH 3017-60K140-110				6500	6500	2920	3100	3820	6620							
RH 3017 -47H140-150				5200	5200	2520	2700	3420	6200			15	15/ 5,5	12,7	12,7/ 3,8	
RH 3017 -60K140-150				6500	6500	2920	3100	3820	6620							
RH 3024-47H180-185	72 à 216	4685	2500	5200	5200	3200	3460	4450	8310	10	1,80	18,5	18,5 / 6	15,7	15,7 / 4,7	64
RH 3024-60K180-185				6500	6500	3740	4000	4990	8850							
RH 4024-47H180-185	96 à 288	5685	2500	5200	5200	3850	4200	5530	10680	10	1,80	18,5	18,5 /	15,7	15,7 / 4,7	65
RH 4024-47H180-220												22	22 / 7,5	18,7	18,7 / 5,6	
RH 4024-60K180-185				6500	6500	4570	4920	6250	11400			18,5	18,5 /	15,7	15,7 / 4,7	
RH 4024-60K180-220												22	22 / 7,5	18,7	18,7 / 5,6	
RH 5024-52H215-220	120 à 360	6816	2500	5200	5800	4750	5350	6850	13450	10	2,15	22	22 / 7,5	18,7	18,7 / 5,6	
RH 5024-52H215-300												30	30 / 9	24,7	24,7 / 7,3	
RH 5024-65K215-220				6500	7100	5670	6270	7770	14370			22	22 / 7,5	18,7	18,7 / 5,6	
RH 5024-65K215-300												30	30 / 9	24,7	24,7 / 7,3	
RH 5029-56H245-220	145 à 435	6940	3000	5600	6200	5800	6800	8340	17000	2 x 6	2,45	22	22 / 7,5	18,7	18,7 / 5,5	66
RH 5029-56H245-300												30	30 / 9	25,5	25,5 / 7,6	
RH 5029-56H245-370												37	42 / 14	31,5	31,5 / 9,3	
RH 5029-70K245-300				7000	7600	6840	7800	9380	18000			30	30 / 9	25,5	25,5 / 7,6	
RH 5029-70K245-370												37	42 / 14	31,5	31,5 / 9,3	
RH 6029-56H245-300	174 à 522	7940	3000	5600	6200	6400	7200	9400	18960	2 x 6	2,45	30	30 / 9	25,5	25,5 / 7,6	67
RH 6029-56H245-370												37	42 / 14	31,5	31,5 / 9,3	
RH 6029-56H245-450												45	52 / 19	38,3	38,3 / 11,5	
RH 6029-70K245-370				7000	7600	7620	8920	10680	29180			37	42 / 14	31,5	31,5 / 9,3	
RH 6029-70K245-450												45	52/ 19	38,3	38,3 / 11,5	
RH 7029-59I275-300	203 à 610	8960	3000	5900	6500	6600	7600	10500	21100	2 x 6	2,75	30	30 / 9	25,5	25,5 / 7,6	68
RH 7029-59I275-370												37	42 / 14	31,5	31,5 / 9,3	
RH 7029-59I275-450												45	52 / 19	38,3	38,3 / 11,5	
RH 7029-73L275-370				7300	8200	7800	8800	11300	22300			37	42 / 14	31,2	31,5 / 9,3	
RH 7029-73L275-450												45	52 / 19	38,3	38,3 / 11,5	
RH 8029- 59I305-370	232 à 696	10515	3000	5900	6500	8000	9150	13550	27350	10	3,05	37	42 / 14	31,5	31,5 / 9,3	
RH 8029- 59I305-450												45	52 / 19	38,3	38,3 / 11,5	
RH 8029- 59I305-550												55	52 / 19	46,8	46,8 / 14	
RH 8029- 73L305-450				7300	7900	9550	10700	15100	28900	10		45	52 / 19	38,3	38,3/ 11,5	
RH 8029- 73L305-550												55	52 / 19	46,8	46,8 / 14	
RH 8029- 87O305-450				8700	9300	11100	12250	16550	30450	10		45	52 / 19	38,3	38,3 / 11.5	
RH 8029- 87O305-550												55	52 / 19	46,8	46,8 / 14	

(*) in 4 directions
BR = Collecting Basin BGC = Large capacity basin (add 600 mm to H)

Drawings and Dimensions RH

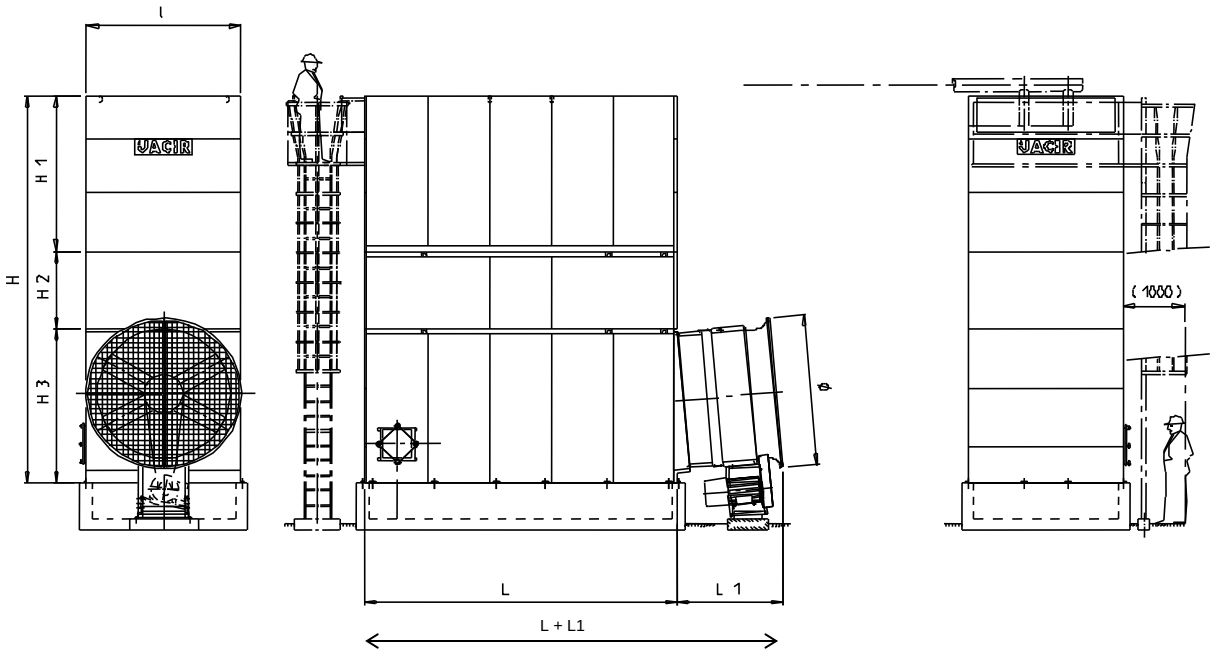
Tower with basin



	W water outlet [DN]	X overflow [DN]	Y drain [DN]	Z makeup water [DN]
RH 3017	200	100	50	32
RH 3024	200	100	50	32
RH 4024	250	100	50	32
RH 5024	250	100	50	40
RH 5029	300	100	50	40
RH 6029	300	100	50	40
RH 7029	300	100	50	40
RH 8029	350	100	50	40

Drawings and dimensions RH

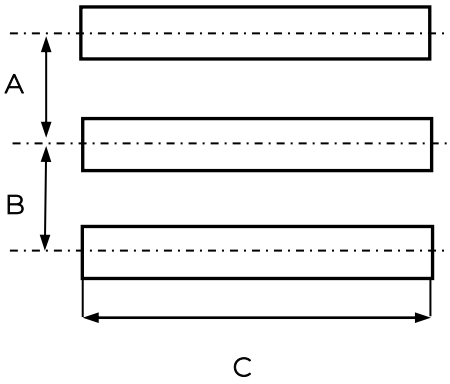
Tower without basin



Support RH

Our cooling towers can stand on the ground or on a concrete ground, but we recommend to install them on concrete or steel longitudinal beams.
Check that the ground can stand the operating load, and that the surface or supports are flat.

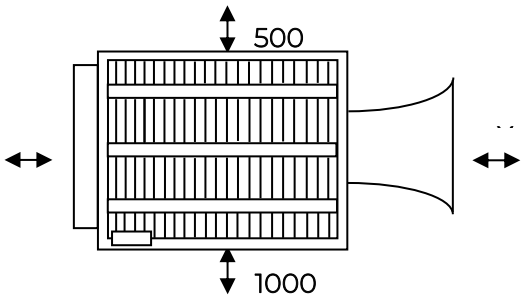
Quantity and position of supports (customer supply) without sound attenuation



	Qty	Distance between supports under basin A [mm]	Distance between supports under basin B [mm]	Minimum length C [mm]
RH 3017	2	1800		> 3100
RH 3024	3	1250	1250	> 3100
RH 4024		1250	1250	> 4100
RH 5024		1250	1250	> 5100
RH 5029		1500	1500	> 5400
RH 6029		1500	1500	> 6400
RH 7029		1500	1500	> 7400
RH 8029		1500	1500	> 9050

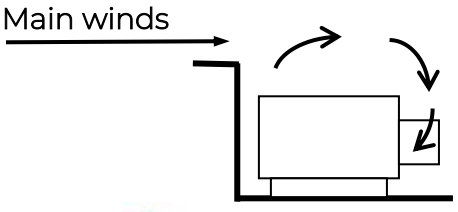
Layout RH

Walls, higher or equal to the tower must not surround on all sides a cooling tower, furthermore without any openings.
This could create a risk of a « re-circulation »; the air discharged (hot and saturated) may be recycled into the unit and significantly reduces the thermal efficiency of the tower. In any case, the free access on the four sides of the tower must be secured to ensure that the fans are supplied correctly with air and that there is proper access for installation and maintenance.
If these rules are not applied, it is inevitable that the cooling tower will not operate properly.

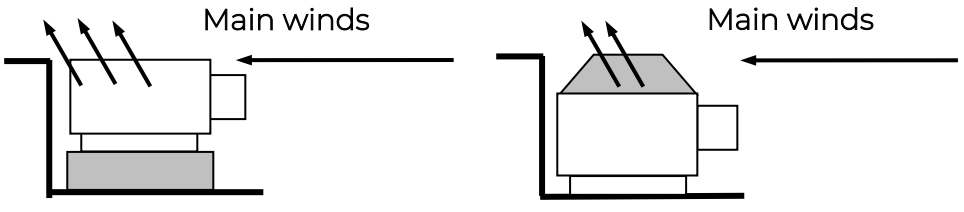


Model	Distance X (mm)
3017	1800
3024	1800
4024	1800
5024	2100
5029	2700
6029	2700
7029	2700
8029	2700

NO



YES



WATER EVAPORATION

Consumption by evaporation is approximately 1.7kg/h per 1 000kcal/h.

DECONCENTRATION

Due to the evaporation and to the water recycling, impurities or salts in the water are concentrated. To make sure that this concentration is not too high, drain must be carried out.
If not, concentration rates of 10, 100 or even 1,000 would occur over time.
In order to pre-determine the installation requirements, consider drain value twice the evaporation level. In operation, with an efficient water treatment, this figure may decrease, especially in the case of a stainless-steel cooling tower (concentration rate of 3 to 5 possible).
There are three possibilities to choose according to the case:

1- Continuous blow down

Connection piece to be installed at the pump discharge just before the tower, if possible, at the level of the water distribution pipes so that the purge only takes place when the circulation pump is operating.

The blow down flow rate can be calculated using the formula: [100 S / (M - S)] % of the make-up water in which:
S: Salinity of the make-up water compensating for evaporation.
M: Maximum acceptable salinity level of water in circuits.

Example:
Salinity of make-up water = HT 20 ° F
Maximum acceptable salinity = HT 40 ° F
100 x 20 / (40 - 20) = 100 % make-up water flow rate
Therefore, the continuous blow down must be equal to the evaporated make-up water flow rate (rate=2).

Consequently, the real water consumption is twice the theoretical evaporated water flow.

2- Discontinuous blow down

The conductivity of the water in the circuit is controlled and the device is purged while not exceeding the TH value.

3- JACIR Automated Inductive Blow down

Once water conductivity level has been reached, a motorised valve can be activated to drain the required quantity of water to maintain the right concentration level. See separate documentation.

WATER TREATMENT

It is essential that good quality water is available to ensure that the closed-circuit cooling network operates correctly. If the water contains a significant amount of impurities, it is recommended that a filtration device to be installed in parallel for 5 to 10% of the recycled water flow.
If the water contains salts that form deposits, iron or corrosive chemical elements, a make-up water treatment system must be installed to obtain purer water, which is close to being chemically neutral, and which can supply the cooling devices without causing damage.
In some cases, algae, moss, fungus or permanent shells can tend to grow in cooling towers. There are products that can be added periodically to the water circuit to prevent these organisms from developing.

Water treatment should be undertaken by a specialized Company.
PREVENTS THE RISK OF LEGIONNAIRES' DISEASE: see separate documentation

Prescription RH

Evaporative cooling tower, high efficiency open circuit with forced centrifugal fans, RH ..... JACIR type,

Thermal characteristics

The dissipated power will be..... kW, with a temperature range from .....°C to .....°C, an ambient air temperature of ...°C, and a wet bulb temperature of..... °C.

Sound level characteristics

The sound pressure level of the tower will not exceed.... dB (A) at ..... meters in free field over 4 directions. To achieve it, the tower has one of the following types of soundproofing devices:
Special sound attenuation: 50mm thick high density rock wool double casing, covered by 1.2mm thick steel sheet.

Infill: X – STREAM

It will be made of 2mm thick PP toothed blades, with 66 mm high. They will equally spread the water along the blades, into drops down to the lower blades' layers. The cooling occurs during the drops fall between the layers; therefore, this exchange surface will be highly resistant to clogging. It can be used for water with solids content up to 400 ppm. In the case of waters with high salts content, the X-STREAM will be self-cleaning by thermal expansion.

Tower casing and inclined plane basin

These will be made of single, self-supporting sheet steel panels twice or 4 times folded on the 4 sides.
Side panels will be designed to be able to receive a double casing if necessary.
Stainless steel rivets with a high locking capacity will be used for assembly. Elastomer gaskets will be used, without any mastic sealing.
The basin will be fitted with an inspection door (540 X 540 mm), floating valve that can easily be adjusted, a drain, an overflow and an anti-cavitation strainer.
The basin will be inclined and plane so that all the water can be replaced easily and the cleaning is simple: the drain hole bottom will be lower than the lowest part of the basin in order to secure 100 % drain. Height between basin bottom and the infill is 1425 mm for easy access.
The basin will be:

- Standard basin (B) or
- High water capacity basin (BGC) or
- Collecting basin (water passing through): BR.

Accessibility

In case of sound baffles, plume less tube coil or outlet air duct, large inspection doors (550 x 390 mm) to nozzles and basin will be installed in order to remove easily pipes, nozzles and packing. For maintenance, an additional casing will be provided, located between the plume suppression coil and the drift eliminators, with an access door 550 X 390 mm.

Water distribution

Water will be distributed by steel open air channels. They will be installed with PP several layers nozzles especially designed to achieve an optimal distribution through the whole air section, and with large water nozzle to avoid clogging even in the case of high suspended solids content. These nozzles operate under low pressure (0 to 0.3 mWC), in order to low pumping head and to distribute large size drops, which prevents the drift from getting out of the cooling tower.

Fans

The axial fans will be adjustable stand still type.
The number of blades and the material will be selected according to the thermal and sound requisition. The inlet cones will be made of polyester. Their calyx shape drastically will improve the fan efficiency. The fan stack will be made in the same material as the cooling tower in galvanised steel (option stainless steel). All the mechanical components to be maintained will be located at man chest, out of the wet air flow. A fan guard, installed with hinges will make the access to the tower safe. As an option, Jacir will be able to provide an anti-blade freezing device, economical and maintenance free. A fan bearing lubrication line is extended on the fan stack. It is made of Rilsan.

Electric motor(s) and coupling

The motor is a closed type with ventilated case with a power of kW....., rpm ....., IP55 protected class F. V-belts, selected for 150 % of nominal power, are used for transmission.

Steel structure

The tower will be made of:

- Zendzimir process galvanised metal (2 mm thick) at 275 gr/m² with finishing ZINCALU paint applied to the external sides after assembly,
- Stainless steel X-STEEL or 316 L (1.4404) metal for long life, water savings and high-pressure machine cleaning.