NC® steel
COOLING TOWER

specifications

MARLEY®

Specifications / Base

Specifications / Options

NC towers are galvanized steel, factory assembled, crossflow cooling towers, designed to serve air conditioning and refrigeration systems as well as industrial process loads and power generation plants on clean water. They evolve from a factory-assembled concept of towers pioneered by Marley some 60 years ago, and incorporate all of the design advancements that our customers have found valuable. The NC has been designed specifically for sound control and tonnage density and represents the current state of the art in this cooling tower category.

This booklet not only relates the language to use in describing an appropriate NC 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 thru 26 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 thru 10 indicate the features of the basic cooling tower. These features accomplish the specified thermal performance, but do not include many operation and maintenance-enhancing accessories that are usually desired by those who are responsible for the continued operation of the system. It will also incorporate those standard materials which testing and experience have shown to provide longevity in normal operating conditions.

Pages 11 thru 26 provide specifications intended to add those features, components and materials that will customize the tower to meet the user's requirements.

Space does not permit definition and explanation of all of the possible options that can be applied to the NC. We realize that you, the purchaser, must be happy with the tower's characteristics, and we are prepared to provide—or provide for—any reasonable enhancement that you are willing to define and purchase. *Your needs will become part of the continuing evolution of this Marley product line.*

Specifications

1.0 **Base:**

1.1 Provide an induced draft, crossflow type, factory assembled, film fill, industrial duty, galvanized steel cooling tower situated as shown on the plans. The limiting overall dimensions of the tower shall be _____ wide, _____ long, and _____ high. Total operating horsepower of all fans shall not exceed ____ hp, consisting of ___ @ _____ hp motor(s). Tower shall be similar and equal in all respects to Marley Model _____.

1.2 The cooling tower shall be designed for quiet operation, and shall produce an overall level of sound not higher than _____ dB(A) measured at _____ ft from the locations in the following table. Sound levels shall be independently verified by a CTI-licensed sound test agency to ensure validity and reliability of the manufacturer's published values. Measurement and analysis of the sound levels shall be conducted by a certified Professional Engineer in Acoustical Engineering. Sound pressure levels shall be measured and recorded in the acoustic near-field and far-field locations using ANSI S1.4 Type 1 precision instrumentation and in full conformance with CTI ATC-128 test code published by the Cooling Technology Institute (CTI). All low sound options shall be CTI certified for thermal performance.

Location	63	125	250	500	1000
Discharge					
Air Inlet					
Cased Face					

Location	2000	4000	8000	Overall dB(A)
Discharge				
Air Inlet				
Cased Face				

Specification Value

- Your specification base 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 will have focused your attention on a cooling tower selection that fits your space allotment, and whose power usage is acceptable. Limitations on physical size and total operating horsepower avoid the introduction of unforeseen operational and site-related influences. Specifying the number of cells and the maximum fan hp/cell will work to your advantage.

  The benefit of crossflow towers is that they are inherently easy to operate, access and maintain. Compared to counterflow towers, crossflow towers have a spacious plenum between banks of fill for easy access to all of the tower's internal components, plus the water distribution system is adjacent to the fan deck and can be maintained during operation.

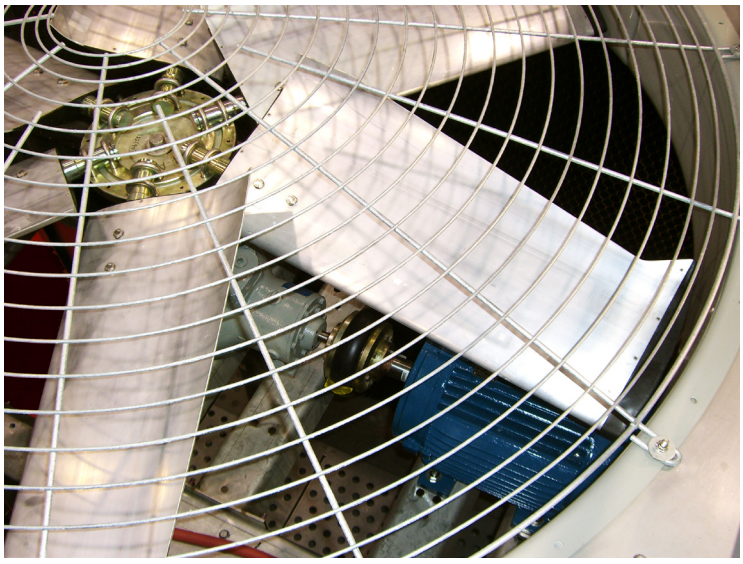
  The NC is also available unassembled for on-site assembly.

- Recognizing how important sound control is and how difficult it is to measure cooling tower sound at various locations where background noise may interfere with testing, all published sound data for Marley NC cooling towers has been independently verified by a CTI-licensed test agency so you can trust that the sound from your cooling tower will meet sound levels as specified.

Specifications	Specification Value
2.0 **Thermal Performance and Efficiency:**	
2.1 The tower shall be capable of cooling _____ gpm of water from ____ °F to _____ °F at a design entering air wet-bulb temperature of _____ °F, and its thermal rating shall be certified by the Cooling Technology Institute .	■ Certification means that the 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. CTI CERTIFIED
2.2 The tower shall be capable of a minimum _____ gpm/hp efficiency per ASHRAE Standard 90.1.	■ The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 40.2 gpm/hp @ 95/85/75. 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 gpm/hp. ***Each model's ASHRAE Standard 90.1 rating can be viewed in our online sizing and selection software at spxcooling.com/update.***
3.0 **Performance Warranty:**	
3.1 CTI 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 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 tower will perform satisfactorily in your situation. Certification is established under relatively controlled conditions, and towers seldom operate under such ideal circumstances. They are affected by nearby structures, machinery, enclosures, effluent from other towers, etc. Responsible and knowledgeable bidders will take such site-specific effects into consideration in selecting the 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.
4.0 **Design Loading:**	
4.1 The structure and anchorage shall be designed to withstand a wind load of 50 psf while operating, based on International Building Code ASCE7-10, as well as a .3g seismic load. The fan deck, hot-water basin covers and, where specified, maintenance platforms shall be designed for 60 psf live load or a 200 lb concentrated load. Guardrails, where specified, shall be capable of withstanding a 200 lb concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.	■ It is important to understand the distinction between ***structure*** and ***anchorage***. Specifying that only the ***anchorage*** meet these requirements means the tower can become non-functional, even fall down, yet remain attached to the foundation. Specifying ***structure*** will require the tower to remain operational. The indicated design values are the minimum allowed under accepted design standards. They give you assurance that the tower can be shipped, handled, hoisted–and ultimately operated in a normal cooling tower environment. Most NC models will withstand significantly higher wind and seismic loads. If your geographic location dictates higher wind load or seismic load values, please make the appropriate changes, after discussion with your Marley sales representative. ***Some countries and states, like Florida, require structure and anchorage to meet a given loading. Check with your local officials.*** **50 psf windload, .3g seismic load**–applicable for most applications but consult the local code official for actual requirements. **60 psf live load, 200 lb concentrated load**–ensures the tower can be safely accessed for routine maintenance when a guardrail is installed as well as ensuring the end user complies with government safety laws.

Specifications	Specification Value
4.2 The tower shall be structurally capable of being supported at the four outer corners of the tower cell. Alternatively, the tower manufacturer shall provide supporting steel to adapt tower to be supported at four outer corners. *NC8401-NC8414 only.*	
5.0 **Construction:**	
5.1 Except where otherwise specified, all components of the cooling tower shall be fabricated of steel, protected against corrosion by G-235 galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 300 ppm; a sulfate content (SO_4) up to 250 ppm; a calcium content ($CaCO_3$) up to 500 ppm; and silica (SiO_2) up to 150 ppm. The circulating water shall contain no oil, grease, fatty acids or organic solvents. Fiberglass casing, polyurethane barriers, and thermosetting hybrids and the components they are adhered to shall be considered non-recyclable and not allowed.	■ In the history of cooling towers, no other coating for carbon steel has exhibited the success and longevity of galvanization in exposure to the normal cooling tower water quality defined at left. No paints, electrostatically-applied coatings or rubberized compounds, however exotic they may be, can approach galvanization's history of success. Except for those unusual operating situations where the circulating water may be so laden with suspended solids, algae, fatty acids, product fibers, and active organisms reflected in the basis of design (BOD), that plugging of the fill is a probability, reasonable attention to the construction materials and/or their coatings is all that is normally required. If extended longevity of the tower is required–or unusually harsh operating conditions are expected–consider specifying stainless steel as either the base construction material, or the material utilized for specific components of your choice. See Stainless Steel Options on page 11.
5.2 The specifications, as written, are intended to indicate those materials that will be capable of withstanding the above water quality in continuing service, as well as the loads described in paragraph 4.1. They are to be regarded as minimum requirements. Where component materials peculiar to individual tower designs are not specified, the manufacturers shall take the above water quality and load carrying capabilities into account in the selection of their materials of manufacture.	 *Factory Assembly*

Specifications	Specification Value
6.0 **Mechanical Equipment**:	
6.1 Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 13,000 ft/min. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. All gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater and the gear sets shall have AGMA Quality Class of 9 or greater. The gearbox shall include any modifications to enable operation down to 10% of full speed.	■ Propeller-type fans require only half the operating hp of blower-type fans. However, they should be readily adjustable to permit compensation for jobsite conditions. With NC, the choice is yours. The exclusive Marley System 5 Geareducer® requires no oil changes for five years, offering you exceptional reliability and low maintenance. Ideal for owners concerned about downtime or maintenance costs. Currently available on NC models up to 60 hp, the Marley Power Belt drive system features power band belts and long-life bearings for dependable service. TEFC motors offer additional benefits over TEAO motors whose only source of cooling is the flow of air produced by the cooling tower fan. This air rate is not always ideal due to motor position, blockage, etc. TEFC ensures the motor will always be cooled properly. Unless otherwise specified, motor speed will be 1800 RPM in 60 Hertz areas and 1500 RPM in 50 Hertz areas on standard models. Low sound models will use motor speeds appropriate for the specific model. If you prefer the operating flexibility of two-speed operation, please specify two-speed, single-winding or double-winding motors which offer full and half speeds for maximum energy savings. Incidentally, two speed, double-winding motors are a better choice than separate “pony” motors which simply double the problems indicated above and induce parasitic loads during operation for lower than nameplate efficiency. The value of a 5 year mechanical equipment warranty speaks for itself. Except for the motor, virtually all of the mechanical equipment on a Marley tower is designed and manufactured by SPX Cooling Technologies, Inc. Cooling tower vendors who purchase commercial fans, gear reducers, driveshafts, etc. may require that you deal directly with those commercial suppliers for warranty satisfaction.
6.1 (alternate)* Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 13,000 ft/min. Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, pulleys and tapered roller bearings. Bearings and fan shaft shall be contained in a cast steel housing to ensure proper fan shaft alignment, pillow block bearings shall not be allowed. Bearings shall be rated at an L_{10A} service life of 40,000 hours or greater. **Currently available on NC models up to 60 hp.*	
6.2 Single-speed motor(s) shall be ____ hp maximum, NEMA Premium Efficiency, TEFC, 1.15 service factor, inverter duty, variable torque, and specially insulated for cooling tower duty (Class F). Speed and electrical characteristics shall be _____ RPM, single-winding, 3-phase, ____ hertz, ____ volts. Motor shall operate in the shaft-horizontal position for geardrive towers and shaft-down position for belt drive towers. Nameplate horsepower shall not be exceeded at design operation.	
6.2 (alternate) Two-speed motor(s) shall be ____ hp maximum, TEFC, 1.15 service factor, variable torque, and specially insulated for cooling tower duty (Class F). Speed and electrical characteristics shall be _____ RPM, 3 phase, ____ hertz, ____ volts. Motor shall operate in the shaft-horizontal position for geardrive	



Specifications	Specification Value

towers and the shaft-down position for belt drive towers. Nameplate horsepower shall not be exceeded at design operation.

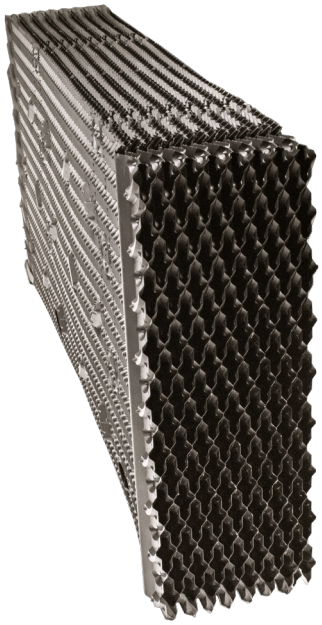
6.3 The motor to gearbox close coupling shall be a tire-type, single piece, flexible element design to accommodate frequent speed changes that are inherent with VFD applications.

6.4 The complete mechanical equipment assembly for each cell shall be supported by two horizontal steel beams that resist misalignment between the motor and the gear reducer/belt drive system. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than five (5) years following the date of tower shipment. This warranty shall cover the fan, speed reducer, drive shaft and couplings, and the mechanical equipment support. The electric motor shall carry a manufacturer's warranty of at least one year.

7.0 **Fill, Louvers and Drift Eliminators:**

7.1 Fill shall be film type, thermoformed PVC, with louvers and eliminators formed as part of each fill sheet. Fill shall be suspended from hot dip galvanized structural tubing supported from the tower structure, and shall be elevated above the floor of the cold-water basin to facilitate cleaning. Air inlet faces of the tower shall be free of water splash out.

7.2 Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.



- Louvers integral with the fill keep the flowing water within the confines of the fill. The separate external louvers used by others may permit water to escape the fill and form ice or produce an unsightly situation adjacent to the tower and waste water. If you plan to use your tower in the wintertime, particularly for free cooling, integral louvers will put your operating concerns to rest. Integral louvers offer the best available technology for winter operation and water conservation.

- Drift rate varies with design water loading and air rate, as well as drift eliminator depth and number of directional changes. The exclusive patented MarKey® drift eliminators achieve the lowest available drift rates so less water escapes the tower. A drift rate of 0.0005% of circulating water flow is readily available on many standard models. If a lower rate is required, please discuss with your Marley sales representative.

Keep in mind…

- Drift for towers with three-pass high efficiency eliminators constitute a small percentage of water usage.
- Unlike thermal performance, drift rates are not certified and field drift tests are cost prohibitive for most applications.
- Drift rates below 0.001% are difficult to measure in the field.
- Certain water treatment chemicals can impact the drift rate.

Specifications	Specification Value
8.0 **Hot Water Distribution System:**	
8.1 Two open galvanized steel basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basin components shall be installed and sealed at the factory and assembled with bolted connections. Tap screws shall not be acceptable due to their potential to develop leaks. The basins shall be equipped with removable, galvanized steel covers capable of withstanding the loads described in paragraph 4.1. The water distribution system shall be accessible and maintainable during tower fan and water operation.	■ Gravity-flow distribution basins are a feature of crossflow type towers, resulting in operating pump heads of 10 to 20 feet less than that encountered in counterflow towers with pressurized spray systems. Also, these basins are located where they can be easily inspected–even maintained–while the tower is in operation.
8.2 Each basin shall include an inlet hole and bolt circle to accept a 125# flange connection per ANSI B16.1. Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow.	
8.3 The water distribution system shall be accessible and maintainable while tower is operating.	■ Some manufacturers require shutting down the tower to clean the distribution system. Can you afford to do that?
9.0 **Casing, Fan Deck and Fan Guard:**	
9.1 The casing and fan deck shall be galvanized steel, and shall be capable of withstanding the loads described in paragraph 4.1. The top of the fan opening shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 5/16" and 7 gauge rods, and hot dip galvanized after fabrication. Fan cylinders 5'-0" in height and over shall not be required to have a fan guard.	■ Materials other than heavy-gauge steel for fan decks may be unable to meet your specified loading requirements. See "Guardrail and Ladder" remarks on page 13. In addition, steel is excellent at resisting damage, cracking, UV exposure and fire.

Specifications	Specification Value

10.0 **Access:**

10.1 A large galvanized, rectangular access door shall be located on both cased faces for entry into the cold-water basin. Doors shall provide convenient access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system. The access doors shall be _____" wide by _____" high.

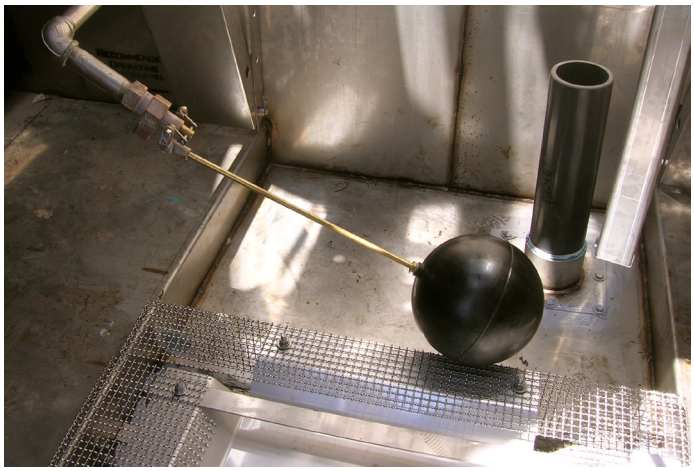
- Small access doors are prohibitive and discourage maintenance, which in turn can impact your operation. Specifying the size of the door will cause some bidders to take exception, alerting you to a potential maintenance headache. Two doors are standard on all NC towers–one in each endwall.

Access Door Opening		
Model	Width	Height
NC8401 - NC8402	30"	33"
NC8403 - NC8409	30"	48"
NC8410	30"	34.5"
NC8411 - NC8412	30"	47.5"
NC8413 - NC8414	30"	48"
NC8422	36"	79"

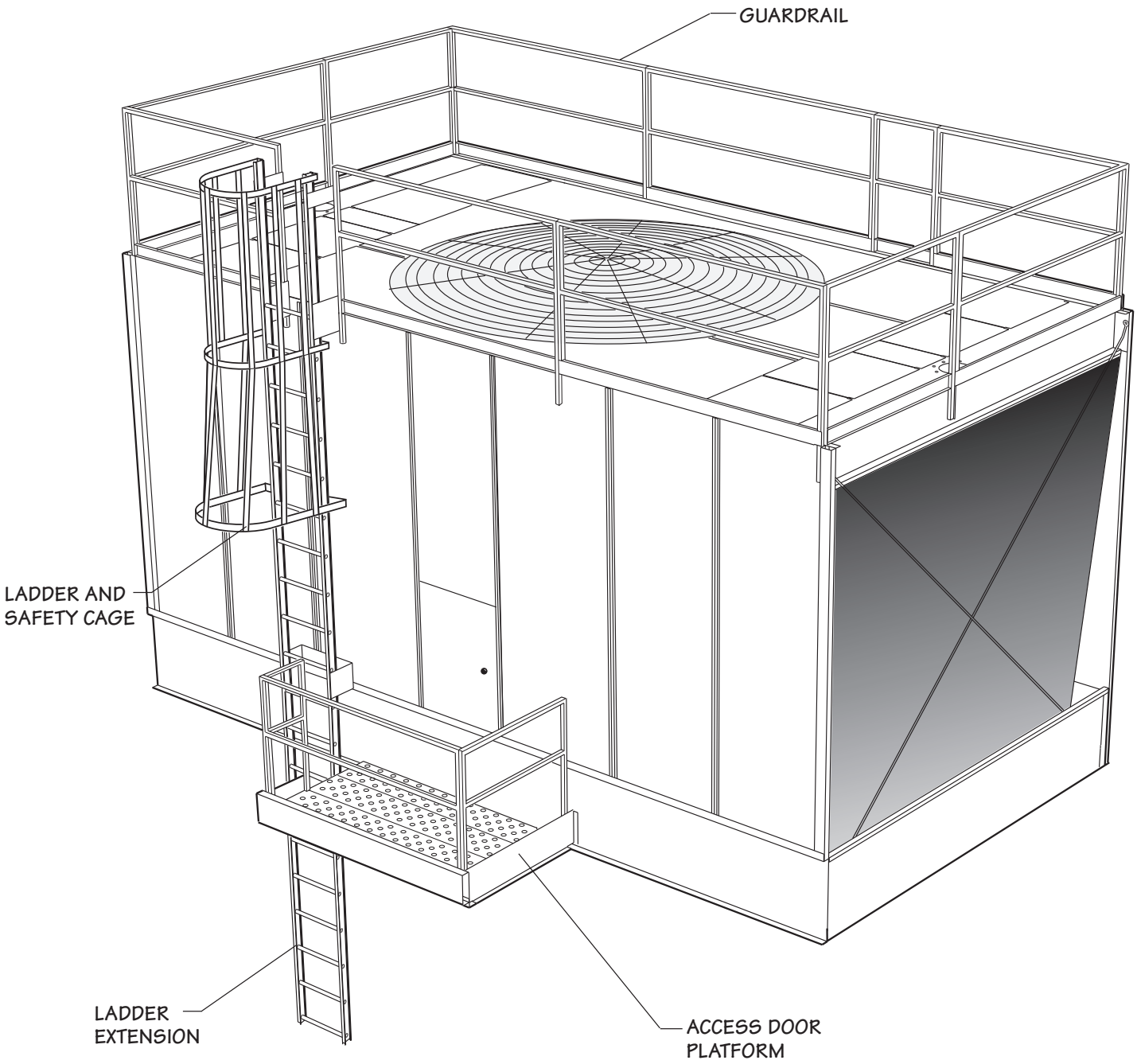
11.0 **Cold Water Collection Basin**:

11.1 The collection basin shall be G-235 galvanized steel and assembled with bolted connections. Tap screws shall not be acceptable due to their potential to develop leaks. The basins shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with debris screens. A factory installed, float operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt that may accumulate. Towers of more than one cell shall include a method for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating.

- The NC tower design offers side-suctions, side-outlet sumps, and bottom outlets to accommodate a significant 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.

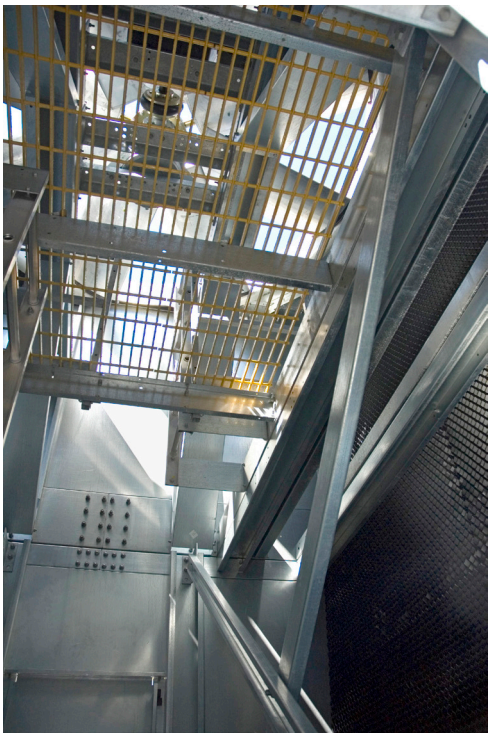


Specifications	Specification Value
Stainless Steel Options	
Stainless Steel Collection Basin:	
11.1: *Replace paragraph 11.1 with the following:* The collection basin shall be welded 301L stainless steel construction. Only low-carbon stainless steel alloys will be accepted in order to minimize the risk of intergranular corrosion in the weld zones. The basin shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with stainless steel debris screens. A factory-installed, float-operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt that may accumulate. Towers of more than one cell shall include a method for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. All steel items that project into the basin shall also be made of stainless steel.	■ The collection basin is the only part of the tower that is subject to periods of stagnant water, concentrated with treatment chemicals and customary contaminants. It is also the most expensive and difficult part of any tower to repair or replace. For these reasons, many customers–particularly those who are replacing older towers–choose to specify stainless steel cold water basins. Also, see the notes on page 10 regarding the standard Cold Water Collection Basin. They apply equally well to the stainless steel basin.
	■ The 316 alloy was designed to increase resistance to chlorides. Generally, cooling towers in HVAC service utilize water sources, which do not approach the limits of 300 series stainless, even up to several cycles of concentration. Industrial cooling towers, generally circulating more aggressive water, use 300 series stainless as standard metallurgy, upgrading to 316 for situations such as estuary water or other significant source of chlorides. The vast majority of cooling tower water sources result in an acceptable environment for 300 series stainless steel, with HVAC systems typically being on the mild end of the spectrum. If you have one of the rare instances where water quality exceeds 900ppm Cl then talk to your Marley sales representative about 316SS.
Stainless Steel Distribution Basin:	
8.1: *Replace paragraph 8.1 with the following:* Two open 301L stainless steel basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basin components shall be installed and sealed at the factory and assembled with bolted connections. Tap screws shall not be acceptable due to their potential to develop leaks. The basins shall be equipped with removable, stainless steel covers capable of withstanding the loads described in paragraph 4.1. All components of these basins, with the exception of the nozzles, shall be stainless steel. The water distribution system shall be accessible and maintainable during tower fan and water operation.	■ The corrosion potential of contaminated water increases with temperature–and these basins see the hottest water in the tower. If your design hot water temperature is over 125°F, or if your operating system can produce excursions beyond that point, you would be well advised to consider this option. It would also be advisable to change the fill support tubes in Para. 7.1 from galvanized structural tubing to 300 stainless steel structural tubing. See notes regarding Section 8.0 on page 9.
All Stainless Tower:	■ Where water quality falls outside the limits indicated in Paragraph 5.1, an all-stainless tower is worthy of your consideration. Ask your Marley representative for literature number SPEC SS-NC or download at spxcooling.com.


GUARDRAIL
LADDER AND
SAFETY CAGE
LADDER
EXTENSION
ACCESS DOOR
PLATFORM

Specifications	Specification Value
Convenience and Safety Options	
Guardrail and Ladder:	
10.2 *Add the following paragraph to the Access section:* The top of the tower shall be equipped with a guardrail complete with kneerail and toeboard, designed according to OSHA guidelines and factory welded into sub-assemblies for ease of field installation. Posts, toprails and kneerails shall be 1.5" square tubing. The guardrail assembly shall be hot dipped galvanized after welding and capable of withstanding a 200 pound concentrated live load in any direction. Posts shall be spaced on centers of 8'-0" or less. A 1'-6" wide aluminum ladder with 3" I-beam side rails and 1.25" diameter rungs shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.	■ The NC cooling tower has been designed to minimize the need for maintenance personnel to get on top of the tower to perform maintenance and inspections. For the comfort and safety of your operating personnel, we recommend that you specify a ladder and guardrail. Many users' own safety rules may dictate these options. 
Ladder Extension:	
10.2 *Add the following to the end of the Guardrail and Ladder paragraph above:* Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the roof (grade) level to the base of the tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the tower ladder; and anchoring it at its base.	■ Many towers are installed such that the base of the tower is 2'-0" or more above the roof or grade level. This makes it difficult to get up to the foot of the attached ladder. The ladder extension alleviates this problem. Marley ladder extensions are available in standard 5'-0" and 11'-0" lengths.
Ladder Safety Cage:	
10.3 *Add the following paragraph in the Access section:* A heavy gauge aluminum safety cage, welded into subassemblies for ease of field installation, shall surround the ladder, extending from a point approximately 7'-0" above the foot of the ladder to the top of the guardrail. Maximum weight of welded subassemblies shall not exceed 20 lb for ease of installation.	■ To meet OSHA guidelines, towers with fan decks of 20'-0" or more above roof or grade, and which are equipped with ladders, should have safety cages surrounding the ladders, but with approximately 7'-0" clear headroom.
Ladder Safety Gate:	
10.2 *Add the following to the end of the Guardrail and Ladder paragraph above:* A steel, self-closing gate shall be provided at the guardrail level of the ladder.	■ A galvanized steel self-closing gate can be located at the guardrail level of the fan deck, the exterior motor access platform and/or the access door platform for enhanced fall protection. Stainless steel is available with the stainless guardrail option. For the comfort and safety of your operating personnel, we recommend that you specify a self-closing gate. Many users' own safety rules may dictate these options.

Specifications	Specification Value
Access Door Platform:	
10.2 *Add the following paragraph to the Access section:* There shall be an access platform at the base of the tower extending from the vertical ladder to the access door. The platform shall be surrounded by an OSHA compliant guardrail system welded into subassemblies for ease of installation. The walking surface of the platform shall be perforated to provide a non-slip surface for personnel safety.	■ Where towers are installed on an elevated grillage or piers, it is often difficult to get to–and through–the access door conveniently. This platform provides easy, safe and comfortable access to that door. It also extends beyond the door to provide ready access to the optional Control System. See drawing on page 12.
Plenum Walkway:	
10.2 *Add the following paragraph to the Access section:* Provide a factory-installed walkway extending from one cased-face access door to the other cased face. A steel framework shall support the walkway and the top of the walkway shall be at or above the cold-water basin overflow level. The walkway and framework to be equivalent material as the tower basin and have a minimum width of 36".	
Interior Mechanical Equipment Access Platform: *NC8402 thru NC8409*	
10.2 *Add the following paragraph to the Access section:* A factory-installed, elevated platform convenient for the care and maintenance of the tower's mechanical equipment shall be provided. The walkway and framework to be equivalent material as the tower basin.	
Interior Mechanical Equipment Access Platform: *NC8410 thru NC8422*	
10.2 *Add the following paragraph in the Access section:* An internal ladder shall extend upward from the plenum walkway to an elevated fiberglass bar grating platform convenient for the care and maintenance of the tower's mechanical equipment. The platform shall be surrounded by an OSHA compliant guardrail system welded into subassemblies for ease of installation.	

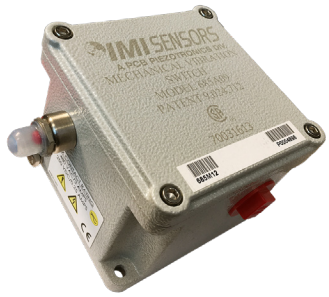


Mechanical Equipment Access Platform

NOTE

OSHA and other concerned authorities are in the process of developing guidelines regarding the safety procedures and protective equipment that should be provided maintenance personnel who are required to go inside cooling towers. We feel it advisable to provide for as much maintenance as possible from outside the cooling tower and, to that end, offer such options as Guardrail and Ladder–pg 13, Ladder Extension–pg 13, Ladder Safety Cage–pg 13, Access Door Platform–pg 14, and Motor Out of the Airstream–pg 21. Such interior convenience options as Plenum Walkway–pg 14, that are offered are not meant as an invitation to perform inside maintenance. They are intended solely to maximize the comfort and safety of maintenance personnel during the performance of any inside work which may become necessary.

Specifications	Specification Value
Control Options	
Fan Motor Starter Control Panel:	
6.4 *Add the following paragraph to the Mechanical Equipment section:* Each cell of the cooling tower shall be equipped with a UL / CUL 508 listed control panel in a NEMA 3R or 4X outdoor enclosure capable of controlling single-speed or two-speed motors as required, and designed specifically for cooling tower applications. The panel shall include a main circuit breaker with an external operating handle, lockable in the off position for safety. Full voltage non-reversing magnetic starter shall be controlled with a thermostatic or solid-state temperature controller. Door mounted selector switches shall be provided to enable automatic or manual control and wired for 120VAC control. Control circuit to be wired out to terminal blocks for field connection to a remote vibration switch, overload trip alarms and remote temperature control devices. The temperature controller shall be adjustable for the required cold-water temperature. If a thermostatic controller is used it shall be mounted on the side of the tower with the temperature sensing bulb installed in the cold-water basin using a suspension mounting bracket. If a solid-state temperature controller is used the controller will be door mounted on the control panel. The solid-state temperature controller will display two temperatures, one for outgoing water and the other for set point. Water temperature input shall be obtained using a three-wire RTD with dry well in the outlet water piping and wired back to the solid-state temperature controller in the control panel.	■ If it is your opinion that the control system for the cooling tower be part of the tower manufacturer's responsibility, we are in wholehearted agreement with you. Who better to determine the most efficient mode and manner of a cooling tower's operation–and to apply a system most compatible with it–than the designer and manufacturer of the cooling tower? Marley variable speed drives are also available for enhanced temperature control, energy management and mechanical equipment longevity. See specifications on page 17.
Terminal Box:	
6.4 *Add the following paragraph in the Mechanical Equipment section:* A factory installed terminal box shall be furnished and mounted to the outside of the tower where applicable. The fan motor and optional components–including the vibration switch and water level probes–shall be factory wired to terminal points inside the terminal box. Optional tower components which ship loose, including the oil level switch and immersion heaters shall be field wired to the terminal box. Enclosure shall be NEMA 3R or NEMA 4X with hinged and lockable door	■ The Marley Terminal Box simplifies all electrical connections to the cooling tower motor and optional control accessories. • Eliminates wiring errors in the field • Reduces field wiring labor and materials • Provides an external access location to internal cooling tower wiring • NEMA 4X fiberglass enclosure suitable for corrosive applications • Terminal points are well identified • UL 508 assembly

Specifications	Specification Value
meeting UL and CSA standards. Terminal box shall include lockable stainless steel snap-latch door fasteners, terminal blocks marked with wire numbers, sub-pan and a wiring diagram. Complete assembly shall be built to UL 508A standards. Conduit entry and exit points shall be the bottom of the enclosure preventing water collection in the enclosure.	
Vibration Limit Switch:	
6.4 *Add the following paragraph to the Mechanical Equipment section:* A vibration limit switch in a 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, an 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. 
Basin Heater:	
11.2 *Add the following paragraph to the Cold Water Basin section:* Provide a system of electric immersion heaters and controls for each cell of the tower to prevent freezing of water in the collection basin during periods of shutdown. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A NEMA 4 control panel and associated temperature probe shall include circuitry to monitor cold water temperature and low water level, providing ON OFF thermostatic like control. The temperature probe shall be located in the cold-water basin. The system shall be capable of maintaining 40°F water temperature at an ambient air temperature of _____ °F.	■ The Marley basin heater components described at left represent our recommendation for a reliable automatic system for the prevention of basin freezing. They are normally shipped separately for installation at the jobsite by the installing contractor. When purchased in conjunction with the enhanced Control System option, however, they are customarily factory-mounted and tested.  ***When zinc ions are present in basin water, copper immersion heaters must not be used. Insist upon stainless steel.*** The ambient air temperature that you insert in the specifications should be the lowest 1% level of winter temperature prevalent at site.
Water Level Control System:	
11.2 *Add the following paragraph to the Cold Water Basin section:* Provide a water level control system including a NEMA 4X control panel, water level probes and probe stilling chamber. The control system shall monitor the water level in the cold-water basin to determine level	■ Solid-state liquid level controls provide you with state-of-the-art systems to control and monitor the water level in your cooling tower collection basin. Relays operating in conjunction with suspended stainless steel electrode probes monitor basin water levels, providing simple solenoid-valve water make-up or discrete on/off signals to more sophisticated automation controls. Optional configurations might include make-up along with high and low water level alarm and cutoff, or pump cutoff. Packaged systems including any of these variations are available. Consult your Marley sales representative or download literature number ACC-NC-9 from spxcooling.com for additional information.

Specifications	Specification Value

events used for cold-water make-up, high and low alarms or pump shut down. The control panel shall use electromechanical relays providing power for the make-up solenoid and electrical contacts for alarm and pump shutdown control circuits. Probes shall be contained in a vertical stilling chamber to stabilize the water in the cold-water basin. Probes shall have replaceable stainless steel tips and level height shall be field adjustable.

Fan Motor Variable Speed Drive:

ACH550 VFD System

6.4 *Add the following paragraph in the Mechanical Equipment section when VFD is used with customer's Building Management System:* For fan control a complete UL listed variable speed drive system in a NEMA 1 indoor, NEMA 12 indoor or NEMA 3R outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching. VFD output switching signal shall be programmed to not cause mechanical vibration issues with backlash in gearbox teeth or vibration issues associated with long driveshafts. The VFD shall be programmed for variable torque applications and shall catch a fan spinning in the forward or reverse direction without tripping. VFD panel construction shall include a main disconnect with short circuit and thermal overload protection with external operating handle, lockable in the off position for lock-out tag-out safety procedures. A service switch directly ahead of the VFD shall be provided for voltage isolation during VFD maintenance. An integrated full voltage non-reversing bypass starter shall be furnished allowing fan motor operation if VFD has failed. The VFD system shall receive a speed reference signal from the building management system monitoring the cooling tower cold-water temperature. As an option to receiving the speed reference signal from a building management system, the drive must have the capability to receive a 4-20 mA temperature signal from an RTD transmitter. When using an RTD for temperature monitoring and speed control the VFD shall have an internal PI regulator to modulate fan speed maintaining set

■ Marley Variable Speed Drive systems are designed to combine absolute temperature control with ideal energy management. The cooling tower user selects a cold water temperature and the drive system will vary the fan speed to maintain that temperature. Precise temperature control is accomplished with far less stress to the mechanical equipment components. The improved energy management provides energy savings to the user.

Motors operated on a VFD shall carry a service factor of 1.0. When operating on a VFD, the drive parameters should be programmed to limit the current to motor nameplate hp. Adjust the Motor specification accordingly.

Specifications	Specification Value

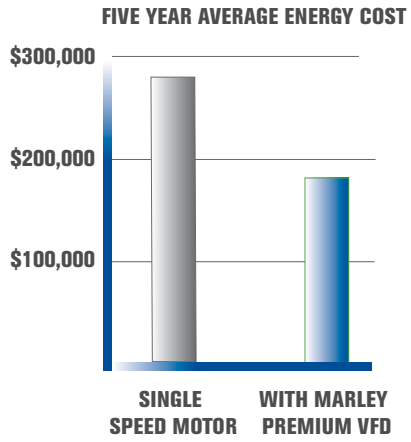
point temperature. The drive's panel shall display the set-point temperature and cold-water temperature on two separate lines. The bypass shall include a complete electromechanical magnetic bypass circuit with the capability to isolate the VFD when in the bypass mode. Transfer to the bypass mode shall be manual in the event of VFD failure. Once the motor is transferred to the bypass circuit the fan motor will run at constant full speed. Operator controls shall be mounted on the front of the enclosure and shall consist of Start and Stop control, Bypass/VFD selection, Auto/Manual selections and manual speed control. To prevent heating problems in the fan motor the VFD system shall de-energize the motor once 25% motor speed is reached and cooling is no longer required. The cooling tower manufacturer shall offer VFD start-up assistance to assure proper VFD programming for cooling tower operation.

Marley Premium VFD System

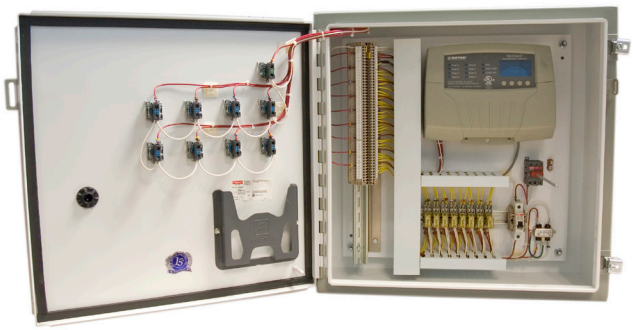
6.4 *Add the following paragraph in the Mechanical Equipment section when VFD is used as a stand alone system and not controlled by a BMS:* For fan control a complete UL listed variable speed drive system in a NEMA 12 indoor or NEMA 3R outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching. VFD output switching signal shall be programmed as not to cause mechanical vibration issues with backlash in gearbox teeth or vibration issues associated with long drive shafts. VFD shall be programmed for variable torque application. The VFD shall catch a fan spinning in the forward or reverse direction without tripping. VFD panel construction shall include a main disconnect with short circuit and thermal overload protection with external operating handle, lockable in the off position for lock-out tag-out safety procedures. A service switch directly ahead of the VFD shall be provided for voltage isolation during VFD maintenance. An integrated full voltage non-reversing bypass starter shall be furnished allowing fan motor operation if VFD has failed. In the event of a system fault the VFD program logic shall evaluate type of fault determining if safe to automatically transfer fan motor

Specifications	Specification Value

to the bypass starter. Automatic bypass with an earth ground condition shall not be allowed. Once in bypass mode the internal controls will continue to monitor cold-water temperature and cycle the fan motor on and off maintaining cold-water set point temperature. The drive system shall be designed and operated as a stand-alone system without the need for a BMS system. Operator controls shall be mounted on the front of the enclosure and shall consist of Start and Stop control, Bypass/VFD selector switch, Auto/Manual selector switch, Manual speed control, and solid-state temperature controller. An emergency bypass starter selector switch internal to the panel allowing the fan motor to be run at full speed shall be furnished. The system shall include a solid state PI temperature controller to adjust frequency output of the drive in response to the tower cold-water temperature. A four-wire RTD with dry well shall be furnished with the VFD and field installed into the cold-water discharge pipe coming from the cooling tower cell. The temperature of the cold-water and set point shall be displayed on the door of the control panel. The bypass starter shall be integrated into the same enclosure as the VFD including complete circuitry to isolate the VFD when in the bypass mode. To prevent heating problems in the fan motor the VFD system shall de-energize the motor once 25% motor speed is reached and cooling is no longer required. The cooling tower manufacturer shall offer VFD start-up assistance to assure proper VFD programming for cooling tower operation.



20% reduction in fan speed will typically save 50% of electrical energy

Specifications	Specification Value
Motor Sequencer with RTD: 6.4 *Add the following paragraph to the Mechanical Equipment section:* A complete system including a sequencer control panel with temperature RTD and a one-speed or two-speed starter panel for each cell shall be provided. The sequencer shall be furnished to automatically stage multiple fans in a cooling tower lineup. Staging shall be based on a programmed set point temperature and the cold-water discharge representing the total cold water temperature leaving a tower. Enclosure shall be either NEMA 12 indoor or NEMA 4X outdoor with hinged and lockable door meeting UL508 or CUL508 standards. Sequencer operating two speed motors may be configured to cycle through as LO1 – LO2 – LO3 – HI1 – HI2 – HI3 as a default setting or optional setting as LO1 – HI1 – LO2 – HI2 – LO3 – HI3. Indicator lights used to display which cells are energized and at which speed shall be provided on the enclosure door. Indication of running status of each cell and speed shall be brought out to user terminal blocks for remote monitoring. An optional remote set point control via a 4-20mA signal shall be available to remotely control the set point value.	■ Marley sequencer controls help extend the life of the fan motors with automatic lead stage rotation. The sequencing controllers prevent the same motor from always starting first in the normal sequence of operation. Every 24 hours a different motor becomes the lead stage, equalizing the wear on all motors. 
Single Point Power Connection: 6.4 *Add the following paragraph to the Mechanical Equipment section:* Each cell of the cooling tower shall be equipped with a UL/CUL 508 listed SPPC (Single Point Power Connection) control panel in a NEMA 3R or 4X outdoor enclosure. The SPPC panel shall include a main circuit breaker with an external operating handle, lockable in the off position for safety. The SPPC main circuit breaker will feed various control circuits integrated into the SPPC panel including but not limited to: fan motor starter, basin heater controls and water level controls. In the event a VFD is furnished for the cooling tower fan, a feeder breaker in the SPPC panel shall be provided to feed power to a remotely mounted VFD. Operational status contacts wired to user terminal points shall be provided.	■ A main circuit breaker disconnect provides a true single point power connection for cooling tower controls. Contractor connects a single power source and the panel provides power feeds, controls and voltages for tower controls. Typically each cell of a tower requires one SPPC panel. 

Specifications	Specification Value

Miscellaneous Options

Motor out of the Airstream:

6.1 *Add the following to the end of this paragraph:* The motor shall be mounted outside the casing of the tower, and shall be connected to the gear reducer by a dynamically balanced, stainless steel tube and flange driveshaft.

■ For many years, a feature of Marley cooling towers was that the electric motors were located outside the fan cylinders, where they were easily accessible, and where they were not subjected to the constant humidity that exists inside the tower plenum.

Although improved motor designs (insulation, bearings, seals, and lubricants) have now made it feasible for us to locate the motor inside the tower in close-coupled proximity to the Geareducer (page 7), many users still prefer the motor to be located outside the humid airstream. If you are among those users—or are among those who see the wisdom of their thinking—please specify this option. If you do, however, ***please require it of all bidders.***

Fan Cylinder Extensions:

9.1 *Insert the following before the last sentence:* Fan cylinder extensions shall be provided to elevate the fan discharge to a height of ___ ft above the fan deck level.

■ Extensions are available in 1'-0 increments to a maximum height equal to the diameter of the fan. Such extensions may be considered necessary in order to elevate the discharge beyond the bounds of an enclosure. Discuss applicability with your local Marley sales representative.

Inlet Flow Control Valves:

8.2: *Add the following to the end of the paragraph:* Heavy-duty flow-regulator valves shall be provided at the hot-water inlet connections. These valves shall be disc-type, with cast iron bodies and stainless steel operating stems. There shall be a locking handle to maintain the valve setting in any position. Valves shall be right-angle configuration, precluding the need for inlet elbows.

■ Marley flow-control valves have been a favorite of users since the 1950s. They remain serviceable for the life of the tower and provide a continuing means of flow-regulation between hot water basins—and between cells of multi-cell towers as well.

Equalizer Flume Weir Gates:

11.2: *Add the following paragraph to the Cold Water Collection Basin section:* The interconnecting flume between cells shall be equipped with a removable cover plate to permit the shutdown of one cell for maintenance purposes, or to permit independent cell operation. *NC8401-NC8414 only.*

■ If it is your intention to be able to operate both cells of the tower while the flume cover plate is installed, separate outlet connections, float valves and overflows must be provided for each cell. Likewise, this would require separate sensors and controls for basin heater systems, if installed.

Specifications

Inlet Sound Attenuation:

1.3 *Add the following paragraph to the Base section:* The cooling tower shall be equipped with inlet sound attenuation baffles positioned and spaced vertically. The baffles will be spaced across the entire length and extend the full height of the air inlet. The baffles will be constructed of perforated sheet metal and contained within a steel box that is self-supporting. The inlet attenuation shall not impact the thermal performance efficiency of the basic tower configuration. *NC8401-NC8414 only.*

Outlet Sound Attenuation:

1.3 *Add the following paragraph to the Base section:* The cooling tower shall be equipped with outlet sound attenuation baffles positioned and spaced horizontally across the entire fan opening. The baffles will be constructed of perforated sheet metal and contained within a steel box that is self-supporting. *NC8401-NC8414 only.*

Quiet Fan:

6.1 *Replace paragraph 6.1 with the following:* Fan(s) shall be propeller-type, incorporating a minimum of seven aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 11,000 ft/min. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. The gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater. The gear sets shall have AGMA Quality Class of 9 or greater.

6.1 (alternate)* Fan(s) shall be propeller-type, incorporating a minimum of seven aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 11,000 ft/min. Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, pulleys, and tapered roller bearings. Bearings and fan shaft shall be contained in a cast

Specification Value

■ Falling water sound–unlike counterflow towers which allow the water to free-fall and splash into the cold water collection basin, PVC film-fill crossflow towers have no splashing. This allows a crossflow tower much lower sound levels at the air inlet than a counterflow tower–especially induced draft counterflow towers. Even with the "splash-matting" option in a counterflow cold water collection basin, a crossflow tower air inlet is still quieter. Plus you do not have to worry about clogging the splash matting. Yet another maintenance and operation advantage of the crossflow configuration.

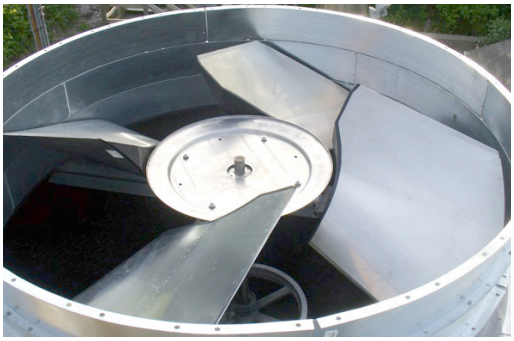
■ The Marley "Quiet Package" includes the affordable Quiet Fan mechanical option, optimized to achieve the lowest possible sound levels while maintaining efficiency. In combination with a Marley Variable Speed Drive, this package is capable of meeting all but the most restrictive sound limitations.

Unlike thermal performance, no certification program exists for sound. All published sound data for Marley NC cooling towers has been independently verified by a CTI-licensed test agency so you can trust that the sound from your NC cooling tower will meet sound levels as specified.

There are a few ways for the client to ensure they get a quiet tower.

• One is to conduct a field sound test after installation. On-site testing after installation can, however, be inaccurate depending on the environment.

• Specifying fan blade tip speed is one way to physically force the tower selection to be quiet. Tip speed is easily checked by multiplying the fan RPM by the fan circumference at the blade tip (π fan dia). Over 12,000 ft/min is considered high by most people. 10,000-12,000 is considered typical and expected. 8,000-10,000 would be considered low sound. Below 8,000 is difficult to hear above the water noise.

Specifications	Specification Value
steel housing to ensure proper fan shaft alignment, pillow block bearings are not allowed. Bearings shall be rated at an L_{10A} service life of 40,000 hours or greater. **Currently available on all models 60 hp or less.*	
Ultra Quiet Fan:	■ For more severe cases requiring the lowest possible fan sound levels, the Marley Ultra Quiet Fan option is now available on all but the NC8401 NC models. Tower height may increase slightly–obtain current sales drawings from your Marley sales representative for accurate dimensions. If your requirement calls for inlet and outlet attenuation, you might consider the Ultra Quiet Fan in lieu of attenuation. Outlet attenuators are not available with the Ultra Quiet Fan option.
6.1 *Replace paragraph 6.1 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. 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 10,000 ft/min. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. The gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater. The gear sets to have AGMA Quality Class of 9 or greater. *Available on models NC8402 through NC8414.*	
Single Hot Water Inlet Connection per Cell:	■ This option reduces what might otherwise be a complex hot water piping layout to a simple, single connection per cell. It also avoids an unsightly (perhaps unsafe) maze of pipe exposed above the top deck of the tower. The single inlet connection can be located either in the tower's endwall casing, or below the cold water basin. The endwall entry point is suitable for single-cell towers, and for those that might be installed in groups of two cells each. Bottom inlet piping lends itself to close-spaced, multicell installations and to those situations where it is appropriate to keep all pipework below the level of the tower. Be sure to specify that the internal pipe extends to the tower exterior panel, either the casing panel or collection basin floor. Some manufacturers require the contractor to complete the internal piping, adding to your cost.
8.2 *Replace this paragraph with the following:* Each cell of the tower shall include a single hot-water inlet connection located as shown on the plans. An internal system of PVC piping shall deliver water equally to the distribution basins without the need for balancing valves. This internal piping system shall require no scheduled maintenance, and shall be located such that it does not interfere with normal maintenance access. The internal piping shall extend to the exterior surface of the tower.	

Specifications	Specification Value
Air Inlet Screens:	
9.1 *Add the following paragraph to the Casing, Fan Deck and Fan Guard section:* The air inlet faces of the tower shall be covered by 1" mesh hot-dipped galvanized welded wire screens. Screens shall be secured to removable galvanized U-edge frames. Screens shall be designed to permit full access to the cold-water basin by removal of one panel on each air inlet.	■ In wooded or windy areas, these screens help to keep leaves or blowing debris out of the cooling tower and circulating water system.
Variable Water Flow Distribution:	
8.2 *Add the following to the end of this paragraph:* The water distribution system shall be equipped with a method to operate under variable flow conditions while maintaining a uniform air-side pressure drop through the fill to maximize cooling efficiency and minimize the risk of ice and scale formation in the fill. System must accommodate flow rates down to _____% of design flow.	
Mechanical Equipment Davit:	■ The portable davit is a professional grade ISO 9001:2000 compliant mechanical removal system that is safe and easy to use.
6.4 *Add the following paragraph to the Mechanical Equipment section:* A portable davit crane shall be mounted on the fan deck of the tower and shall be capable of lifting, extending, and lowering the heaviest mechanical component up to 1000 lb over the fan deck and down the air inlet face of the tower. The davit crane system shall include a winch, cable, and load hook. *NC8401-NC8414 only.*	
Plume Abatement:	
1.2 *Add the following paragraph to the Base section:* Two fin-tube coils utilizing tower inlet water shall be provided at the tower air inlet to abate plume at ___°F and _____% RH when required by ambient conditions. The coils shall be factory installed, constructed of non-corrosive material, and oriented in the tower to provide parallel-path plume abatement. Associated inlet valves to divert water from the coil to the wet section fill media shall be provided by the tower manufacturer. *Available on NC8413 models only.*	■ By combining direct contact (evaporative) and indirect contact (dry) heat exchangers in a parallel arrangement, this system can result in water savings as high as 20% versus conventional cooling towers – while markedly limiting visible plume.

Specifications	Specification Value
High Wind Load/Seismic Designs: 4.1 *Replace this paragraph with the following:* The tower structure, anchorage and all its components shall be designed by licensed structural engineers, employed by the tower manufacturer, per the international building code to withstand a wind load of _____ psf, as well as a _____ seismic load. The fan deck and hot-water basin covers shall be designed for 50 psf live load or a 200 lb concentrated load. Guardrails, where specified, shall be capable of withstanding a 200 lb concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.	■ High wind load designs greater than 30 psf and up to 100 psf are available. It is important to consult the local code official for actual requirements. Some manufacturers may claim their tower is capable but have never had the design reviewed by a licensed structural engineer. Not requiring this review for high wind and seismic regions can be dangerous to you and the public.
Multicell Basin Equalizer Outlets: 11.2 *Add the following paragraph to the Cold Water Collection Basin section:* A hole and bolt circle shall be provided in the depressed section of the basin for equalizer piping between cells. A full-face, .25" thick, 50 durometer gasket shall be provided at each equalizer location.	■ Used as water level equalizers between multicell towers. Not intended for water migration. Piping and attachment hardware by others. Flat faced flange required.
Basin Sweeper Piping: 11.2 *Add the following paragraph to the Cold Water Collection Basin section:* The cold water basin shall be equipped with PVC sweeper piping with plastic nozzles. The piping shall be factory installed under the fill and designed to force all dirt and debris to the depressed section of the collection basin. *NC8401-NC8414 only.*	■ PVC sweeper piping and nozzles.
Basin Inlet Covers 11.2 *Add the following paragraph to the Cold Water Collection Basin section:* The cold-water basin shall be equipped with basin inlet covers to help shield basin from debris and sunlight exposure.	■ SunShield™ cold-water basin covers protect basin from debris and block sunlight to deter algae growth.

Specifications	Specification Value
Extended Geareducer Lube-Line with Dipstick: 6.4 *Add the following paragraph to the Mechanical Equipment section:* An external oil level dipstick shall be located adjacent to the motor at the fan deck surface and shall be accessible from a portable maintenance ladder.	■ The dipstick option is accessible from a portable maintenance ladder on one and two cell towers only. Maintenance considerations recommend this option be combined with the ladder and guardrail option on installations of three or more cells since the dipstick cannot be reached without accessing the fan deck.
FM Approval: *Not available on single-cell NC8422.* 5.3 *Add the following paragraph to the Construction section:* The tower shall be listed in the current FM Approval Guide (approvalguide.com) and conform to the FM Approval Standard for Cooling Towers, Class Number 4930 that is approved for use without sprinkler systems. The tower shall have successfully passed full scale fire testing, static and cyclic wind pressure testing, large missile impact testing (for Zone HM), and structural design evaluation as administered by FM Approvals. The tower shall be capable of +70/-140 psf for Zone H as defined by FM Global. A copy of the FM Approval Certificate of Compliance dated November 2013 or later shall be available upon request.	■ **Marley NC8401 though NC8414 models are the only crossflow cooling towers FM Approved for single-cell and multicell installations. NC8422 (NC Everest®) models are FM Approved for multicell installations only.** This could have a very beneficial effect upon your fire insurance premiums. Towers not able to meet FM requirements may require the inclusion of a fire protection sprinkler system to achieve a comparable level of insurance premium cost. Even if you are not insured by FM, this requirement ensures that each cell will contain any fire that may occur without losing the ability of limited operations and capacity. FM APPROVED

NC steel

SPECIFICATIONS

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SPX