

Sigma 1000-1200

CROSSFLOW COOLING TOWER

MARLEY®



The Marley Difference

You'll enjoy single source responsibility and reliability because we design and manufacture virtually all major cooling tower components.

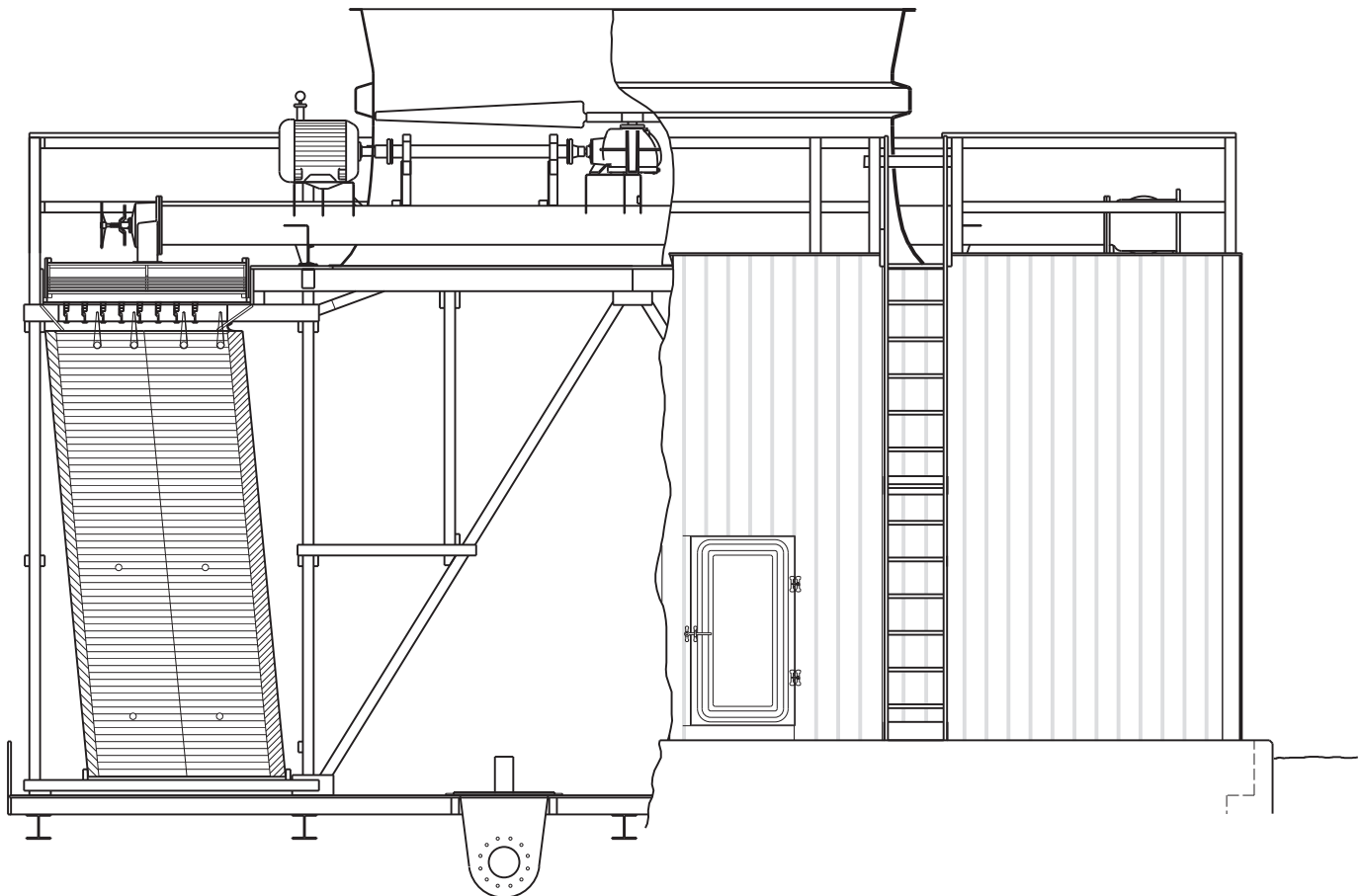
All Marley components are designed and selected to be part of an integrated system. For example, the spray pattern from nozzles and the pressure drop through drift eliminators both affect a fill's heat transfer capacity. So, we include that impact in our thermal analysis.

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.

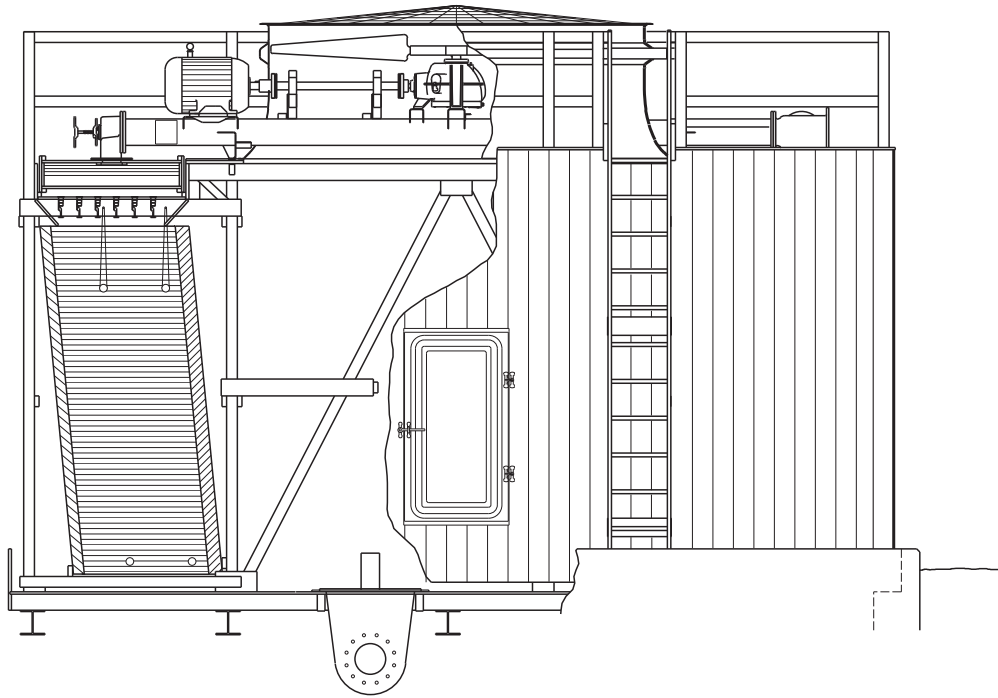
How many other cooling tower companies can offer you this assurance? They may use Brand "A" nozzles with Brand "B" fill and Brand "C" drift eliminators. When they all come together, the whole may be less than the sum of the parts.

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.



Sigma 1200 Cross-Section



Sigma 1000 Cross-Section

- **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 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 towers for their corrosion resistance and suitability for cooling tower service. Pressure-treated lumber, heavy-galvanized steel, stainless steel, PVC and fiberglass keep your Sigma tower working year after year.
- **Efficient Field Assembly.** Precise factory fabrication assures that every component in your Sigma tower will fit as designed. And SPX Cooling Technologies offers an unparalleled nationwide construction organization to build your tower quickly and economically.
- **Low Operating Costs.** Marley's high-efficiency fill and fans, gravity-flow water distribution, and efficient Geareducer® drive work together to offer maximum cooling with minimum power use.
- **Low Maintenance Costs.** Induced-draft propeller fans on Marley right-angle Geareducer units; TEFC, 1.15 service factor motors; and heavy-duty mechanical equipment supports assure long service life with minimal maintenance.
- **All-Season Reliability.** Sigma towers perform as specified in the heat of summer. They respond well to energy management techniques in the 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 Sigma cooling tower except motors. We'll have the parts if you ever need them.

Construction and Components

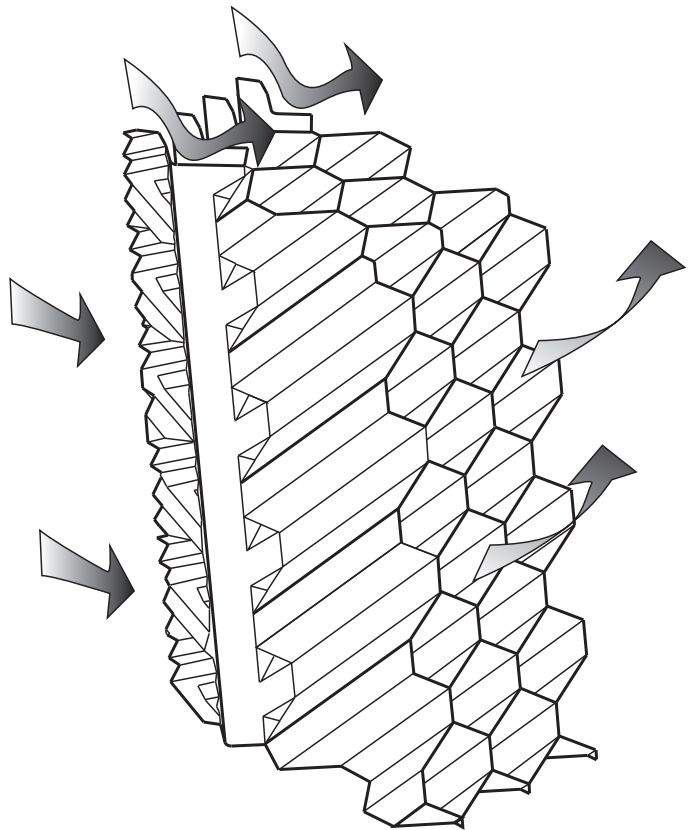
Fill/Louvers/Drift Eliminators

Marley high-performance film fill is the heart of every Sigma 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 vacuum formed 15 mil (.015") thick polyvinyl-chloride (PVC) capable of service at hot water temperatures up to 125°F. Stainless steel structural tubes resting in stainless steel hangers support the fill, and PVC tubes control alignment. Series 1000 fill includes two stainless supports, and Series 1200 fill uses four stainless supports. 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.

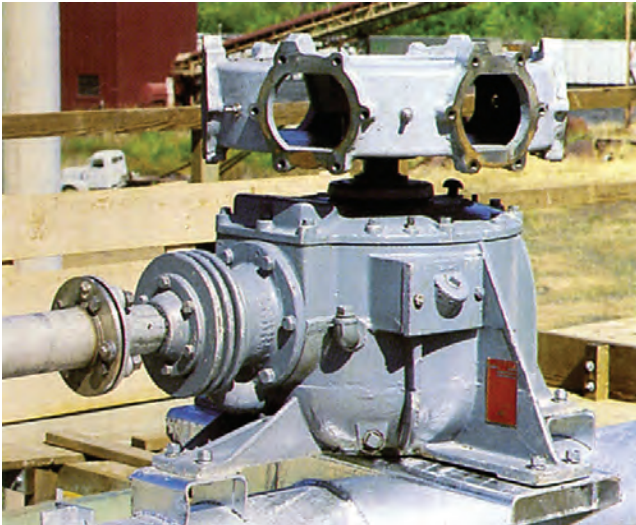


Integral drift eliminators prevent the costly nuisance of drift spotting on objects in the surrounding environment. Their unique shape induces the air flow through three distinct direction changes as illustrated above. The final turn directs air toward the fan to save you fan horsepower. Moisture carried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

Construction and Components

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 reducers used in the Sigma line contribute 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. We run-in every Geareducer unit 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 at least 2.0 as applied.

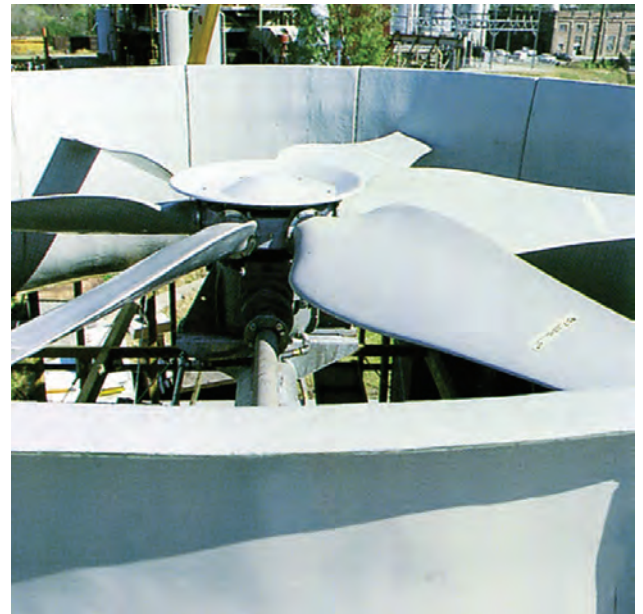
Splash-type lubrication and integral cooling fins preclude the need for maintenance-intensive oil pumps and coolers. A constant oil bath or flow lubricates every bearing in forward or reverse motion – at full or half speed.

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 Series 1000/1200 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 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 job site restrictions. The true airfoil blades, designed specifically for cooling towers, offer efficient, quiet operation and long service life.



Fans operate inside structural GRP (glass-reinforced polyester) eased-inlet fan cylinders designed and applied to maximize fan performance. Cylinder height varies from 3'-5" to 7'-0", depending on fan diameter. Cylinders less than 6'-0" tall include galvanized welded fan guards. (See Access and Safety on page 7.)

Marley-manufactured driveshafts transmit power from the motor to the Geareducer assembly. All 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 reducing air turbulence in the fan entrance region.

Construction and Components

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 are standard 125# flanges. Marley flow-control valves balance the flow to both distribution basins of each cell. Water flows from each valve through a splash-suppression chamber into the treated fir plywood distribution basin.



Polypropylene patented “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. All plywood is treated exterior grade. The nozzles are chemically and biologically inert, so they'll last indefinitely.

Structure and Materials

Sigma tower design conforms to the latest edition of the National Design Specification for Wood Construction (NDS) published by the National Forest Products Association. Wind load criterion is normally 30 pounds per square foot of projected area and the design meets 5%g seismic loading, based on a maximum water temperature of 120°F.

Pressure-treated Douglas Fir is the standard material for structural members in Sigma towers because it offers predictably consistent structural strength and provides long service life in cooling towers. Treated redwood structure is available as an option. However, you will benefit in the long run from specifying redwood very selectively and very carefully.



Unless otherwise specified, all lumber – regardless of species – is pressure treated after fabrication. Lumber treatment is CCA, infused into the wood by the full-cell process to 0.40 lb/ft³ retention.

The primary structural elements of all Sigma towers are the 4" x 4" columns. Column bent lines occur on 4'-0" longitudinal centers.

The 4" x 4" tower diagonals carry loads to heavy-duty hot-dip galvanized steel anchor plates or hot-dip galvanized anchor weldments. The system of longitudinal and transverse diagonal bracing provides stability in a true tension-compression design.



Construction and Components

All structural framing connections use 1/2" dia. galvanized machine bolts with either fiber-reinforced nylon shear connectors or FRP connector straps.

The fan deck is pressure treated exterior grade fir plywood designed for a uniform live load of 60 psf.



Access and Safety

The Sigma tower is designed to meet all OSHA requirements. A 3'-6" high 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. Each tower normally includes two ladders—one at each endwall.

Hinged doors through the endwall casing permit access to the interior of the tower at the basin level. Single-cell towers have one door. Multicell towers have doors in both endwalls, plus accessways through any and all partition walls.

Removable fan guards on Series 1000 models keep personnel away from operating fans. The galvanized, heavy-gauge welded rod guards lift off for easy access to the mechanical equipment. The taller fan cylinders used on Series 1200 models effectively keep personnel away from the fan, eliminating the need for guards.

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 rib-type, fiber reinforced polyester sheets. Water and corrosion-proof, FRP is immune to biological deterioration and requires no maintenance.

Casing ribs run vertically. Vertical joints between sheets are overlapped one rib and are sealed in the fill areas. 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 Collection Basin

Most Sigma owners install their towers over concrete cold water basins provided by others. However, you can choose a Marley wood collection basin as an optional accessory. (See page 11).

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

Available Options

| Accessory | Description and Remarks |
|--|---|
| Plywood Cold Water Collection Basin | Pressure-treated Douglas fir plywood collection basin for towers located above grade. See page 11. |
| Bottom-Outlet Sump | Square-plan galvanized steel sump with bottom outlet. Outlet connection is a hole and bolt circle conforming to 125# ASME pipe connection. Includes a plugged drain connection in sump bottom. |
| Extended Columns for Deep Collection Basin | Interior tower columns can be extended to permit concrete basin depth of up to 5'-6". Some exceptions apply, so consult your Marley sales representative |
| Fan Cylinder Extensions | Optional flared fan cylinder extensions improve fan efficiency to reduce your operating costs. Extensions on Sigma 1000 Series towers conform to OSHA requirements without fan guards. |
| Cell Partitions | Extra partitions between fan cells for specific operating considerations. See page 9. |
| Vibration Limit Switch | The Marley V6 mechanical switch is a shock sensitive mechanism for shutdown of the electric fan motor. |
| Oil Level Sight Glass | 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. |
| Air Inlet Screens | Galvanized wire mesh screens over the air inlets keep leaves and trash out of the tower. Easily removable. Choose either treated fir frames or galvanized steel U-edge frames. |
| Plywood Distribution Basin Covers | Removable, treated fir plywood 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 working surface for tower maintenance. |

| Accessory | Description and Remarks |
|--|--|
| Additional Access Door | Extra access door on single-cell towers offers easy access through either endwall. |
| Wood Stairway | Pressure-treated Douglas fir 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' above the base of the ladder. If the tower fan deck is more than 20' above roof or grade, OSHA requires safety cages. |
| Plenum Walkway | Pressure-treated Douglas fir 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 working level. Extensions attach to the normal ladder and may require base anchorage (depending on length). |
| Premium Hardware | Choose from several corrosion-resistant hardware options, providing different degrees of protection. |
| Fire Protection | Sprinkler systems and overlay materials let you choose from a range of fire protection options. See page 10. |
| Redwood Fan Deck, Distribution Basin, or Tower Structure | You can choose redwood instead of Douglas fir for any or all of these tower elements. |

Cell Partition Options

Every Sigma tower includes plenum chamber 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, maintaining efficient thermal performance. Basin partitions let you inspect and clean individual basins while the rest of the tower continues to operate.

Specify extra partitions carefully because excess partitions can sometimes discourage routine maintenance and good housekeeping procedures. Two options are available to meet specific design goals:

- Fill area partitions are available, but usually not necessary. The solid sheet design of film fill prevents water and air migration between the fill areas of adjacent cells, regardless of operating mode.
- 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 exterior grade, pressure-treated fir plywood, sealed to cold water basin partitions made from the same material as the basin sides. For concrete basin partitions, design drawings are available that specify the appropriate Marley dimensions.

Optional weir gates in wood basin partitions let you mix or segregate the water in the basin to meet your operating needs. Marley weir gates come with removable cover plates.



Wood Stairway with Access Platform



Oil-Level Sight Glass

Special Component Options

Fire Protection Options

The PVC fill, louvers and drift eliminators used on Sigma towers are fire-retardant, having flame spread ratings less than 25 per ASTM E-84. Standard fan decking material is pressure-treated fir plywood which ignites poorly and burns slowly. For these reasons, governing agencies (such as Factory Mutual) may not require fire protection sprinkler systems on Sigma towers.

On specific jobs you may want to weigh the cost of various modifications against the cost (and maintenance) of a sprinkler system – or the cost of higher insurance premiums. One or more of the following tower modifications may negate the need for a sprinkler system:

- Fire-retardant fan cylinders and optional casing offer flame spread less than 25 per ASTM E-84.
- A 1/4" thick fiber-reinforced cement board (FRC) overlay on the fan deck acts as a fire stop and provides a nonskid walking surface.
- A 1/4" FRC overlay on the distribution basin covers acts as a fire stop.
- Barrier walls keep fire from spreading between cells in multicell towers. Specify barrier wall design by containment period, such as a "20-minute fire wall". Barrier walls are full-width, full-height of the tower interior (except cold water basin), and consist of pressure-treated fir plywood both sides of the column line between cells. Plywood thickness (and cost) vary according to the specified containment time.
- Steel construction. Remember that the Sigma series is available in steel construction – either galvanized or stainless – as are a number of other Marley series, all of which meet all established fire code requirements.

If your insurance carrier insists on a sprinkler system for your tower, consult your Marley sales representative. We can provide a sprinkler system to fit your needs, or work with your people to be sure that the sprinkler system and tower will meet your specification.

Non-Standard Motors

Although you can buy your Sigma 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 are also available.

Cold Water Collection Basins

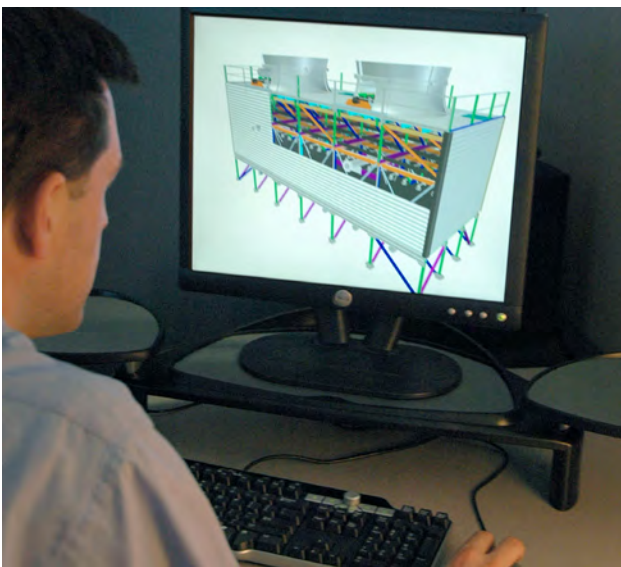
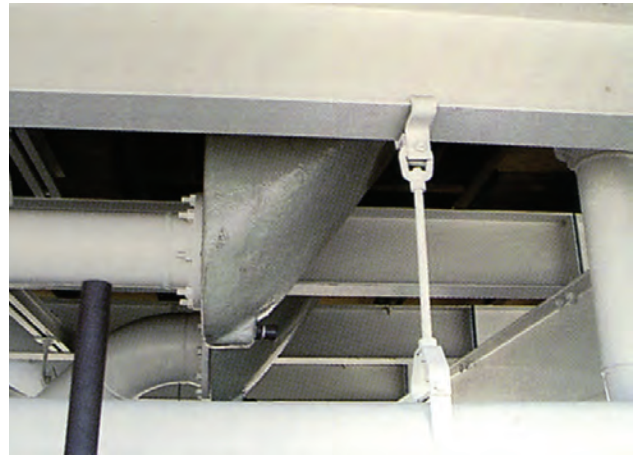
If you plan to locate your tower above grade, a treated Douglas fir Marley cold water collection basin is available, complete with the necessary operating accessories. The basin floor is exterior grade, pressure-treated fir plywood, supported on joists. Basin sides are plywood, machined to fit the basin floor, providing a water-tight joint after sealing.

The standard wood basin includes at least one depressed, side-outlet sump. The number and size of sumps depends on the circulating water rate and the overall size of the tower. Unless otherwise specified, sumps include plugged drains and hot-dip galvanized debris screens. Standard sumps are FRP construction or hot-dip galvanized steel, depending on outlet size.

Stainless steel sumps and screens are available as options at extra cost.

Each basin includes an overflow/cleanout connection consisting of a galvanized 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.



High Design Loadings

Our engineers will make sure that your Sigma tower will withstand any higher-than-normal design loadings (wind, earthquake, 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 120°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.

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.

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