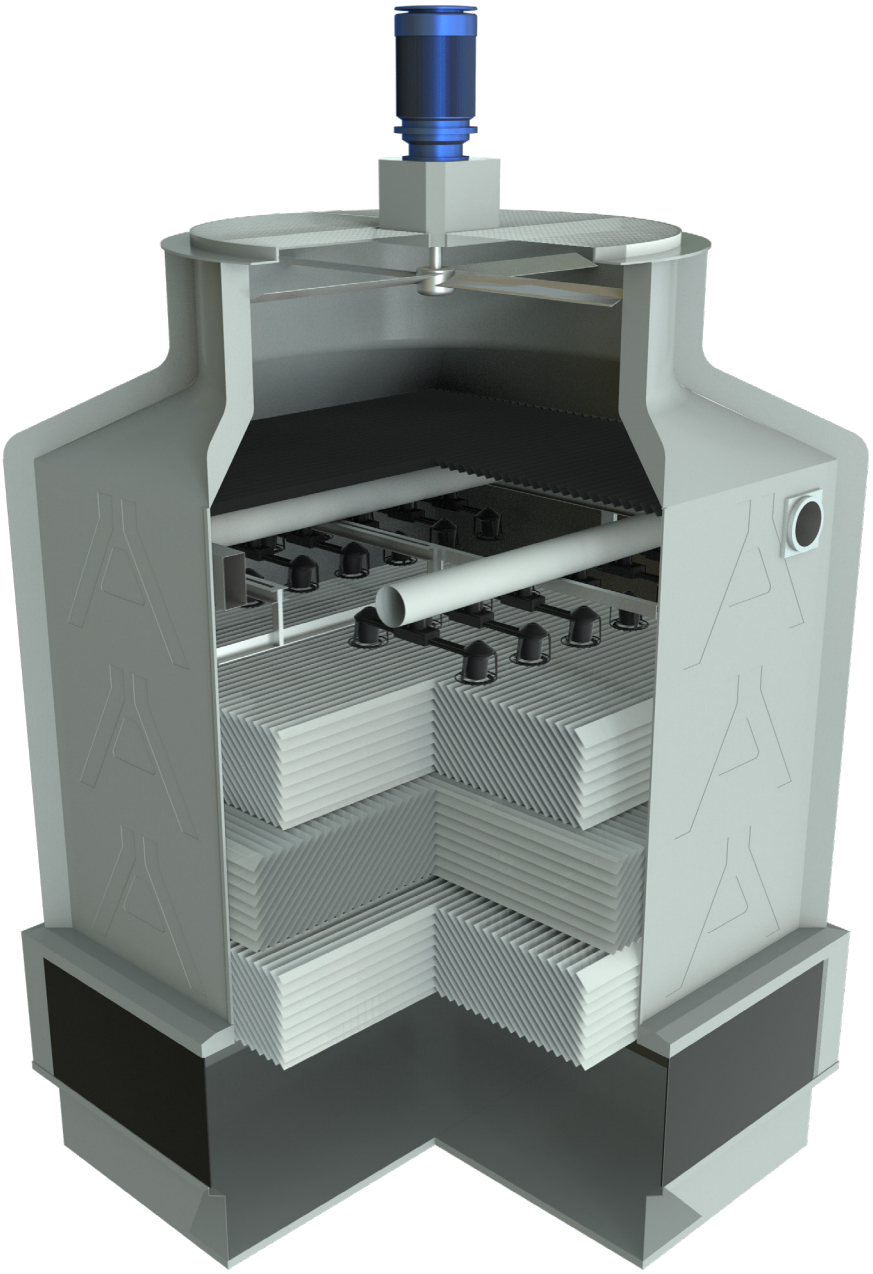
CP cooling tower

INDUCED DRAFT COUNTERFLOW DESIGN

specifications



MARLEY®

Specifications / Base

Specifications / Options

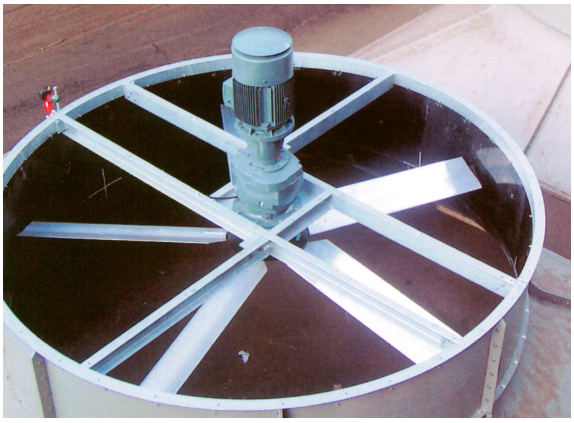
CP towers are induced draft, stainless steel structure with fiberglass cladding, counterflow cooling towers, designed to serve light to medium industrial process loads on clean and dirty water and HVAC clean water applications. For more than 30 years the CP continues a reputation of high reliability and low sound even when operating in high temperature, high wind load environments. The CP can be shipped and lifted preassembled or on larger models, preassembled into modules for final assembly at site.

The specifications portion of this publication not only relates the language to use in describing an appropriate CP cooling tower—but also defines why certain items and features are important enough to specify with the intention of insisting upon compliance by all bidders. The left hand column of pages 4 through 11 provides appropriate text for the various specification paragraphs, whereas the right hand column comments on the meaning of the subject matter and explains its value.

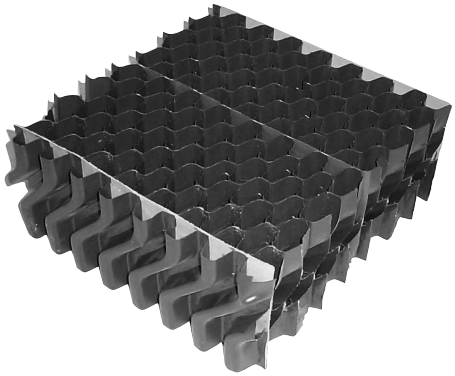
Pages 4 through 7 indicate those paragraphs which will result in the purchase of a basic cooling tower—one that accomplishes the specified thermal performance, but which will lack many operation—and maintenance-enhancing accessories and features that are usually desired by those persons who are responsible for the continuing operation of the system of which the cooling tower is part. It will also incorporate those standard materials which testing and experience has proven to provide acceptable longevity in normal operating conditions.

Pages 8 through 11 provide paragraphs intended to add those features, components, and materials that will customize the cooling tower to meet the user's requirements.

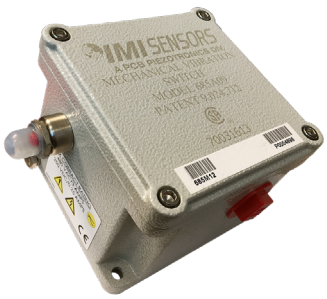
Specifications	Specification Value
1.0 **Base:**	
1.1 Furnish and install an induced-draft, counterflow-type, factory assembled or field erected, film fill, industrial duty, cooling tower. Unit shall consist of _____ cell(s), as shown on plans. The limiting overall dimensions of the tower shall be _____ wide, _____ long, and _____ high. Total operating power of all fans shall not exceed _____ kW (hp), consisting of_____ @ _____ kW (hp) motor(s). Tower shall be similar and equal in all aspects to CP Model _____.	■ The base of your specification establishes the type, configuration, base material, and physical limitations of the cooling tower to be quoted. During the planning and layout stages of your project, you may have focused your attention on a cooling tower selection that fit your space allotment, and whose power usage was acceptable. Limitations on physical size and total operating fan and pump power avoid the introduction of unforeseen operational and site-related influences. Even further control will result if you specify the number of cells, and the maximum fan kW/cell (hp/cell). You are specifying a counterflow tower, which is a type noted–and usually specified–for its economical use of ground space on projects where the required thermal performance is very difficult. The one you have chosen to specify utilizes a heat transfer fill which provides optimum thermal performance for your water condition. You are also specifying materials of construction which are impervious to the ills that beset towers constructed of more traditional materials. Life expectancy is not typically a characteristic of concern in this tower. **Note:** If it is your intention to evaluate offerings on the basis of first cost, plus the cost of ownership and operation, please be clear on your inquiry documents regarding the parameters under consideration, as well as the value that you intend to place upon each of them. (e.g. cost per kW (hp); cost per meter (feet) of pump head; cost per m^2 (sq ft) of basin area, etc.) They **WILL** affect the sizing of the tower.
2.0 **Thermal Performance:**	
2.1 The tower shall be capable of cooling _____ m^3/h (gpm) of water from ____°C (°F) to _____°C (°F) at a design entering air wet-bulb temperature of _____°C (°F). The cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plans. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test in the presence of the manufacturer, and under the supervision of a qualified, disinterested third party in accordance with DIN EN 14705 (CTI ATC-105) standards during the first full year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer shall make alterations as it deems necessary to overcome indicated deficiency. Should alterations prove to be inadequate, the owner, at the cooling tower manufacturer's option, shall be compensated by either (or a combination of both) of the following: (a) Installation of additional cooling tower capacity; (b) A refund of a percentage of the contract price proportional to the deficiency as established.	■ Your reason for purchasing a cooling tower is to obtain a continuing flow of cooled water as defined in the first paragraph at left. If the tower that you purchase is incapable of performing as specified, then you will not have received full value for your money. DIN EN 14705 might apply depending upon location. Substitute if preferred in place of CTI ATC-105 Standard. Bear in mind that the size–and cost–of a cooling tower varies directly with its true thermal capability. This paragraph is intended to protect you against either intentional or inadvertent under sizing of the tower by the manufacturer. Judging the level of performance of a cooling tower on critical processes is never easy, and the potential risk of a non-performing cooling tower usually causes the requirement for a mandatory acceptance test to be very desirable. Your contract with the successful bidder should establish the acceptable remedies for missed performance, which might include: • The addition of one or more cells of tower, as necessary, to bring the cooling tower to the specified level of performance. This is usually limited to the scope of work as defined in the specifications, which means that you (the owner) will have to pay for the additional basin, wiring, starters, piping, etc. • The reimbursement of a portion of the total contract price equal to the percentage deficiency in performance.

Specifications	Specification Value
3.0 **Construction:**	
3.1 The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 450 mg/l (ppm); a sulfate content (SO_4) up to 800 mg/l (ppm); a calcium content ($CaCO_3$) up to 800 mg/l (ppm); silica (SiO_2) up to 150 mg/l (ppm); and design hot water temperatures up to 50°C (120°F). The circulating water shall contain no oil, grease, fatty acids, or organic solvents.	■ For pure resistance to corrosion–coupled with the capability to meet stringent fire and building codes–there is no substitute for stainless steel! No paints or electrostatically-applied coatings, however exotic they may be, can match stainless steel's ability to withstand adverse operating conditions. Structural framework of 1.4401/316 stainless steel is also available. For harsher operating conditions please substitute 1.4301 stainless steel with 1.4401 in section 3.2.
3.2 The structural framework of the tower shall be of heavy gauge cold-formed and/or mill shapes of series 1.4301 stainless steel (SS304). The tower structure shall meet Eurocode 3 (DIN EN 1993 together with its German national Annex) design standards. All structural shapes shall be open profile to follow the Eurovent guidelines for minimizing the Legionella risk. Welded structural shapes shall not be allowed.	■ Since 2012 the new Eurocode 3 is required for all steel structures in EU countries. Any closed structural members which do not ensure proper water drainage may pose a high risk for Legionella bacteria.
4.0 **Mechanical Equipment**:	
4.1 Fan(s) shall be axial propeller-type, incorporating aluminum alloy blades attached to a steel fan hub. Blades shall be individually adjustable to accommodate for site conditions. The fan assembly shall be mounted directly to a geared motor shaft.	■ Propeller-type fans require only half the operating power of blower-type fans. However, they should be readily adjustable to permit compensation for job site conditions. FRP fan blades are available to substitute aluminum alloy if required.
4.2 Geared motor(s) shall be ____ kW maximum, high-efficient IE2 (NEMA Premium Efficiency), variable torque, inverter duty and insulated for cooling tower duty. Speed and electrical characteristics shall be _____ RPM, single-winding, 3 phase, ____ hertz, ____ volts. The geared motor shall be mounted in a vertical position, with the geared motor in the outlet air stream outside of the fan hood. The motor shall be capable of being used with a variable frequency drive. The geared motor shall be a low-noise design and suitable for continuous cooling tower operation. The AGMA service factor shall not fall below 2.	Motor speed will be 1500 (1800) RPM on standard models. Low sound models will use motor speeds appropriate for the specific model.
	
4.3 The complete mechanical equipment assembly for each cell shall be supported by a single-piece welded steel assembly, hot-dip galvanized structural support mounted on the FRP fan ring.	■ The mechanical equipment support needs to be designed and manufactured to maintain alignment of rotating parts.

Specifications	Specification Value
5.0 **Fill, Louvers and Drift Eliminators:**	
5.1 Counterflow fill shall be diagonal offset-flute, film type, thermoformed PVC. Fill shall be supported by open stainless steel profiles of the tower structure and have a flame spread rating less than 25. Weight shall 25 kg/m^3 (1.6 lb/ft^3).	■ Fill modules can be removed for inspection and cleaning in accordance with local anti-legioinella guidelines.
5.2 Cellular drift eliminators shall be thermoformed UV resistant polypropylene with a minimum of three changes in air direction, and shall limit drift losses to 0.0005 % or less of the design water flow rate according to Eurovent guidelines. Pack height shall be 150 mm (6") and support distance 1200 mm (48").	■ Drift rate varies with design water loading and air rate, as well as drift eliminator depth and number of directional changes. If a lower rate is required, please discuss with your Marley sales representative.
5.3 Air inlet louvers shall be thermoformed honeycomb PVC to limit water splash out and prevent direct sunlight from entering the basin. FRP blade-type louvers with spacing of more than 40 mm (1.6") shall not be acceptable.	■ Honeycomb louvers limit the sunlight entering the collection basin, reduces the potential for algae growth and the risk for freezing during winter operation.
6.0 **Hot Water Distribution System:**	
6.1 A low pressured spray system shall distribute water evenly over the fill. The main pipes shall be corrosion resistant PVC with polypropylene spray nozzles attached to the lateral arms. The distribution system shall be designed to be self-cleaning during operation.	■ The combination of PVC piping and polypropylene nozzles is very resistant to the build-up of scale and slime. For high temperature applications PP piping can be provided. If required discuss with your Marley sales representative.
7.0 **Casing:**	
7.1 Casing panels shall be UV stabilized FRP. The casing shall have a stainless steel support structure. The panels shall have a minimum thickness of 5 mm (.2") and a minimum density of 6.5 kg/m^2 (1.4 lb/ft^2). To minimize water splash out a deflector shall be integrated into the panel design.	■ Integrated deflectors help minimize splash out, reducing water losses and prevent freezing during winter operation.
8.0 **Fan Hood and Fan Guard:**	
8.1 To achieve optimized airflow from the rectangular wet area to the fan cylinder an eased inlet fan hood shall be integrated into the cooling tower design. The fan hood shall be UV stabilized FRP with a minimum thickness of 5 mm (.2") and a minimum density of 8 kg/m^2 (1.6 lb/ft^2). The top of the fan hood shall be equipped with a welded, field installed hot dip galvanized fan guard. The fan guard is made of four sections, each with a supporting steel frame and shall be easily removable.	



Specifications	Specification Value
9.0 **Access:**	
8.1 A large rectangular inspection door shall be located at the water distribution level to provide access to the fill and water distribution system. The access door shall be connected with hinges to the tower, hatches shall not be permitted.	■ Inspection doors properly fixed to the tower with hinges and not designed as hatches are easier and safer to open and close. This increases the safety of the maintenance personal at site.
9.0 **Scope of Work**:	
9.1 The cooling tower manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site, and for the erection of the tower over supports provided by others. Unless otherwise specified, all supply and return piping, pumps, controls, and electrical wiring will be outside the cooling tower manufacturer's scope of work.	■ Please be clear in your specifications and inquiry documents regarding the full scope of work expected. That will help assure that your bid comparisons will be made on as equal a basis as possible–and will help to avoid any misunderstandings during the execution and implementation of the contract.

Specifications	Specification Value
FRP Cold Water Collection Basin:	
3.3 *Add the following paragraph to the Construction section:* Sections of the cold water basin shall be molded of FRP and laminated to each other providing a watertight seal. Minimum wall thickness shall be 6 mm (.24") and minimum density shall be 9.6 kg/m² (2 lb/ft²). An overflow and drain connection and a stainless steel debris screen shall be provided in each cell of the tower. The basin floor shall slope toward a depressed sump to follow Eurovent recommendation to prevention spread of legionella and to allow complete flush out of debris and silt which may accumulate. The cold water basin and tower shall be supported by a structural beam assembly of welded sections, provided and installed by the cooling tower manufacturer. The assembly sections shall be hot-dip galvanized after fabrication.	■ The CP cooling tower design offers bottom outlet as standard. Side suction outlets may be supplied to accommodate a variety of piping schemes. Unless so specified, the tower you may be asked to approve may only be available with one type of suction connection requiring you to redesign your piping layout. The sloping floor and low-level drain is valuable because it provides a way to achieve flush-out cleanability.
Mechanical Access Platform with Ladder and Safety Cage:	
8.2 *Add the following paragraph in the Access section:* There shall be a mechanical access platform at the fan discharge level allowing access to the mechanical system. The platform shall be galvanized steel bar grating, supported by galvanized steel framework attached to the tower. The platform shall be surrounded by a guardrail, knee rail, and toeboard designed according to ISO 14122-2 (OSHA) standards. A ladder with safety cage shall be permanently attached to the platform, rising from the base of the tower to the top of the handrail to provide easy access to the mechanical equipment and maintenance platform. The ladder and safety shall be hot dip galvanized steel and shall comply with ISO 14122-2 (OSHA) specifications.	■ Periodic inspection and maintenance of a cooling tower distribution system is fundamental to preserving maximum cooling system efficiency. All cooling towers–crossflow or counterflow–are subject to clogging to varying degrees by waterborne contaminants such as pipe scale and sediment. Therefore, safe and easy access to these components is of significant value to the operator. One ladder per fan cell is an available option for all models. Alternately one ladder for every two fan cells may be provided for models larger than CP100/ CP1000 cooling towers.
Vibration Limit Switch:	
4.4 *Add the following paragraph in the Mechanical Equipment section:* A vibration limit switch in a IP 65 (NEMA 4X) housing shall be installed on the mechanical equipment support and wired to the shutdown circuit of the fan motor starter or VFD. The purpose of this switch will be to interrupt control power voltage to a safety circuit in the event of excessive vibration causing the starter or VFD equipment to de-energize the motor. It shall be adjustable for sensitivity, and include a means to reset the switch.	■ Unless specified otherwise, a IMI Sensors mechanical vibration switch will be provided. The requirement for manual reset assures that the cooling tower will be visited to determine the cause of excessive vibration. 

Specifications	Specification Value
Electric Oil Level Switch:	
4.4 *Add the following paragraph to the Mechanical Equipment section:* An oil level switch combining indicating gauge and adjustable low and high oil limit switch shall be provided and installed outside the fan hood.	
External Lube Line with Oil Level Dip Stick, Air Vent and Drain:	
4.5 *Add the following paragraph to the Mechanical Equipment section:* A stainless steel oil gauge and drain line shall extend from the fan gear drive to the vicinity outside the fan cylinder, and shall be equipped with an oil level dip stick.	
Film Fill for Industrial Applications using Clean Water:	
Note: This option not available with CTI Certification.	
5.1 *Replace paragraph 5.1 with the following:* Counterflow film fill shall be offset vertical-flute, thermoformed PP (polypropylene) suitable for a TSS (total suspended solids) content lower than 150 mg/l (ppm). Layers of compact PP packs shall be arranged cross-wise on top of each other. Fill shall be supported by open stainless steel profiles of the tower structure.	
Splash Fill Industrial Applications using Dirty Water:	■ For dirty water applications, e.g. suspended solids above 50 mg/l, diagonal offset film-fill is not suitable for reliable operation because of the risk of clogging and fouling. Please contact your Marley sales representative for detailed advice.
Note: This option not available with CTI Certification.	
5.1 *Replace paragraph 5.1 with the following:* Counterflow fill shall be low clog trickle-grid type splash fill made of PP (polypropylene) or PE (polyethylene) suitable for a TSS (total suspended solids) content lower than 250 mg/l (ppm). Fill shall be supported by open stainless steel profiles of the tower structure.	
Mechanical Make-Up Valve:	
3.3 *Add the following paragraph to the Construction section:* A float operated, mechanical make-up valve shall be included in the collection basin.	

Specifications	Specification Value
Splash Attenuation:	
1.2 *Insert the following paragraph in the Base section:* The cooling tower shall be equipped with polypropylene splash attenuation media installed in the collection basin to reduce falling water noise.	■ Sound emitted by a standard CP cooling tower operating in an unobstructed environment will meet all but the most restrictive noise limitations–and will react favorably to natural attenuation. Where the tower has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance–by about 5 or 6 dB(A) each time the distance doubles. Where noise at a critical point is likely to exceed an acceptable limit, you have several options–listed below in ascending order of cost impact: • In many cases, noise concerns are limited to night time, when ambient noise levels are lower and neighbors are trying to sleep. You can usually resolve these situations by using variable speed drives, and operating the fans at reduced speed "after hours". The natural night time reduction in wet-bulb temperature makes this a very feasible solution in most areas of the world. Variable speed drives automatically minimize the tower's noise level during periods of reduced load and/or reduced ambient without sacrificing the system's ability to maintain a constant cold water temperature. This is a relatively inexpensive solution, and can pay for itself quickly in reduced energy costs. • In counterflow towers, the water falling from the fill media into the collection basin creates high-frequency splash noise at the air inlets that may be objectionable. Splash attenuation media installed in the collection basin may be the most economical way to significantly reduce sound levels at this critical location. • Where noise is a concern at all times (for example, near a hospital), one possible solution is to oversize the tower so it can operate continuously at reduced (⅔ or ½) motor speed even at the highest design wet-bulb temperature. Typical sound reductions are 7 dB(A) at ⅔ fan speed or 10 dB(A) at ½ fan speed, but larger reductions are often possible. • The most extreme cases may require inlet and discharge sound attenuator sections–however, the static pressure loss imposed by discharge attenuators may necessitate an increase in tower size and/or motor power. Your Marley sales representative will be able to help you meet your sound requirements.
Ultra Quiet Fan:	
4.1 *Replace paragraph 4.1 with the following:* Fan(s) shall be propeller-type, incorporating wide-chord acoustic geometry, corrosion and fire resistant marine grade aluminum blades and aluminum hubs or FRP blades and steel hubs. Blades shall be resiliently mounted to fan hub and individually adjustable. Fan blades shall be open cavity with suitable drainage to avoid accumulation of moisture. Foam filled blades are not allowed due to potential moisture contamination of the foam core causing an imbalance of the fan leading to vibration issues. Maximum fan tip speed shall be 51 m/s (10,000 ft/min). The fan assembly shall be mounted directly to a geared motor shaft.	■ For more severe cases requiring the lowest possible fan sound levels the "Ultra Quiet" fan option is now available on all CP models. Tower height may increase slightly–obtain current sales drawings from your Marley sales representative for accurate dimensions. 

Specifications	Specification Value
Certification:	
2.1 *Replace paragraph 2.1 with the following:* The tower shall be capable of cooling _____ m^3/hr of water from ____ °C to _____ °C at a design entering air wet-bulb temperature of _____ °C. The thermal performance rating shall be certified by Eurovent and the Cooling Technology Institute.	■ Certification means that the cooling tower has been tested under operating conditions and found to perform as rated by the manufacturer under those circumstances. It assures the buyer that the tower is not intentionally or inadvertently undersized by the manufacturer.
2.2 The tower shall be capable of minimum _____ m^3/hr per kW efficiency at 35°C-29.5°C-25.5°C, per ASHRAE Standard 90.1.	The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 8.68 m^3/hr/kW @ 35/29.5/23.8. There are no efficiency requirements for non-comfort cooling applications. If you want greater efficiency you can require it by specifying a higher ASHRAE Standard 90.1 8.68 m^3/hr/kW. ***Each model's ASHRAE Standard 90.1 rating can be viewed in our online sizing and selection software at spxcooling.com/update.***
2.3 CTI and Eurovent certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI, Eurovent or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the owner to compensate for the performance deficiency.	■ Certification alone is not sufficient to assure you that the cooling tower will perform satisfactorily in your situation. Certification is established under relatively controlled conditions, and cooling towers seldom operate under such ideal circumstances. They are affected by nearby structures, machinery, enclosures, effluent from other sources, etc. Responsible and knowledgeable bidders will take such site-specific effects into consideration in selecting the cooling tower– but the specifier must insist by the written specification that the designer/manufacturer guarantee this “real world” performance. Any reluctance on the part of the bidder should cause you some concern.

SPX participates in the ECP programme for Cooling Towers. Range – CP Series. Certification Diploma #20.09.052. Ongoing certificate validity: eurovent-certification.com

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