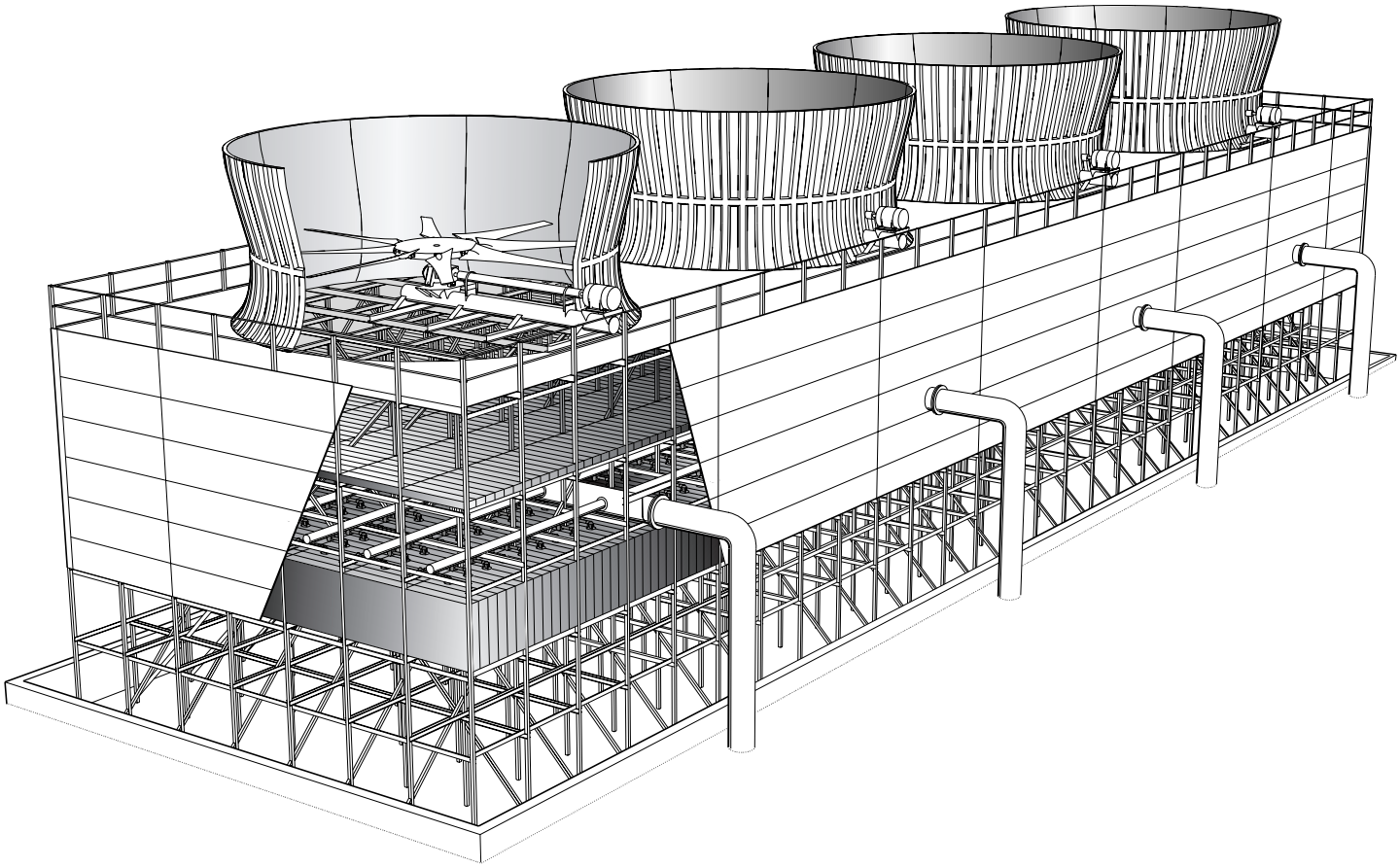
W400 class
COOLING TOWER

specifications

MARLEY®

W400 Cooling Tower — Contents



Marley Class W400 towers are field erected, heavy duty, film fill, counterflow cooling towers of wood construction designed to serve all normal cooling water systems. They represent the current generation of towers that were the basis of Marley's entrance into the cooling tower marketplace in the 1920s, and incorporate over 90 years of design advancements that our customers have found valuable. The Marley Class W400 cooling tower represents the current state of the art in this cooling tower category.

This publication not only relates the language to use in describing an appropriate Class W400 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 all pages 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 6 through 15 indicate those paragraphs that are descriptive of a cooling tower which will not only accomplish the specified thermal performance, but which will include all normal operation and maintenance-enhancing accessories and features. It will also incorporate those standard materials which testing and experience has proven to provide best results in normal operating conditions.

Pages 16 through 26 provide some paragraphs 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 Class W400 cooling tower. SPX Cooling Technologies realizes 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.

Specifications	Specification Value
1.0 **Base:**	
1.1 Furnish and install an induced-draft, counterflow-type, field-erected, wood-framed, film-filled, industrial-duty cooling tower of _____ cell(s), situated as shown on the site plan. The limiting overall dimensions of the tower shall be ____ ft wide x ____ ft long x ____ ft. high to the top of the fan cylinders. Total operating horsepower of the fans shall not exceed ____ hp, consisting of ___ @ _____ hp motor(s).	■ This paragraph 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 horsepower avoid the introduction of unforeseen operational and site-related influences. Even further control of this problem will result if you specify the number of cells, and the maximum fan 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 is film-filled, which normally provides maximum cooling effect in significantly less area than would be required by a splash-filled crossflow tower. However, if your circulating water is heavily contaminated with debris or product carryover, and there is a reasonable probability of clogging close-spaced counterflow fill, you may wish to specify clog resistant film fill or a splash-fill crossflow tower as described in SPEC 600. Please discuss your system needs with your Marley representative. 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. (i.e. Dollars per hp; dollars per ft. of pump head; dollars per 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 _____ gpm of water from ____ °F to _____ °F at a design entering air wet-bulb temperature of _____ °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.	■ 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. 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 undersizing 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 specs, 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.
2.2 The purchaser will arrange for an on-site thermal performance test, to be conducted in the presence of the manufacturer and owner, and under the supervision of a qualified, disinterested third party in accordance with CTI (Cooling Technology Institute) ATC-105 standards during the first full year of operation. If the tower fails to perform within the limits of test tolerance, then the cooling tower manufacturer will install additional cells and/or make such corrections as are agreeable to the owner and shall pay for the cost of a retest. If the tower still fails to perform as specified, then the manufacturer shall make such reimbursements as are	

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appropriate and agreeable to the owner to compensate for the performance deficiency.	**Under no circumstances should you allow the manufacturer to repitch the fans to increase motor brake horsepower above that shown in the proposal. That creates additional operating costs that will continue for the life of the tower—and imposes no penalty on the manufacturer.**
3.0 **Construction Standards:**	
3.1 Except where otherwise specified, all lumber used in the tower shall be pressure treated Douglas fir. The structural framework of the tower, as well as all lumber grades and application, shall be in accordance with CTI STD-114. Boxed heart lumber, as defined in section 6.1 of CTI STD-114, will not be allowed.	■ The hot, humid environment in which a cooling tower normally operates can render the limits of customary construction standards inadequate for cooling tower design. In recognition of this, CTI has issued the CTI Code Tower Standard Specifications referred to at left. In addition to reducing the loads that may be applied to members of given size, these specifications identify the type of loads that must be applied; establish how those loads are applied; identify appropriate fasteners and connectors, and their application; define acceptable joint criteria; and prescribe acceptable treatment procedures.
3.2 All lumber shall be pressure treated after fabrication with chromated copper arsenate (CCA) by the full-cell process to a minimum chemical retention of 0.4 lbs/cu ft. in accordance with CTI STD-112. Retention shall be verified by sample borings, and treatment reports shall be maintained and available upon owner request. Minor field cuts as may be necessary for fan cylinder openings and column bases shall be touched up after cutting with a leach-resistant preservative treatment suitable for exterior exposure.	Exceptions taken to these specifications may be indicative of offerings in which the design standards applied will significantly limit the structural capability and longevity of the tower. If California redwood construction is preferred, please see page 22.
3.3 All structural connections, splices, and joint connectors shall be in accordance with the National Design Specification for Wood Construction (NDS) and CTI STD-119. The cooling tower manufacturer shall maintain structural design calculations for review by the purchaser.	Marley has produced a number of *"Marley Difference"* publications having to do with both the science, and the art, of designing cooling towers. *Item S-1W* of that series deals with Wood Design Standards, *Item MC-3* deals with Pressure Treatment, and *Item MC-4* explains the fallacy of using boxed heart lumber. Other issues of these *Marley Difference* pieces will be referred to throughout the explanatory portion of this specification—**and copies are available to you upon request.**
3.4 All stairways, ladders, guardrails and walkways shall conform to OSHA standards.	
4.0 **Design Loading:**	
4.1 The tower and all its components shall be designed to withstand a wind load based on ASCE-7 and a seismic load based on UBC. As a minimum, a stability load of 2.5% shall be applied to the structure. For jobs outside the US, a minimum design wind load of 30 psf shall be used. Fan decks and other work levels shall be designed to withstand a uniform load of 60 psf, or a concentrated live load of 600 lbs. Fill and fill supports shall be capable of withstanding a 40 psf live load. Guardrails shall be capable of withstanding a 200 lb. concentrated live load in any direction.	■ The indicated design values are the minimum allowables under the specified design standards. If your geographic location dictates higher wind load or seismic load values, please make the appropriate changes.

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5.0 **Circulating Water Quality:**

5.1 It is anticipated that the circulating water will have the following characteristics:

pH range	____to ____
Chlorides (NaCl)	____ ppm
Sulfate (SO_4)	____ ppm
Sodium Bic. ($NaHCO_3$)	____ ppm
Calcium ($CaCO_3$)	____ ppm
Oil or grease	____ ppm
Silica (SiO_2)	____ ppm
Max. water temperature	____ °F
Total suspended solids	____ ppm
Bacteria count	____ cfu/ml
(Other) _____	

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. They are to be regarded as minimum requirements. Where components peculiar to individual tower designs are not specified, the manufacturer shall take the above water quality into account in the selection of their materials of manufacture.

■ For purposes of this specification, "normal" circulating water conditions are defined as follows:

- A pH level between 6.5 and 9.0.
- A chloride content below 750 ppm (NaCl) – or below 455 ppm (Cl -).
- A sulfate content (SO_4) below 1200 ppm. (Sulfates can attack concrete, and contribute to scale.)
- A sodium bicarbonate ($NaHCO_3$) content below 300 ppm.
- Calcium ($CaCO_3$) below 800 ppm.
- Oil and/or grease negligible.
- Silica (SiO_2) below 150 ppm.
- A maximum hot water temperature of 120°F.
- Total suspended solids (TSS) below 50 ppm.
- A bacteria count <10,000 cfu/ml.
- No significant contamination with unusual chemicals or foreign substances.

If your circulating water quality falls outside any of the parameters listed above, some changes in the materials specifications may be required, most of which are listed on pages 16 thru 19. Where there is any question in your mind, please provide Marley with an analysis of your makeup water, along with the number of concentrations you intend to permit in your circulating water. Better still, since the quality of the water in a cooling tower soon reflects the quality of the surrounding air, an analysis of the circulating water from another cooling tower on site, if one exists, might be very informative.

Except for those unusual operating situations where the circulating water may be so laden with suspended solids, algae, fatty acids, product fibers, active organisms reflected in BOD, and the like that plugging of the cooling tower fill is a probability, reasonable attention to the hardware materials and/or their coatings is all that is normally required. Please work with your Marley sales representative.

6.0 **Structure**:

6.1 Columns shall be 4" x 4" (nominal), or larger, spaced on no greater than 6'-0" centers both longitudinally and transversely. Columns requiring anchorage shall be anchored to the concrete cold water basin by hot dip galvanized (HDG) cast iron anchor castings.

6.2 There shall be 2" x 4" (nominal) or larger longitudinal and transverse girts, and 2" x 6" (nominal) fan deck support girts on both sides of interior columns; and on the inside of all perimeter columns. Girt lines shall be located on vertical centers not to exceed 7'-0". Girt splicing shall conform strictly to the requirements of CTI STD-119.

6.3 A tension/compression system of diagonal braces shall stiffen the structure, and transfer wind and seismic loads to the basin anchor points. Diagonal connectors shall be of FRP or corrosion resistant

■ Where the tower's incoming hot water temperature consistently exceeds 120°F, the strength characteristics of the lumber may be reduced, particularly in the upper regions of the tower. Depending upon the size of the tower, and the resultant safety margins, some changes in timber sizes may be required. Your having specified the appropriate CTI STD-114 (Para: 3.1) for Douglas fir towers, or CTI STD-103 for California redwood towers will have required the manufacturer to use proper design practices.

The structural value of girts, joists, and other structural members is no better than the splices that give them continuity. *Marley Difference Item S-6* deals with splices, and how they are often misdesigned.

Diagonal connectors are discussed in *Marley Difference Item S-4*. The value of forbidding penetration of the wood's treatment layer, of course, speaks for itself. Of even greater importance is the admonition against the use of ferrous metal penetrating connectors. They will cause destructive brown rot to attack the wood.

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metal. Shear plates shall be integral with the FRP connector side straps. Connectors of cast iron or black steel, or which have sharp edges or protrusions that penetrate the treatment layer of the wood, will not be acceptable. Diagonals shall be anchored to the cold water basin using FRP diagonal connectors and hot dip galvanized cast iron anchor castings. The line of action through the diagonal to the point of anchorage shall be direct. Eccentric loading of diagonal braces will not be permitted.

6.4 Critical framing joints shall be made with structural shear plates molded of glass-filled nylon or equally inert material of comparable strength. Framing specific to those joints shall be factory counter-bored to accept insertion of the shear plates. Bidders shall include with their quotation complete framework wind and/or seismic diagrams for all models quoted, based upon the specified performance and design loadings.

6.5 All structural connections and splices shall be through-bolted using full shank 1⁄2" diameter, or larger, series 300 stainless steel machine bolts, nuts and washers.

7.0 **Fan Deck and Fan Cylinders:**

7.1 The fan deck shall act as a working platform for maintenance personnel. It shall be fabricated of no less than 1" thick, 7 ply minimum, exterior grade, tongue & groove, treated plywood, supported by fan deck girts and joists on 2'-0" centers. To minimize turbulence of airflow into the fan cylinder, fan deck protrusion into the fan cylinder opening shall not exceed 1".

7.2 Fan cylinders shall be molded FRP, no less than 6'-0" high, with eased inlets to promote smooth airflow at blade tips. The operating plane of the fan shall be at a level above the fan deck of at least 15% of the overall fan diameter. Fan tip clearance shall not exceed 0.5% of the fan diameter. If velocity recovery fan cylinders are used, they shall have a maximum flare angle of 12°, with a maximum assumed velocity recovery of 75% of the difference in average velocity pressure. Each fan

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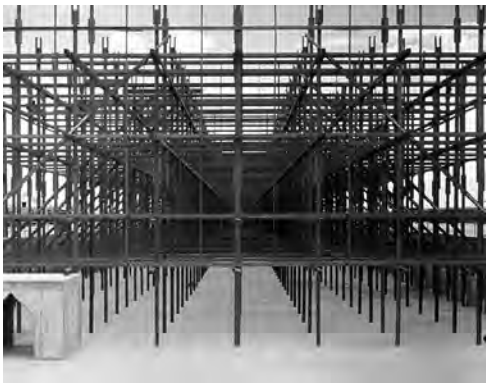
Marley Difference Item S-5 deals with diagonal anchorage, the integrity of which is, of course, the key to any tower's long term structural stability.



Eccentric loading can render the best of design intentions inappropriate. *Marley Difference Item S-2* discusses diagonals, and explains the need to maintain a straight "line of action" throughout the diagonal.

The importance of shear plates is discussed at length in *Marley Difference Item S-3*. Without them, high loads in critical joints must depend upon the value of a bolt alone. In a well-designed shear plate joint, the bolt essentially carries no load. It merely serves to clamp the joint members together. To have structurally designed their offerings, bidders will have had to develop the wind and/or seismic diagrams specified. Please require them.

Series 300 stainless hardware is appropriate for the “normal” water conditions defined on page 8. If your air or water quality dictates hardware of higher premium (i.e. type 316 stainless steel, silicon bronze, etc.), please see pages 16 through 18, and discuss your requirements with your Marley sales representative.

■ Fan deck-related options can be found on pages 22 and 26. Fiberglass-reinforced polyester fan cylinders provide the close tip clearances and smooth airflow contour necessary for good fan performance. The inert, noncorroding nature of FRP assures that these characteristics will persist. Marley Difference Item A-1a explains the need for the specification language indicated at left.

If fire-retardant FRP is required or preferred for fan cylinders or fan decks, please add the words “having a flame spread rate of 25 or less” after “FRP” in paragraph 7.2.

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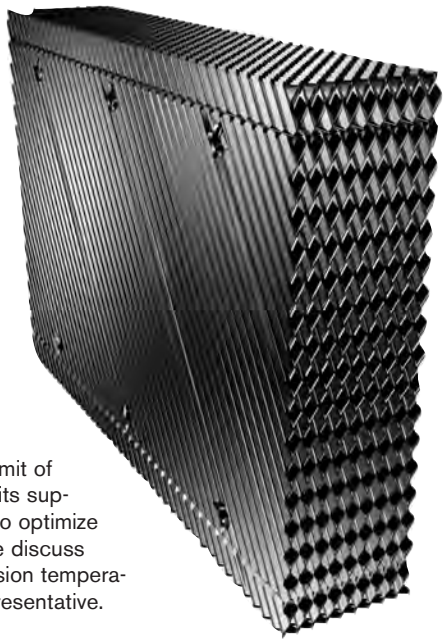
cylinder segment shall be through-bolted to both the fan deck and a primary fan deck framing member. Anchorage by lag screws into the fan deck alone will not be permitted. Fan cylinder connection and anchorage hardware shall be series 300 stainless steel.

8.0 **Fill and Drift Eliminator:**

8.1 Fill shall be cellular film-type, thermoformed PVC, manufactured of 15 mil or heavier stock and shall be assembled into sturdy packs. For fill heights of 4'-0" or less, full height packs shall be required. For taller fill heights, no more than two vertical layers shall be allowed with the 4'-0" section on the bottom. Fill shall be supported as required to accommodate construction loads and operational loads and the specified 40 psf live load, as well as ice loads in freezing climates.

8.2 Drift eliminators shall also be thermoformed of 17 mil or heavier PVC. They shall be cellular type, triple-pass, and shall limit drift losses to no more than 0.010% of design GPM flow rate. They shall be factory-assembled into easily-handled packs that nest together to form a continuous plane of drift eliminators throughout the plan area of each tower cell. Eliminators shall be supported by framing girts on no greater than 6'-0 centers, and shall be capable of withstanding a snow load of 25 psf.



- In a film-fill counterflow towers, great care is taken to assure full and even coverage of the fill with the circulating water. Multiple layers of fill packs tend to defeat this effort by causing the water to redistribute itself after each layer. Minimizing the number of layers will assure minimal airflow disruption and when required, locating the one interface point nearer the spray chamber at the top of the fill section will reduce the tendency for fill fouling.

The applied water temperature limit of normal PVC film fill depends on its support and configuration. In order to optimize your fill material selection, please discuss your expected normal and excursion temperatures with your Marley sales representative.

Drift rate varies with design water loading, air rate, drift eliminator depth, and density. The indicated rate of 0.010% is easily achievable without premium cost. If a lower rate is required, please discuss with your Marley sales representative.

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9.0 **Mechanical Equipment:**	
9.1 The primary air delivery system for each cell shall consist of an electric motor, an extended driveshaft, a geared speed-reduction unit, a multi-bladed propeller-type fan, and a rigid unitized support.	
9.2 Motors shall be ____-speed, single winding, variable torque, ___ HP maximum, TEFC, and specially insulated for cooling tower duty. Speed and electrical characteristics shall be ____ RPM, ___ phase, ___ hertz, ____ volts. If the load applied to the motors exceeds 90% of their nameplate rating, then they shall have a 1.15 service factor and the service factor beyond 1.0 shall not be considered available for load.	■ • Typical speed choices are “single” or “two”. Two-speed motors are worthy of your consideration because of the increased controllability they offer – and because of their significantly reduced annual power requirements. • For 60 Hz power, single-speed design is 1800 RPM, and normal two-speed design is 1800/900 RPM. • For 50 Hz power, single-speed design is 1500 RPM, and normal two-speed design is 1500/750 RPM. Change the motor specifications to indicate the characteristics you require. Dual winding, explosion proof, 1800/1200 RPM, space heaters, etc.
9.3 Motors shall be located outside the fan cylinders and shall be connected to the speed reducers by tubular, extended, full floating, non-lubricated driveshafts. Driveshaft tubes and flanges shall be manufactured of type 304 stainless steel. Couplings shall be hot dip galvanized cast iron, joined to the driveshaft by flexible neoprene bushings and cadmium plated steel inserts. Connecting hardware shall be 300 stainless steel. Driveshaft assemblies shall be dynamically balanced at the factory at full motor speed. Two galvanized steel driveshaft guards anchored to the mechanical equipment support shall surround the driveshaft for containment in the event of failure.	 The driveshaft turns at the motor speed and is, therefore, most sensitive to operational imbalance. Stainless steel manufacture assures that the driveshaft will not become unbalanced as a result of corrosion. The heavy nature of the castings from which the couplings are machined usually makes the hot dip galvanized couplings acceptable in all but the most corrosive atmospheres. See page 19 for optional type stainless steel, and carbon fiber driveshafts.
9.4 Gear reduction units shall be rightangle type, utilizing helical and/or spiral bevel matched gear sets. Cases shall be epoxy coated, ASTM Class 20, gray cast iron. Bearings shall be tapered roller type. Gears and bearings shall be splash lubricated in a bath of turbine type mineral oil, and units shall be capable of operating in either forward or reverse with equal facility. Speed reduction units using external oil pumps will not be allowed. Gear reducers shall meet or exceed the requirements of CTI STD-111 and AGMA Std. 420.04, and service factor at applied horsepower shall not be less than 2.0. They shall be run-in under load and adjusted at the factory, and the interior surfaces coated with a rust-proofing oil prior to shipment.	■ The Geareducer® is, essentially, the heart of your fan drive system. It must support the fan, rotate the fan at the appropriate speed, and maintain critical fan positioning within the fan cylinders–and must perform these functions reliably through many years of demanding use. Requiring adherence to the standards specified helps to assure that level of dependability. 

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9.5 Each cell shall be equipped with an external oil level gauge and gear reducer drain line, terminating at a sight-glass and plug located outside the fan cylinder near the motor.	The extended oil line to an external sight-glass provides a means of checking the level of oil in the Geareducer. It also permits periodic draining of the Geareducer at a convenient location.
9.6 Fans shall have a minimum of five GRE (glass reinforced epoxy) blades, with appropriate twist and taper to produce maximum airflow. All blades shall be fabricated with consistent moment weights to permit the change-out of individual blades without the need for total fan rebalance. Hubs shall be fabricated of hot dip galvanized steel and ductile cast iron, assembled with series 300 stainless steel hardware. Spoke-type hubs, if used, shall be equipped with an FRP hub cover to prevent recirculation of air at the plane of the fan. Hubs shall be statically balanced at the factory.	■ Many of the large fans used on cooling towers operate at tip speeds approaching 13,000 ft/min. When the blade tips encounter the occasional solid droplet of water that escapes the eliminators, erosion of the leading edge can occur on fans whose designs do not address this problem. This has, over time, contributed to some fan failures in the past. Fans of the size used on large cooling towers are applied at speeds and horsepowers that generate considerable torque — and structural tubular steel resists this torque most effectively. The Marley torque-tube assures that all of the mechanical equipment remains aligned, and that the rotating fan is properly positioned within the fan cylinder. Hot dipping after fabrication assures that all steel surfaces will be heavily coated with zinc for long-term protection against corrosion.
9.7 The complete mechanical equipment assembly for each cell shall be supported by a rigid, unitized, torque-tube type support that prevents misalignment between the motor and the gear reducer. Support shall be heavy-wall tubular steel, to which heavy plate platforms for the motor and gear reducer have been welded, as well as structural outriggers to provide structural stability and transmit loads into the tower structure. The assembly shall be hot dip galvanized after fabrication.	

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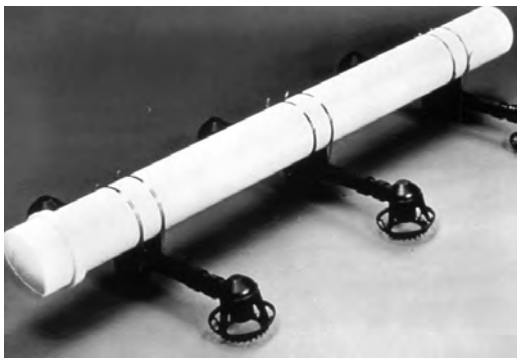
10.0 **Casing:**	
10.1 The outside walls of the tower above the air inlet elevation shall be cased with 8 oz/sq ft corrugated FRP panels attached to tower columns with stainless steel screw shank fasteners and self-sealing washers. Panels shall be installed with corrugations horizontal, and shall be lapped to shed water inward to the tower. Fasteners shall be applied in every casing valley at each column line. Vertical joints shall be lapped and sealed watertight. Casing ends at tower corners shall be covered with 12 oz/sq ft FRP 90° corner rolls.	■ If preferred, change casing weight from 8 oz/sq ft to either 10 oz/sq ft or 12 oz/sq ft. Marley standard casing material has a flame spread rating of 50. If greater fire retardancy is preferred, it would be appropriate to add the following sentence to the end of the paragraph at left: "Casing panels and corner rolls shall have a flame spread rate of 25 or less."
11.0 **Hot Water Distribution System**:	
11.1 Hot water shall be distributed to the fill in each cell via a system of headers, laterals, branch arms, and nozzles, installed in the region above the fill and beneath the drift eliminators. Headers may be either RTR (reinforced thermosetting resin) or PVC. Laterals shall be PVC. Branch arms and nozzles shall be injection-molded polypropylene. The joint between branch arms and nozzles shall be threaded so nozzles can be easily removed for cleaning of the branch arms. Nozzles shall be of the large orifice, low-pressure, down-spray type, having no moving parts or restrictors that will promote clogging.	■ This "side inlet" method of piping the cooling tower requires you to provide a header at the base of the tower, along with separate risers for each cell. Using this method, you may conveniently valve off cells on an individual basis. In cold weather regions, you should also consider running a drain line from the riser to the cold water basin to drain the riser during shutdown in freezing weather. Bypasses, if used, should be designed only after thorough discussion with your Marley sales representative. Water distribution in a cooling tower should be relatively equal throughout. Distribution systems which create uneven water distribution promote reduced tower performance by developing high water concentration areas which block air flow and/or low water concentration areas which create air bypass regions.
11.2 The piping system shall be sized for a flow velocity that will insure relatively equal flow to all areas of the cooling tower fill. Headers shall be equipped with individual 25 psi flanged inlets, drilled to conform to Class 125 and Class 150 ANSI requirements, located approximately 1'-0" outside the tower casing at or near the transverse centerline of each cell. All headers having a diameter of 24" or larger shall be vented to atmosphere by an open standpipe at the downstream end of the header.	



Specifications	Specification Value
12.0 **Cell Partitions**:	
12.1 The tower shall be partitioned such that the fan of each cell can be operated and cycled independently of the remaining cells. Full-width, 8 oz/sq ft FRP panel partitions shall extend from casing to casing across the tower, and from the top of the fill upward to the underneath side of the fan deck floor.	■ Multicell towers must have air plenum partitions between cells. Otherwise, air will be induced downward through an inoperative fan, bypassing the fill of the operating cell. Without these partitions, part-load or off-season operation of the tower would be completely unsatisfactory. Unless complete separation between cells is required for reasons of system operation, partitions in the fill area of film-filled counterflow towers serve no useful purpose. There is no tendency for distributed water to wander excessively beyond the limits of the tower cell. Without these wind walls, the area surrounding counterflow towers would quickly become unsightly—or in wintertime, potentially dangerous. Also, if the fire-related options defined on page 26 are exercised, it would be appropriate to add the following sentence to the end of paragraph 12.2: "All FRP panels shall have a flame spread rate of 25 or less."
12.2 A full-length, 8 oz/sq ft FRP panel partition shall extend from endwall to endwall along the approximate centerline of the tower, rising from the normal operating water level to the underneath side of the fill. If endwalls are open for air entry, wind walls shall extend inward at an approximate 45° angle from the corner columns of the end cells to meet the longitudinal partition. The purpose of this partition system will be to prevent falling water from being blown out the leeward face of the tower.	
13.0 **Access and Safety**:	
13.1 The tower shall be designed and equipped to provide comfortable, safe access to all components requiring routine inspection and maintenance.	■ The rigors of normal industrial cooling tower operation require that all vital areas of the tower be readily, easily, and safely accessed. Be extremely wary of those manufacturers who suggest that one of your access requirements is not really necessary. Their suggestion may be evidence that such access in their design is difficult—and may very well become a focus of significant cost to you in the future. The access doors on other towers may be unreasonably small. Specifying the size of the door will cause those bidders to take exception, alerting you to a potential maintenance headache. Stairways are also available at both ends of the tower; and enclosed for snow and ice protection. See page 20. If preferred for stairway, change "Douglas fir" to "California redwood". See page 22. Several additional access and safety related options are offered on pages 19 thru 21.
13.2 The fan deck of the tower shall be surrounded by a sturdy treated Douglas fir 2" x 4" (nominal) guardrail, complete with kneerail and toeboard, conforming to OSHA standards. The guardrail shall be 42" high and shall be through-bolted to columns on 6'-0" centers both longitudinally and transversely.	
13.3 Each cell shall have a 30" square lift-off access hatch in the fan deck floor, and a ladder leading down to a 3'-0" x 6'-0" landing at the drift eliminator level. A removal section through the eliminators lifts out for access into the spray chamber for nozzle cleaning and inspection.	

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13.4 One endwall of the tower shall be equipped with a treated Douglas fir stairway rising from the level of the cold water basin curb to the fan deck. Stairs shall be 45°, 36" wide, with 8" rise and run. Landings shall occur at 6' elevations. Guardrails and kneerails shall be 2" x 4" (nominal). Toeboards shall be 1" x 4" (nominal). Guardrails shall be through-bolted to the stairway posts.

13.5 Fan cylinders shall have removable segments for access to the mechanical equipment components, and shall have a coupling guard, conforming to OSHA standards, to shroud that portion of the driveshaft that extends outside the fan cylinder.

14.0 **Scope of Work**:

14.1 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 a concrete basin and foundation. The concrete basin and foundation shall have been designed and installed by others, based upon certified loads and dimensions provided by the cooling tower manufacturer. Unless otherwise specified, all external piping, risers, valves, pumps, sumps and screens, anchor bolts, controls, electrical wiring, fire protection, lightning protection, and water treatment equipment will be outside the tower manufacturer's scope of work.

Specification Value

- 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
Premium Hardware Options	
Level 1 - Series 300 Stainless Steel:	■ **All of the material changes listed under Level 1 are recommended where chlorides are below 1500 PPM (NaCl) or below 910 PPM (Cl -) but acidity is less than pH 6.5—or in the presence of H_2S.**
6.1 *Change the last sentence to read:* Columns requiring anchorage shall be anchored to the concrete cold water basin by Series 300 stainless steel anchor castings, bent plates, or weldments.	The materials of construction indicated in the base specification are entirely suitable for the "normal" water conditions defined on page 8. If your water quality is typified by the conditions indicated in the description above, all of the changes indicated on this page may be required. However, many of the components mentioned are outside intimate contact with the circulating water stream and, therefore, may not require specification revision. Bolts, nuts and washers, of course, are Series 300 stainless steel as standard.
6.3 *Change the fifth sentence to read:* Diagonals shall be anchored to the cold water basin using FRP diagonal connectors and Series 300 stainless steel anchor castings, bent plates, or weldments.	Also, several other water chemistries can occur that may or may not necessitate changes in materials of construction and/or operating procedures. Prior to finalizing the tower selection and specification, we ask that you provide us with your best analysis of what your circulating water quality and chemistry will be.
9.3 F*or an all stainless steel driveshaft change the third sentence to read:* Couplings shall be cast 304 stainless steel, joined to the driveshaft by flexible neoprene bushings and type 302 stainless steel inserts. Also, add the following sentence at the end of this paragraph: The driveshaft guards shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012"). For a carbon fiber driveshaft with stainless steel couplings, replace entire paragraph 9.3 with the description found on page 19.	The value of the specification revision is, of course, that they help assure you will have achieved maximum longevity from your cooling tower in its anticipated operating environment.
9.6 *Add the following sentence to the end of the paragraph:* Galvanized steel components shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012").	
9.7 *Change the last sentence to read:* The assembly shall be hot dip galvanized after fabrication, and epoxy-coated after galvanizing to a dry film thickness of 12 mils (.012").	

Specifications

Level 2 - Type 316 Stainless Steel

6.1 *Change the last sentence to read:* Columns requiring anchorage shall be anchored to the concrete cold water basin by type 316 stainless steel anchor castings, bent plates, or weldments.

6.3 *Change the fifth sentence to read:* Diagonals shall be anchored to the cold water basin using FRP diagonal connectors and type 316 stainless steel anchor castings, bent plates, or weldments.

6.5 *Change the paragraph to read:* All structural connections and splices shall be through-bolted using full shank 1/2" diameter, or larger, type 316 stainless steel machine bolts, nuts and washers.

7.2 *Change the last sentence to read:* Fan cylinder connection and anchorage hardware shall be type 316 stainless steel.

9.3 *For an all 316 stainless steel driveshaft change the second, third and fourth sentences to read:* Driveshaft tubes and flanges shall be manufactured of type 316 stainless steel. Couplings shall be cast 316 stainless steel, joined to the driveshaft by flexible neoprene bushings and type 316 stainless steel inserts. Connecting hardware shall be 316 stainless steel.

Also, add the following sentence at the end of this paragraph: The driveshaft guards shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012").

For a carbon fiber driveshaft with 316 stainless steel couplings, replace entire paragraph 9.3 with the description found on page 19.

9.6 *Add the following sentence at the end of this paragraph:* Galvanized steel components shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012").

9.7 *Change the last sentence to read:* The assembly shall be hot dip galvanized after fabrication, and epoxy-coated after galvanizing to a dry film thickness of 12 mils (.012").

Specification Value

■ **All of the material changes listed under Level 2 are recommended where chlorides are between 1500 PPM and 4000 PPM (NaCl) or between 910 PPM and 2425 PPM (Cl -).**

The materials of construction indicated in the base specification are entirely suitable for the "normal" water conditions defined on page 8. If your water quality is typified by the conditions indicated in the description bottom of page 16, all of the changes indicated on this page may be required. However, many of the components mentioned are outside intimate contact with the circulating water stream and, therefore, may not require specification revision.

Also, several other water chemistries can occur that may or may not necessitate changes in materials of construction and/or operating procedures. Prior to finalizing the tower selection and specification, we ask that you provide us with your best analysis of what your circulating water quality and chemistry will be.

The value of the specification revision is, of course, that they help assure you will have achieved maximum longevity from your cooling tower in its anticipated operating environment.

Specifications

Level 3 - Silicone Bronze

6.1 *Change the last sentence to read:* Columns requiring anchorage shall be anchored to the concrete cold water basin by heavy gauge silicon bronze anchor clips.

6.3 *Change the fifth sentence to read:* Diagonals shall be anchored to the cold water basin using FRP diagonal connectors and heavy gauge silicon bronze anchor clips.

6.5 *Change the paragraph to read:* All structural connections and splices shall be through-bolted using full shank ½" diameter, or larger, silicon bronze machine bolts, nuts and washers. Exposed bolt heads, threads and nuts shall be covered with plastic cups to prevent water impact erosion.

7.2 *Change the last sentence to read:* Fan cylinder connection and anchorage hardware shall be 316 stainless steel.

9.3 *For an all 316 stainless steel driveshaft change the second, third and fourth sentences to read:* Driveshaft tubes and flanges shall be manufactured of type 316 stainless steel. Couplings shall be cast 316 stainless steel, joined to the driveshaft by flexible neoprene bushings and type 316 stainless steel inserts. Connecting hardware shall be 316 stainless steel.

Also, add the following sentence at the end of paragraph 9.3: The driveshaft guards shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012").
For a carbon fiber driveshaft with 316 stainless steel couplings, replace the entire paragraph 9.3 with the description found on page 19.

9.6 *Add the following sentence at the end of the paragraph:* Galvanized steel components shall be epoxy coated after galvanizing to a dry film thickness of 12 mils (.012").

Specification Value

■ **All of the material changes listed under Level 3 are recommended where chlorides are above 4000 PPM (NaCl) or above 2425 PPM (Cl -) and where neither H_2S nor ammonia are present.**

The materials of construction indicated in the base specification are entirely suitable for the "normal" water conditions defined on page 8. If your water quality is typified by the conditions indicated on page 17, all of the changes indicated on this page may be required. However, many of the components mentioned are outside intimate contact with the circulating water stream and, therefore, may not require specification revision.

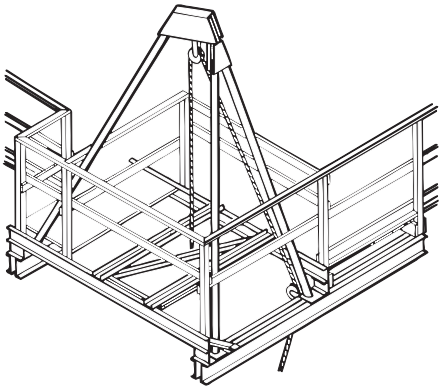
Also, several other water chemistries can occur that may or may not necessitate changes in materials of construction and/or operating procedures. Prior to finalizing the tower selection and specification, we ask that you provide us with your best analysis of what your circulating water quality and chemistry will be.

The value of the specification revision is, of course, that they help assure you will have achieved maximum longevity from your cooling tower in its anticipated operating environment.

Silicon bronze, while very resistant to corrosion in a chloride environment, is subject to erosion in high-flow areas. Therefore, plastic cups, designed for this service, are used to prevent direct water impingement on the hardware.

Specifications	Specification Value
9.7 *Change the last sentence to read:* The assembly shall be hot-dip galvanized after fabrication, and epoxy-coated after galvanizing to a dry film thickness of 12 mils (.012")	
Driveshaft Material Options	
All Stainless Steel Driveshaft:	
9.3 *Replace the third sentence with the following:* Couplings shall be cast 316 stainless, joined to the driveshaft by flexible neoprene bushings and type 302 stainless steel inserts.	■ Normal HDG cast iron couplings may form blush rust over time. Where that is unwanted, or where abnormally high corrosion levels are anticipated, specify this all stainless steel driveshaft.
Carbon Fiber Driveshaft / Type 316 Stainless Steel Couplings:	
9.3 *Replace this paragraph as follows:* Motors shall be located outside the fan cylinders and shall be connected to the speed reducers by tubular, extended, full floating, non-lubricated driveshafts. Driveshaft tubes shall be carbon fiber/glass/epoxy composite. Flanges shall be manufactured of type 304 stainless steel, attached to the tube by type 316 stainless steel compression rings. Couplings shall be cast 316 stainless, joined to the driveshaft by flexible neoprene bushings and type 316 stainless steel inserts. Connecting hardware shall be 316 stainless steel. Driveshaft assemblies shall be dynamically balanced at the factory at full motor speed. Two TE/HDG driveshaft guards anchored to the mechanical equipment support shall surround the driveshaft for containment in the event of failure.	■ Carbon fiber driveshafts are preferred by many customers on the strength of their ability to remain dimensionally unaffected by long stationary periods in direct sunlight. Steel driveshafts may go through temporary imbalance in those circumstances. Use where chloride levels in the circulating water and drift may exceed 1500 ppm, as NaCl. 
Access and Maintenance Options	
Fan Cylinder View Port:	
7.2 *Add the following to the end of this paragraph:* Each fan cylinder shall include a 6" diameter, screened view port with a removable acrylic window.	■ Allows online viewing of fan operation.

Specifications	Specification Value
Fiberglass Ladder: 13.4 *Change the next to last sentence to read:* A fiberglass ladder and safety cage designed per OSHA recommendations shall be provided at the other end of the tower. Ladder shall rise from the level of the cold water basin curb to the fan deck.	■ These are sometimes referred to as "escape" ladders. They are a ready means of egress in case of emergency. They are recommended equipment for towers exceeding 200'-0" in length. If you want this ladder on your tower, regardless of length, please make the change indicated at left.
Steel Ladder: 13.4 *Add the following sentences to this paragraph:* A hot dip galvanized vertical steel ladder with safety cage per OSHA recommendations shall be provided at the other end of the tower. Ladder shall rise from the level of the cold water basin curb to the fan deck.	
Second Stairway at End of Tower: 13.4 *Change the first sentence to read as follows:* Both endwalls of the tower shall be equipped with treated Douglas fir stairways rising from the level of the cold water basin curb to the fan deck.	■ On long towers, a second stairway is a very desirable option for your maintenance people.
Fiberglass Stairway: 13.4 *Change this paragraph to read:* One endwall of the tower shall be equipped with a structural fiberglass stairway rising from the level of the cold water basin curb to the fan deck. Stairs shall be 41.5°, 30" wide, with 8" rise and 9" run. Treads shall have a nonskid surface. Landings shall occur at 6'-0 elevations. Stair rails shall be 2" x 2" FRP, through-bolted to 3" x 3" FRP stairway posts. All stairway bolts and fasteners shall be series 300 stainless steel.	
Enclosed Stairway: 13.4 *Add the following to this paragraph:* The stairway shall be enclosed with tower casing material to keep out snow and sleet. Roof support headroom shall be 7'-0" above top stairway landing. Latched doors shall be provided at the entrance and exit of the stairway. The door at the fan deck elevation shall open inward to prevent snow and ice buildup from rendering the door inoperable. Stairway side casings shall be translucent for visibility.	■ As the specification wording implies, the enclosed stairway is of great benefit in those geographic regions where heavy snowfalls are the norm.

Specifications	Specification Value
Mechanical Equipment Temporary Access Catwalk:	
13.5 *Add the following sentence to this paragraph:* Provide a 24" wide portable expanded aluminum catwalk, complete with guardrail, kneerail, and toeboard that will extend from the fan cylinder accessway to the fan hub/gear reducer/ driveshaft region.	■ This catwalk spans girt lines and provides short-term access to the mechanical equipment. It precludes the need to provide temporary planking.
Mechanical Equipment Permanent Access Catwalk:	
13.5 *Add the following to this paragraph:* Each cell shall be equipped with a 24" wide, permanently-installed walkway extending from the fan cylinder accessway to a work platform at the fan hub/ gear reducer/ driveshaft region. Catwalk and work platform shall be FRP, and shall be equipped with guardrails, kneerails and toeboards.	■ This system avoids the need to install the temporary catwalk every time you need to perform major maintenance. It also provides a substantial work platform, without which you will have to put down temporary decking. Please check with your Marley sales representative to determine what, if any, effect this permanent fixture in the tower airstream will have on tower performance or operating horsepower.
Endwall Derrick:	
13.5 *Add the following after this paragraph:* A permanent galvanized steel derrick shall be provided at the end of the fan deck to facilitate movement of equipment between the fan deck level and grade. The derrick shall be of a capacity sufficient to handle the motors or the gear reducers. Power, hoist, rigging, and cables will be provided by the Owner.	■ Normally, the fan deck level at the end of the tower is readily accessible by a small crane or "cherry picker", making the derrick unnecessary. 
Miscellaneous Options	
Clog-Resistant Fill:	
8.1 *Change the paragraph to read as follows:* Fill shall be honeycomb film-type, thermoformed PVC, manufactured of 15 mil or heavier stock. Fill shall be assembled into sturdy packs, the height of which is the height of the total fill requirement. Multiple layers of smaller fill packs will not be allowed. Fill shall be clog-resistant, having generously-sized, vertically-aligned cells. Fill shall be supported as required to accommodate construction loads and operational loads, as well as ice loads in freezing climates.	■ It is particularly important for clog-resistant fill sheets to be one-piece, full-height. The whole purpose of clog-resistant fill is to maximize flow passages for water that may be laden with debris, scale, fat globules, and the like. Multiple layers of fill packs reduce these flow passages by as much as 50%, making fill clogging a high probability. Also, please understand that clog-resistant fill provides less heat transfer surface than close-spaced fill, so a somewhat larger cooling tower model than anticipated may be required. Please determine the appropriate model selection in conjunction with your Marley sales representative.

Specifications	Specification Value
Redwood Fan Deck:	
7.1 *Change the second sentence to read:* It shall be fabricated of no less than 2" nominal thickness, tongue & groove, treated California redwood, supported by fan deck girts and joists on 2'-0" centers.	■ Although the redwood option for fan deck is available, "dimension" lumber in that application, subject to the alternate wetting and drying that occurs in a cooling tower, ultimately is likely to warp, split, and crack. For that reason, SPX suggests that the standard specification wording found in para. 7.1 is the better choice.
Redwood Stairway and Guardrail:	■ Redwood is somewhat less likely to produce splinters than is Douglas Fir.
13.2 *Change:* Douglas fir to California redwood.	
13.4 *Change:* Douglas fir to California redwood.	
Redwood Tower:	■ The requirement for redwood is usually limited to the framework, stairways and guardrails, with treated plywood remaining the preferred material for decking and flooring for the reasons indicated on the previous pages.
3.1 *Replace the paragraph with the following:* Except where otherwise specified, all lumber used in the tower shall be pressure treated structural grade California redwood per the Redwood Inspection Services Standard Specifications for Grades of California Redwood. The structural framework of the tower, as well as all lumber grades and application, shall be in accordance with CTI STD-103. Boxed heart lumber, as defined in section 6.1 of CTI STD-103, will not be allowed, and appearance grade lumber shall not be used for tower structural members.	
Watertight Cell Partitions:	■ Although the standard cell partitions described in paragraph 12.1 prevent performance-degrading air bypass, they do not stop the casual passage of water between cells. If it is important that inoperative cells remain dry, or if individual cells serve different processes, then your specifications should include this paragraph. With minor modifications, this paragraph can also be made to describe the need for watertight partitions only between certain specific cells—which is a more probable situation than the need for all partitions to be watertight.
12.1 *Change this paragraph to read:* The tower shall be partitioned such that each cell can be operated independently of the remaining cells. Full-width, full-height, watertight, 3⁄4" plywood partitions with horizontal grooved and splined edges shall extend from casing to casing across the tower, and from the basin water level upward to the underneath side of the fan deck.	
Anti-Splashout Casing:	■ Appropriate for windy areas. Standard on towers with greater tan 7'-9" air inlet elevations.
10.1 *Add the following sentence to the end of this paragraph:* To reduce windage losses at the tower corners, the endwall casings shall extend around the corners of the tower to cover the beginning 3' x 0" of the air inlet opening.	

Specifications	Specification Value
Louvers:	
10.2 *Add the following paragraph in the Casing section:* One or more levels of louvers shall be provided in the tower's air intake openings to return windage-lost water to the confines of the basin. Louvers shall be 1" thick, 36" wide, 7 ply, exterior grade, treated plywood. Louvers shall be supported by 2" x 4" (nominal) louver arms bolted to the tower perimeter columns, and tied at the top with molded polypropylene support bars. Air intake openings less than 9'-0" high shall have one level of louvers. Openings of 9'-0" to 15'-0" shall have two levels, and openings larger than 15'-0" shall require three levels of louvers.	■ Appropriate for windy areas, **but not for regions where freezing will occur**. Unlike crossflow towers, counterflow towers are incapable of louver deicing. If icing in the region of the tower is expected to be a concern, SPX recommends the use of a film-filled crossflow tower as defined in SPEC MM. Please obtain a copy from your Marley sales representative. If louvers are specified, the anti-splashout casing would not be required.
Structural Fiberglass Fan Deck:	
7.1 *Replace this paragraph with:* The fan deck shall act as a working platform for maintenance personnel. It shall be pultruded fiberglass with a top surface at least 0.18" thick and shall have a slip-resistant surface. Fan deck panels shall be supported by framing girts and shall interlock along the lengths of the panels to prevent differential deflections between panels. To minimize turbulence of airflow into the fan cylinder, fan deck protrusions into the fan cylinder opening shall not exceed 1".	■ Cooling tower fan decks get maximum exposure to weather and maintenance traffic, and are among the first components of older towers to require replacement. This FRP fan deck precludes that need. If a fire-retardant fan deck is desired, please insert the words "having a flame spread rate of 25 or less," after "FRP".
Control Options	
Control System:	
9.8 *Add the following paragraph in the Mechanical Equipment section:* Each cell of the cooling tower shall be equipped with a UL listed control system 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 fused disconnect with an external operating handle, lockable in the off position for safety. Across-the-line magnetic starters or solid state soft-start starters as required 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	■ If it is your opinion that the control system for the cooling tower should 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 tower's operation–and to apply a system most compatible with it–than the designer and manufacturer of the cooling tower?

Specifications	Specification Value
wired for 120VAC control. Control circuit to be wired out to terminal blocks for field connection to a remote vibration switch and for access to extra 120VAC 50VA control power, 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 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.	
Vibration Limit Switch:	
9.8 *Add the following paragraph in 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, a Marley V6 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.
Variable Speed Drive:	
9.8 *Add the following paragraphs in the Mechanical Equipment section:* 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 and integrated by-pass design. The panel shall include a main disconnect with short circuit protection and external operating handle, lockable in the off position for safety. The system shall include a solid state, PID temperature controller to adjust frequency output of the drive in response to the tower cold water temperature. The temperature of	■ Marley VFD 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 fast payback. Indeed, many utilities offer generous rebates for users having installed VFD drives.

Specifications	Specification Value
the cold water and set point shall be displayed on the door of the control panel. The by-pass circuit shall include a complete magnetic bypass that isolates the VFD when in the bypass mode. Transfer to the bypass mode shall be automatic in the event of VFD failure or for trip faults. The bypass contactor shall be cycled on and off while operating in bypass, to maintain the set-point temperature of the cold water. The drive design shall be operated as a stand- alone system or controlled with a building automation system. The BAS can be the normal source of control and the integrated temperature controller may be used as a backup to the building automation 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 selector switch internal to the panel allowing the cooling tower fan motor to be run at full speed shall be furnished. To prevent heating problems in the cooling tower fan motor and to assure proper gear reducer lubrication the VFD system shall cycle the motor on/off when the minimum allowable motor speed is reached. The cooling tower manufacturer shall supply VFD start-up and tower vibration testing to identify and lock out any vibration levels which may exceed CTI guidelines.	
Low Oil Switch: 9.8 *Add the following paragraph in the Mechanical Equipment Section:* A solid state, capacitance-actuated, CSA approved low oil level switch shall be provided and installed outside the fan cylinder for wiring into the owner's control panel.	■ This can be wired into a control or monitoring system.

Specifications	Specification Value
Fire Safety Options	
Firewalls Between Cells:	
12.1 *Change this paragraph to read as follows:* Per NFPA 214, a 20-minute fire wall shall be provided between cells, consisting of 1/2" thick, 5 ply, exterior grade plywood installed on both sides of the column line between cells. These partitions shall extend from casing to casing across the tower, and from the basin water level upward to the underneath side of the fan deck.	■ **Occasionally, critical processes or local codes may require you to install a fire-protection sprinkler system on a wood tower—or pay higher insurance premiums—or both. An alternative that could be acceptable to your insurance carrier, and which you may wish to evaluate, would be to make your Class W400 tower as fire-resistant as possible. This can be done by any or all of the listed changes:** Firewalls retard the rapid spread of fire from one cooling tower cell to another. Their presence can reduce the scope (and price) of any fire protection system considered necessary by your insurance carrier. They also usually have a positive impact on your insurance premiums. Where necessary, thicker plywood will produce a firewall of longer duration. Discuss what is appropriate for your situation with your Marley sales representative.
Fireproof Fan Deck Overlay:	
7.1 *Add the following to the end of this paragrah:* The fan deck shall be covered with ____ thick, flat, fireproof fiber reinforced cement board, installed over a 6 mil thick polyethylene vapor barrier.	■ Specify your choice of either ¼" thick, ⅜" thick, or ½" thick overlay. All three thicknesses are considered of equal value regarding fire retardance.
Fire-Retardant Fan Cylinders:	
7.2 *Change the first sentence to read as follows:* Fan cylinders shall be molded FRP having a flame spread rate of 25 or less, no less than 6'-0" high, with eased inlets to promote smooth airflow at blade tips.	■ Fire-retardant fan cylinders have a flame spread rate of 25 or less. "Flame spread rate" 0 = Fireproof 100 = the flammability of wood.

W400 class

SPECIFICATIONS

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