

# Sigma steel

CROSSFLOW COOLING TOWER

MARLEY®



## THE MARLEY DIFFERENCE

You'll enjoy single source responsibility and reliability because SPX Cooling Technologies designs and manufactures virtually all major cooling tower components.

All Marley components are designed and selected to be part of an integrated system. For example, the spray pattern from nozzles and the pressure drop through drift eliminators both affect a fill's heat transfer capacity. So, we include that impact in our thermal analysis.

Drift eliminators must be effective at the air velocities where fill is most efficient. So, we've carefully designed both components to work together efficiently.

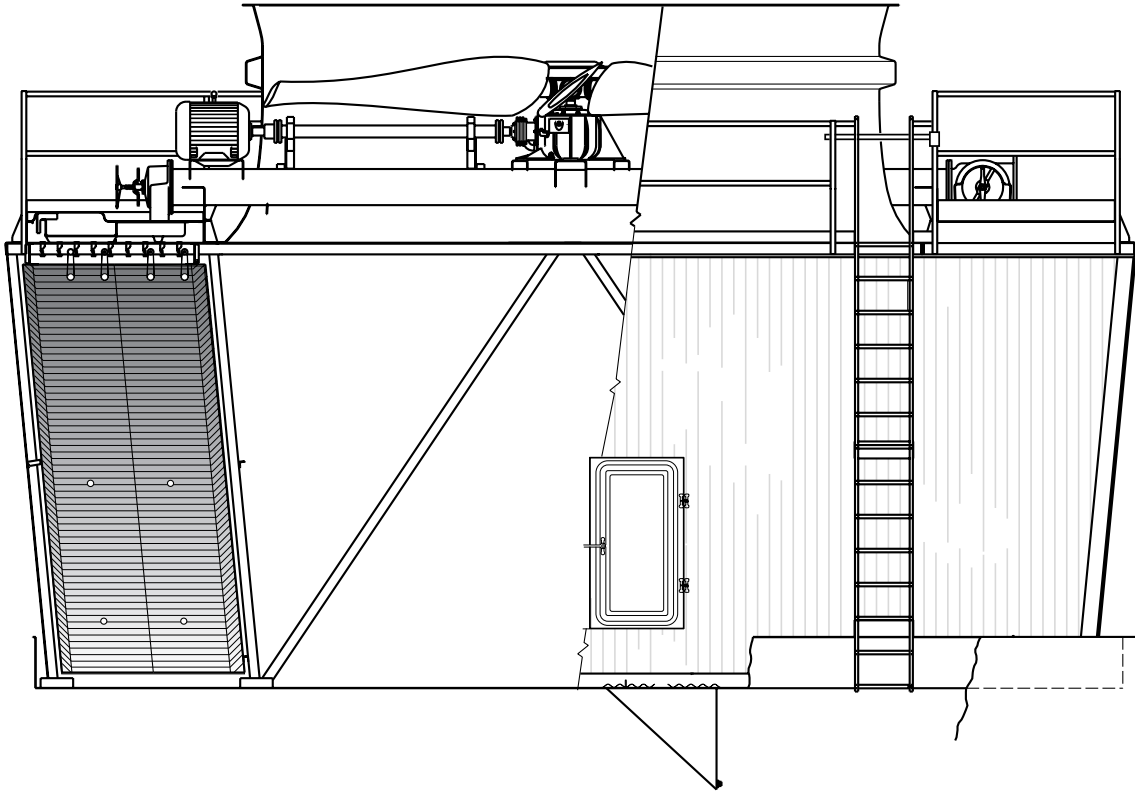
How many other cooling tower companies can offer you this assurance? They may use Brand A nozzles with Brand B fill and Brand C drift eliminators. When they all come together, the whole may be less than the sum of the parts.

Our total system approach assures that all the parts work together to provide you the greatest total performance.

And because we design specifically for cooling towers, all our components will provide many years of service with minimal maintenance.



## THE SIGMA ADVANTAGE



- **Guaranteed Performance.** Don't rely on outside agencies with limited enforcement powers. We'll stand by our responsibility for reliable thermal performance. We designed it. We rate it. We guarantee it.
- **Exclusive 5-Year Mechanical Equipment Warranty.** Your no-cost assurance of trouble-free mechanical operation for 5 years. Isn't that where a lot of your tower maintenance dollars have gone in the past?
- **Long Service Life.** We've carefully chosen all the materials used in Sigma Steel towers for their corrosion resistance and suitability for cooling tower service. Heavy gage steel hot dip galvanized after fabrication, stainless steel, PVC and fiberglass keep your Sigma Steel tower working year after year.
- **Efficient Field Assembly.** Precise factory fabrication assures that every component in your Sigma Steel tower will fit as designed. SPX Cooling Technologies offers an unparalleled nationwide construction organization to build your tower quickly and economically.
- **Low Operating Costs.** Marley high-efficiency fill and fans, gravity-flow water distribution, and efficient Geareducer<sup>®</sup> drive work together to offer maximum cooling with minimum power use.
- **Low Maintenance Costs.** Induced-draft propeller fans on Marley rightangle Geareducer units, TEFC 1.0 or 1.15 service factor motors and heavy-duty mechanical equipment support assure long service life with minimal maintenance.
- **All-Season Reliability.** Sigma Steel towers perform as specified in the heat of summer. They respond well to energy management techniques in spring and fall. They operate virtually ice-free in the dead of winter. And they offer simple maintenance all year long. **We guarantee it.**
- **Single Source Parts Availability.** SPX designs, manufactures, guarantees, and stocks all major components of the tower except motors. We'll have the parts if you ever need them.

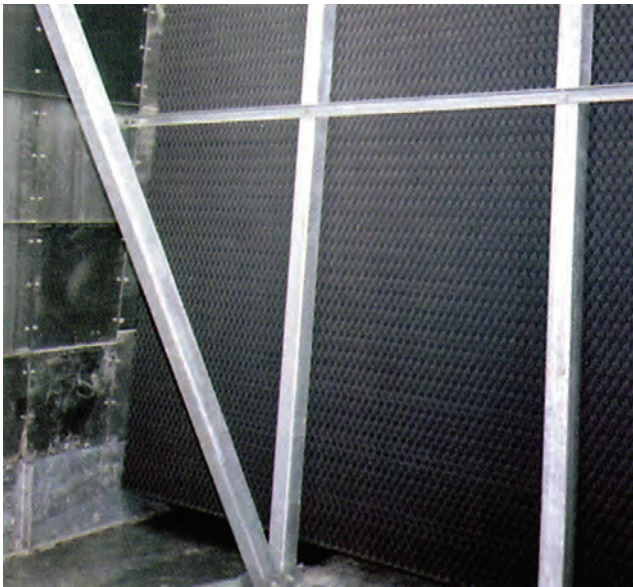


## CONSTRUCTION AND COMPONENTS

### Fill, Louvers, and Drift Eliminators

Marley high-performance film fill is the heart of every Sigma Steel tower. A repeating chevron pattern provides the wetted surface and air turbulence necessary for proper heat transfer while minimizing resistance to airflow so you'll save on fan power. Molded protrusions on each fill sheet assure uniform spacing.

Fill sheets are thermoformed from 15 mil (.015") thick PVC (polyvinyl chloride) stock capable of service at hot water temperatures up to 125°F. Four stainless steel structural tubes resting in stainless steel hangers support the fill while PVC tubes control alignment at mid-height and at the bottom of the fill. This system also holds the bottom of the fill sheets above the cold water basin floor to simplify basin cleaning.



Fill sheets include both louvers and drift eliminators. The louvers in this patented arrangement keep water on the fill sheets and in your tower, and also assure proper heat transfer throughout wide variations in airflow. Users find this fill operates ice-free even in extremely cold weather.

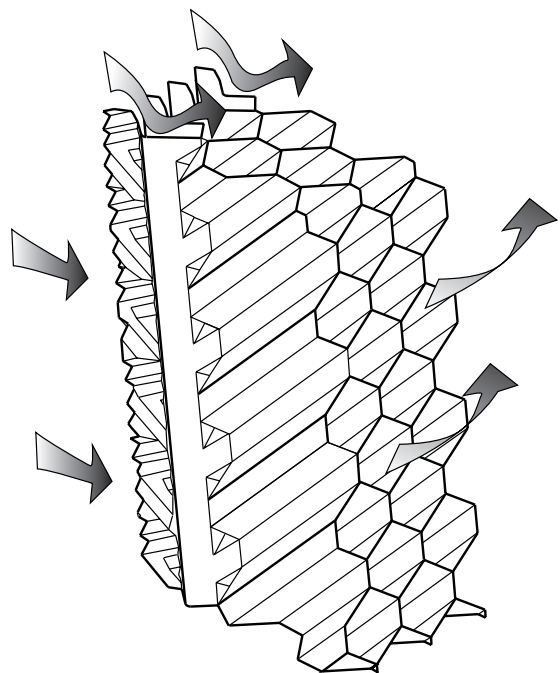
Integral drift eliminators prevent the costly nuisance of drift spotting on objects in the surrounding environment. Their unique shape induces the air flow through three distinct direction changes as illustrated at right. The final turn directs air toward the fan to save you fan horsepower. Moisture carried in the air stream can't make these abrupt turns, so drift is 0.010% or less of the circulating water flow rate.

### Mechanical Equipment

You'll receive a 5-year warranty against failure of any mechanical component in the fan drive system (except the motor, which is warranted by its manufacturer).



The Marley Geareducer speed reducer used in the Sigma line contributes a long record of dependability, long service life, and low maintenance to this assurance of reliability. Their designs meet or exceed the requirements of CTI STD-111 and AGMA Std. 420.04. Every Geareducer unit is run-in under load prior to shipment to make sure that it will operate properly on your tower.



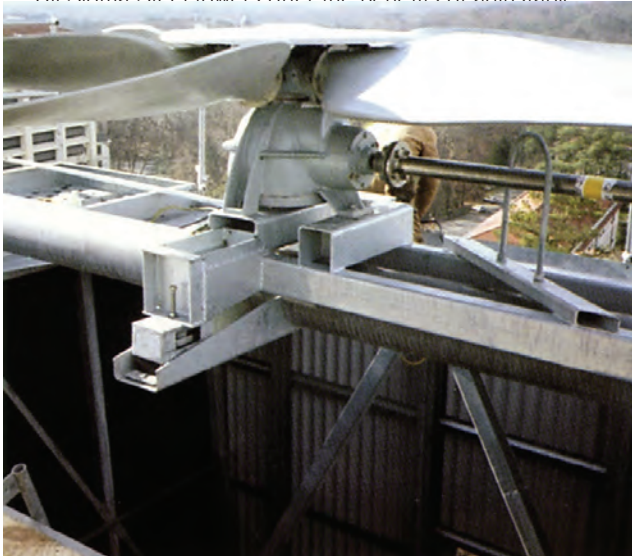
Housings are gray cast iron. Gears are high-strength, case hardened alloy steel. And all bearings are tapered roller bearings. A variety of available horsepower capacities and reduction ratios lets us choose the optimum Geareducer model and fan speed for your job. Service factors are always 2.0 or greater as applied.

Splash-type lubrication and integral cooling fins preclude the need for maintenance-intensive oil pumps and coolers. A constant oil bath or flow lubricates every bearing in forward or reverse motion—at full or half speed.

All Marley Geareducer assemblies are right-angle type with motors located outside the tower's saturated airstream.

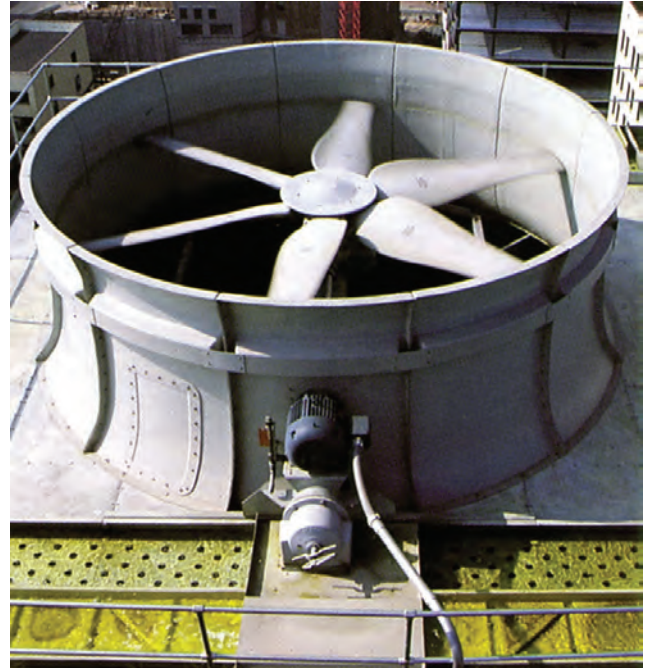
A galvanized steel lube line runs from the Geareducer unit to a standpipe near the motor on each cell, so you can check oil level and change or add oil while standing on the fan deck.

All Sigma Steel towers offer the benefits of adjustable



pitch propeller type Marley fans. The H-3 Series fans normally used on smaller models incorporate cast aluminum blades and machined aluminum hubs. HP-7*i* Series fans, used on larger models, include hollow GRE (glass-reinforced epoxy) blades and epoxy-coated cast iron hubs. Blades on both fan types are adjustable in pitch, so you can take full advantage of rated horsepower or adjust the pitch to compensate for unusual jobsite restrictions. The true airfoil blades, designed specifically for cooling towers, offer efficient, quiet operation and long service life.

Fans operate inside structural FRP (fiber reinforced polyester) eased-inlet fan cylinders designed and applied to maximize fan performance. Standard cylinders are either 6'-0" or 7'-0" tall, depending on fan diameter, so all Sigma Steel towers comply with OSHA standards without need of fan guards.



Marley driveshafts transmit power from the motor to the Geareducer assembly. Standard Marley driveshafts include 304 stainless steel tubes with welded-on stainless steel flanges and bonded neoprene flexible elements to transmit torque. Marley driveshafts are full-floating assemblies with non-lubricated flexible couplings on each end. Their tolerance to misalignment and torsional shock is unequalled in nonspecialized units. All Marley driveshafts are dynamically balanced at the factory to minimize operating vibrations.

Welded unitized hot dip galvanized steel supports maintain alignment throughout the mechanical equipment system. Marley torque-tubes provide superior strength and stability. Their cylindrical shape also keeps operating costs down by minimizing airflow restrictions and by reducing air turbulence in the fan entrance region.

### Water Distribution System

The gravity-flow water distribution system designed into the Sigma tower essentially reduces pump head to its most basic component—static lift—saving you money on pump power. You won't have to force water through internal piping and pressure spray nozzles, as you would in a counterflow tower.



Warm water enters the system through the Sigma galvanized crossover pipe. Inlet connections for your piping conform to standard 125# flanges. Marley flow-control valves balance the flow to both distribution basins of each cell. Water flows from the valves into covered FRP stilling chambers, through a longitudinal FRP flume and then into the hot dip galvanized steel distribution basin.



Polypropylene "Spiral Target" nozzles in the basin floor then distribute the water uniformly over the fill.

All materials in the water distribution system offer long life and minimal maintenance. Valves consist of cast iron bodies and grease-lubricated stainless steel operating stems. Basins are hot dip galvanized after fabrication in accordance with ASTM A123, which requires average zinc thickness of 2.55 mils. Polypropylene nozzles and FRP flumes are chemically and biologically inert.



## Structure and Materials

Sigma Steel tower design conforms to the latest edition of the design standards of ASCE (American Society of Civil Engineers). Wind load criterion is normally 30 pounds per square foot of projected area and the design meets 5%g seismic loading. Materials selections are based on a maximum water temperature of 125°F.

The Sigma Steel structure is a system of mill shape angles, cold-formed channels, and cold-formed angles. All structural members are hot dip galvanized after fabrication in accordance with ASTM A123. Average zinc thickness on structural members varies from 2.55 mils to 3.9 mils, depending on the steel plate thickness as defined in ASTM A123.

Galvanizing after fabrication assures you that the steel in your tower is entirely protected from the effects of corrosion, even on the ends and through bolt holes. You'll enjoy long, reliable corrosion resistance in most operating environments. For even greater protection, you can choose from several stainless steel options, described on page 11.



Columns in all Sigma Steel towers are cold-formed channels located on 4'-0" longitudinal centers. All columns are anchored to the basin.

Transverse channel diagonals carry lateral loads to heavy-duty hot dip galvanized steel anchor plates. Mill shape angles provide longitudinal bracing.

All structural framing connections use 1/2" or 5/8" diameter hot dip galvanized machine bolts.

The fan deck is hot dip galvanized steel designed for a uniform live load of 60 psf.

### Access and Safety

The Sigma Steel tower is designed to meet all OSHA requirements. A 3'-6" high galvanized guardrail system complete with top rails, intermediate rails and toeboards, surrounds the entire top perimeter of the tower.



Aluminum ladders attached to the tower endwalls provide access to the fan deck level. Ladders begin at the cold water basin level and end at the top of the guardrail system. Each tower normally includes two ladders (one at each endwall).

Hinged doors through the endwall casing at each end of the tower plus accessways through any and all partition walls permit access to the interior of the tower at the basin level.

All mechanical equipment is accessible both from the interior of the tower and through the fan cylinder.

Every component of every tower is removable and replaceable.

### Casing

Tower endwalls are cased with gray 8 oz/sq ft corrugated FRP sheets. Water and corrosion-proof, FRP is immune to biological deterioration and requires no maintenance.

Corrugations run vertically. All vertical joints between sheets are overlapped one corrugation and are sealed. Casing attaches to the structural members with stainless steel fasteners and neoprene bonded washers. Corner trim pieces are 12 oz/sq ft molded FRP.

### Cold Water Basin

Most Sigma Steel owners install their towers over concrete cold water basins provided by others. However, you can choose a Marley steel collection basin with side outlet sump as an option. See page 10.

Consult your Marley sales representative for detailed dimensional drawings and load schedules to help you with your basin design.



## AVAILABLE OPTIONS

Accessory	Description and Remarks
HDG Steel Cold Water Basin	Hot dip galvanized steel collection basin with side-outlet sump for towers located above grade. See page 10.
Stainless Steel Cold Water Basin	For corrosive environments or where dictated by experience or personal preference. See pages 10 and 11.
Bottom Outlet Sump	Square-plan galvanized steel sump with bottom outlet. Outlet connection hole and bolt circle conform to 125# ASME pipe connection. Includes a plugged drain connection in sump bottom.
Collection Basin Clean-Out Box	Square-plan galvanized steel box with 3" or 4" diameter bottom outlet flange connection facilitates basin cleaning.
Steel Casing	G-235 mill-galvanized steel sheets are installed with interlocking flanges at all horizontal joints.
Stainless Steel Construction	Choose from several options, providing different degrees of protection against corrosion. See page 11.
Cell Partitions	Basin partitions between fan cells for specific operating considerations. See page 9.
Steel Hot Water Basin Covers	Removable, G-235 galvanized steel covers keep upper basins free of leaves and debris. They also tend to retard growth of algae by keeping ultraviolet radiation away from the warm water in the basins. Covers may be used as a walking surface for tower maintenance.
Air Inlet Screens	Galvanized wire mesh screens over the air inlets keep leaves and trash out of the tower. Easily removable. Includes galvanized steel U-edge frames. Stainless steel screens and frames are also available.
Vibration Limit Switches	Marley M-5 single-pole, double-throw vibration switches in NEMA 4 housing. Double-pole, double-throw models are also available.

Accessory	Description and Remarks
Steel Stairway	Hot dip galvanized steel 45° stairway located at tower endwall provides access to the fan deck. Choose a stairway in place of one endwall ladder, or use both ladders as well as the stairway. Handrails and kneerails are standard, so design conforms to OSHA standards.
Steel Ladder	Galvanized steel ladder conforms to OSHA standards. May be in place of or in addition to standard aluminum ladders.
Ladder Safety Cage	Galvanized steel circular framework bolts to ladder siderails and conforms to OSHA standards. Cages extend from the top of the guardrail to about 7'-0" above the base of the ladder. If the tower fan deck is more than 20'-0" above roof or grade, OSHA requires safety cages.
Plenum Walkway	Hot dip galvanized steel plenum walkways extend the full length of the tower from access door to access door above the water line. Guardrails are optional. However, OSHA requires guardrails if the walkway is 4'-0" or more above the basin floor.
Ladder Extensions	Used when tower is elevated appreciably above access level. Extensions attach to the normal ladder and may require base anchorage (depending on length).
Non-Skid Fan Deck Covering	Non-slip strips overlayed on walking areas provide extra security for operating and maintenance personnel.
Fan Cylinder Extensions	Optional flared fan cylinder extensions improve fan efficiency to reduce your operating costs. Extensions increase cylinder height to 10'-0". Not available for 120" fan diameters.
Geareducer Oil Level Gauge	A brass-fitted oil level sight glass takes the place of the dip stick on the external oil fill and drain system. Permits easy reading of oil level and also lets you change oil through the lube line.



## AVAILABLE OPTIONS



Ladder with Safety Cage

### Cell Partition Options

Every Sigma Steel tower includes plenum chamber partitions, fill area partitions and hot water distribution basin partitions between adjacent cells. Plenum partitions ensure consistent thermal performance as you shut off one fan at a time. They keep air from entering an operating cell through an adjacent idle fan, an effect that reduces thermal performance. Collection basin partitions let you inspect and clean individual basins while the rest of the tower continues to operate.



Steel Casing



Oil-Level Sight Glass

Complete watertight partitions provide total cell isolation. These partitions let you use adjacent cells to serve separate loads with incompatible system temperatures. Watertight partitions extend from louver-face to louver-face and cover the full internal height of the tower, including the cold water basin. Partitions usually consist of G-235 galvanized steel, sealed to cold water basin partitions made from the same material as the basin sides. For concrete basin partitions, Marley drawings specify the appropriate design dimensions.

Partitions in Marley steel collection basins include bolt-on steel weir plates to let you mix or segregate the water in the basin to meet your operating needs.

## SPECIAL COMPONENT OPTIONS

### Cold Water Collection Basins

If you plan to locate your tower above grade, a Marley steel cold water collection basin, in either galvanized or stainless steel construction, complete with the necessary operating accessories is available as an option.

Galvanized basins are hot dip galvanized after fabrication and assembled using field bolted and sealed joints between adjacent sheets. Stainless steel basins may be either field bolted or field welded, depending on your preference, but can only be specified with an all stainless steel Sigma tower to eliminate the potential for galvanic corrosion between galvanized and stainless steel.

Every standard basin includes at least one depressed, side-outlet sump. The number and size of sumps depend on the circulating water rate and the overall size of the tower. Unless otherwise specified, sumps include a drain and a stainless steel or hot dip galvanized debris screen. You may choose either galvanized or stainless steel construction.

Each basin includes at least one overflow/cleanout connection consisting of a full coupling and standpipe. The normally-installed standpipe ensures adequate freeboard in the cold water basin and removes easily for flush-out basin cleaning.

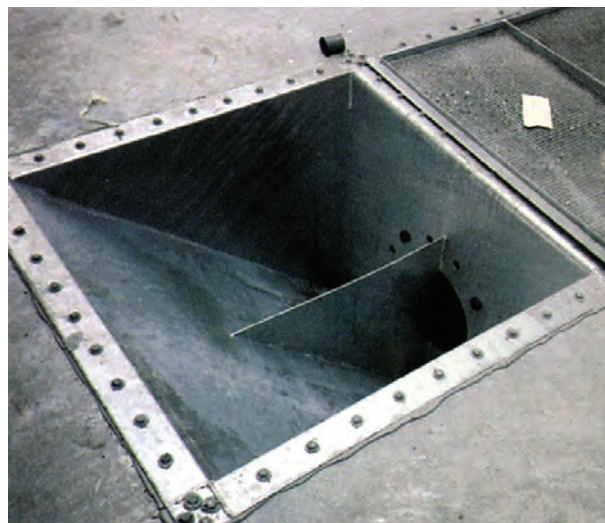
A float-operated, mechanical make-up valve provided with each basin automatically replenishes water lost from the system. The valve is located in the plenum chamber between fill banks, just inside the endwall access door to facilitate adjustment and maintenance.

### Non-Standard Motors

Although you can buy your Sigma Steel tower “less motor” at a cost reduction, it is not normally recommended. Motors supplied on Marley towers meet rigorous specifications developed from environmental chamber tests at our Development Center. These specifications represent prudent minimum design requirements.

Unless otherwise specified, motors provided on Marley cooling towers are TEFC, 1.0 or 1.15 service factor (appropriate to the applied load), 1800 RPM. Other enclosures (such as Explosion Proof) and motors specially wound for non-standard voltages are available at extra cost.

Two-speed motors and motors for variable speed drive applications are also available. Their advantages are discussed in the Sigma Steel Technical Reference Manual.



Depressed side-outlet sump

### High Design Loadings

Our engineers will make sure that your Sigma Steel tower will withstand any higher-than-normal design loadings (wind, seismic, decking, etc.) that you may specify. Clearly define any special design requirements in your tower specifications. We'll make any necessary changes to the tower's structural design. This is equally true if you anticipate incoming hot water temperatures above 125°F.

The specification should also describe the type of load system served by the tower and include the expected water quality analysis so that our engineers can select and recommend appropriate changes in component materials to assure satisfactory service. Discuss any questions about technical requirements with your trained Marley sales representative.

## CORROSION PROTECTION

### Hot Dip Galvanized After Fabrication

Sigma Steel towers meet the rigorous demands of the industrial user and the user with large HVAC loads. Cooling towers on these types of applications are usually very critical, so the standard materials of construction on all Sigma Steel towers offer excellent corrosion resistance.

A primary example is the use of steel that has been hot dip galvanized after fabrication for all structural members, all steel components (except those that are stainless steel) in the wetted section of the tower and all mechanical equipment supports.

Hot dip galvanizing after fabrication offers several advantages over mill-galvanizing used by suppliers of similar-capacity units:

#### Thicker Zinc Application.

Average zinc thickness on steel hot dipped after fabrication is 2.55 mils on all steel up to and including 1/16" thick and 3.91 mils on steel from 1/16" to 1/8" thick. By contrast, the G-210 mill-galvanized steel offered by other suppliers is only 1.9 mils thick. Sigma Steel towers offer from 34% to 106% additional protection based on zinc thickness alone.

**More effective edge protection.** Galvanizing after fabrication assures that all sheared and cut edges receive the full zinc thickness. Mill-galvanized material relies on the zinc adjacent to the sheared or cut edge to protect the exposed steel in those areas. Your Sigma Steel tower will have full protection at all bends, shears, bolt holes—throughout the entire tower.

**Available on heavier-gauge materials.** The steel thicknesses used for structural members on the Sigma Steel tower are typically heavier than those available with mill-galvanizing. The critical nature of most Sigma Steel tower installations demands structural design appropriate for industrial applications. Hot dip galvanizing after fabrication provides corrosion protection for these heavier sections.

The advantages of hot dip galvanized protection after fabrication assure you that your Sigma Steel will provide years of reliable service even on critical industrial applications. If you want even greater protection, select from the options below.

## OPTIONAL MATERIALS

### Premium Materials

All materials used in Sigma Steel towers offer long service life in the corrosive cooling tower environment. PVC fill, FRP and other plastic components are inherently noncorrosive. Steel components are either stainless steel or heavy-galvanized, depending on their location and service in the tower.

If your application involves an unusually corrosive environment or chemically aggressive water, or if you prefer the ultimate in corrosion resistance, you can choose from several options:

**Stainless hardware.** 300 series stainless steel structural hardware (bolts, nuts and washers). The rest of the tower remains heavy galvanized steel.

**All 300 series stainless steel tower.** Every steel component on the tower is stainless steel with the exception of the mechanical equipment. This includes the optional collection basin, if specified.

**Stainless steel driveshafts.** Standard 300 series stainless steel tube and flange with cast 316 stainless steel connecting yokes.

Remember that critical steel components such as fill supports and fan assembly hardware are stainless steel on every Sigma Steel tower as standard. If you have questions or concerns about material upgrades, contact your Marley sales representative. Give us an analysis of your anticipated water quality and we'll offer material recommendations for maximum service life at minimal cost.



SPX Cooling Technologies is dedicated to satisfying the needs of our customers—needs which begin far in advance of the actual purchase of a new Marley cooling tower, and vary over the operating lifetime of the project. Here is a partial listing of the additional services offered by SPX Cooling Technologies to help you do your job most effectively:

**Application/Sizing/Layout Services**—Sales Engineers are trained to help you choose the proper type and size of cooling tower, and will guide you in its appropriate location on site. They will also help you write the specifications for its purchase. As the only manufacturer who makes all types of cooling products, SPX Cooling Technologies can offer you a wide range of options to meet your requirements.

**Construction Service**—We can supply supervision only—or a complete, experienced crew to handle construction.

**Parts Service**—We maintain a stock of spare parts specific to your Marley tower.

**Maintenance Service**—In addition to providing complete instructions and continuing guidance, we will provide as much “hands on” maintenance as you require, or will recommend a local service contractor for your consideration.

**Condition Inspection Service**—From time to time, for your peace of mind, our engineers can give your tower a thorough inspection to evaluate its current condition. This usually allows you to foresee and forestall problems before they become serious.

**Reconstruction Service**—Due to operating or atmospheric conditions, or age, sooner or later your tower will be in need of repairs above and beyond those categorized as normal maintenance. Our reconstruction service can return your tower to as new condition.

**Performance Improvement Service**—Systems served by cooling towers grow in response to demand for the product produced by that system. Most customers find that they could produce more product if the cooling tower could deliver colder water. Fortunately, cooling tower technology advances with time, and we can apply this increased technology to upgrade your tower's thermal performance.

**Tower Replacement Service**—Occasionally, customers will benefit from replacing an installed tower, rather than refurbishing it. SPX Cooling Technologies stands ready to assist you in that endeavor—and, in most cases, the replacement will require little or no change to your concrete basin or support structure.

**SPX COOLING TECHNOLOGIES, INC.**

7401 WEST 129 STREET  
OVERLAND PARK, KS 66213 USA  
913 664 7400 | [spxcooling@spx.com](mailto:spxcooling@spx.com)  
[spxcooling.com](http://spxcooling.com)

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