

/ Marley Class 160 Cooling Tower /



/ 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. From design through installation and on throughout your tower's life, all of SPX will work for you.

/ Class 160 Tower 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!***
- **Long Service Life.** We've carefully chosen all the materials used in Class 160 towers for their corrosion resistance and suitability for cooling tower service. Pressure-treated lumber, heavy-galvanized steel, stainless steel, PVC and fiberglass keep your Class 160 tower working year after year.
- **Efficient Field Assembly.** Precise factory fabrication assures that every component in your Class 160 tower will fit as designed. And SPX offers an unparalleled nationwide construction organization to build your tower quickly and economically.
- **Easy Maintenance Access.** The Class 160's crossflow design gives you quick, direct access to the open distribution basins, plenum and mechanical components for regular inspection and service.
- **Low Operating Costs.** Marley 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 rightangle Geareducer units; TEFC, 1.15 service factor motors; and heavy-duty mechanical equipment supports assure long service life with minimal maintenance.
- **All-Season Reliability.** Class 160 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 tower except motors and some fan sizes. In fact, we stock many of those parts, too. We'll have the parts if you ever need them.

/ Construction and Components /

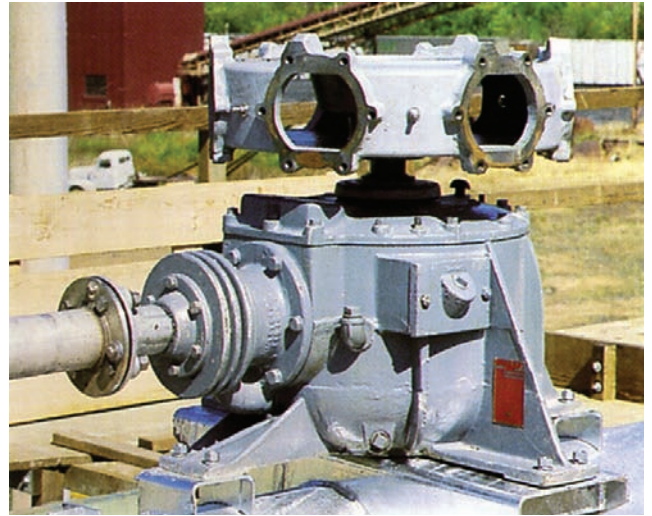
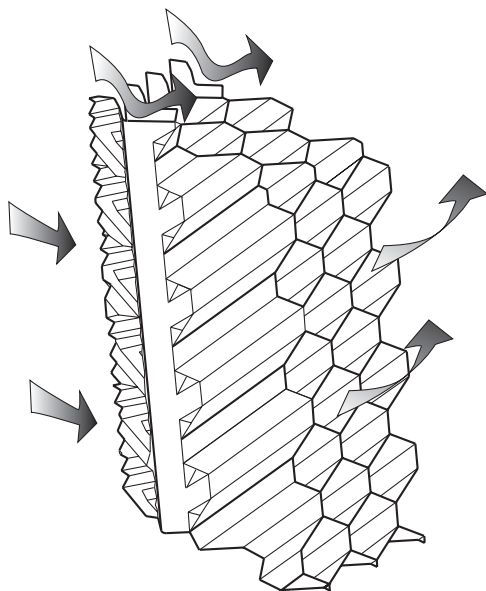
■ Fill/Louvers/Drift Eliminators

Marley high-performance film fill is the heart of every Class 160 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 PVC (polyvinyl chloride) capable of service at hot water temperatures up to 120°F. Consult your Marley sales representative for applications where hot water temperatures are greater than 120°F yet less than 145°F to determine upgrade possibilities. Stainless steel structural tubes resting in stainless steel hangers support the fill, and PVC tubes control alignment. 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 shown below. 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 less than 0.005% of the circulating water flow rate.



■ Mechanical Equipment

The Marley Geareducer speed reducer used in the Class 160 line contributes a long record of dependability, long service life, and low maintenance. 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.

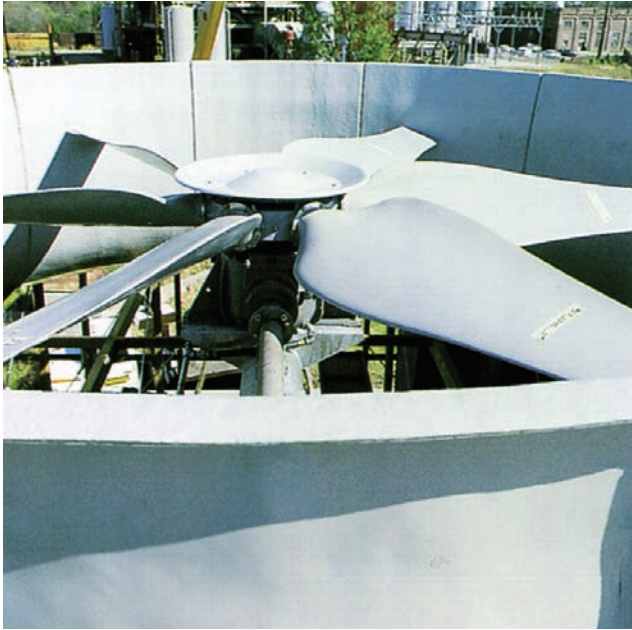
Housings are gray cast iron. Gears are high-strength, case hardened alloy steel. And all bearings are tapered roller bearings. A variety of available horsepower capacities and reduction ratios lets us choose the optimum Geareducer model and fan speed for your job. Service factors are always at least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

Class 160 towers offer the benefits of adjustable pitch propeller type fans. All fans used on Class 160 towers include hollow GRE (glass-reinforced epoxy) blades and epoxy-coated cast iron or galvanized steel hubs. Blades 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 cylinder heights are 6'-0" to 7'-0", depending on fan diameter. 10'-0" cylinders are available as an option.

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 non-specialized 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.

■ Water Distribution System

The gravity-flow water distribution system designed into the Class 160 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 a Marley galvanized crossover pipe. Inlet connections for your piping are drilled to conform to Class 125 ANSI requirements. Marley flow-control valves balance the flow to both distribution basins of each cell. Water flows from the valves through a splash-suppression chamber and into the treated fir plywood distribution basins.

Polypropylene Marley "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

Class 160 tower design conforms to the latest edition of the National Design Specification for Wood Construction (NDS) published by the National Forest Products Association, as well as CTI standards STD-114 and STD-103. Wind load criterion is normally 30 pounds per square foot of projected area and the design meets criteria for UBC Zone 1 seismic loading, based on a maximum water temperature of 120°F.

The primary structural elements of all Class 160 towers are the nominal 4" x 4" columns spaced on 4'-0" longitudinal centers. A system of nominal 4" x 4" tower diagonals carries loads in both tension and compression to heavy-duty hot dip galvanized steel anchor plates.

Pressure-treated Douglas Fir is the standard material for structural members in Class 160 towers because it offers predictably consistent structural strength and provides long service life in cooling towers.

Unless otherwise specified, all lumber is pressure treated after fabrication. Treatment in accordance with CTI Standard STD-112 is available on request.

All structural framing connections use 1/2" diameter 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 Class 160 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 around the fan deck. 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.

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

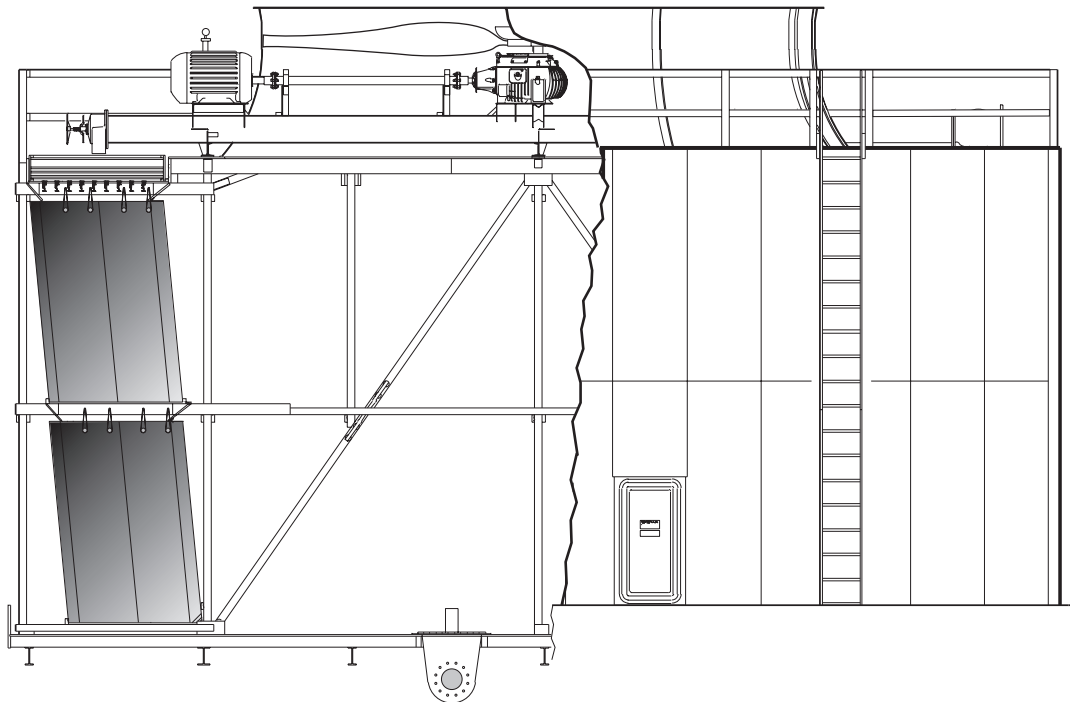
Tower endwalls are cased with gray 8 oz/sq ft ribbed FRP sheets. Water and corrosion-proof FRP is immune to biological deterioration and requires no maintenance.

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 Basin

Most Class 160 owners install their towers over concrete cold water basins provided by others—or you can choose a wood collection basin as an option. See page 11.

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



/ Operating and Environmental Considerations /

Cooling towers are usually selected to produce a specific cold water temperature at the higher summertime wet-bulb temperatures. During the remainder of the year, the cooling tower is capable of producing much colder water. Unless your system will benefit from the coldest possible water temperature, you may want to consider controlling cold water temperatures to higher levels. You'll also save energy by using such control. See Marley *Technical Report #H-001A*, "Cooling Tower Energy and its Management".

Always control leaving water temperature by manipulating the quantity of air that the fan moves through the tower. Varying the quantity of water flow is not normally recommended and can be harmful in freezing weather. You can alternately start and stop single-speed motors to keep water temperatures within an acceptable range. But your flexibility is limited by the amount of starting time per hour allowed by the motor manufacturer.

Increased flexibility can simplify your operating procedures and save you money in the long run, both on operation and on maintenance. Here are two of the more popular options:

- ❑ Two-speed motors improve operating flexibility by increasing the number of potential operating modes. Users in northern climates will find that the tower can carry winter loads at half-speed; reducing fan power requirements by 85+% during that time. Two-speed motors also help to control icing during wintertime operation. See Marley *Technical Report #H-003*, "Operating Cooling Towers During Freezing Weather".

Normally, two-speed motors are provided in 1800/900 RPM, single winding configuration, which is the least expensive two-speed option. They are also available in other combinations including the more expensive double winding.

- ❑ Frequency modulation devices work well on induced draft, propeller fan cooling towers such as the Class 160. However, their design must include the capability to lock out any critical fan speeds and the very low fan speed ranges. Consult your Marley sales representative for specific recommendations when considering variable speed control. In many cases, for example, you'll achieve the best results by using a single control to regulate the speed of several fans on a multicell tower.

■ System Cleanliness

Cooling towers are very effective air washers. Atmospheric dust able to pass through the relatively small louver openings will enter the circulating water system. Increased concentrations can intensify system maintenance by clogging screens and strainers; and smaller particulates can coat system heat transfer surfaces. In areas of low flow velocity (such as the cold water basin), sedimentary deposits can provide a breeding ground for bacteria.

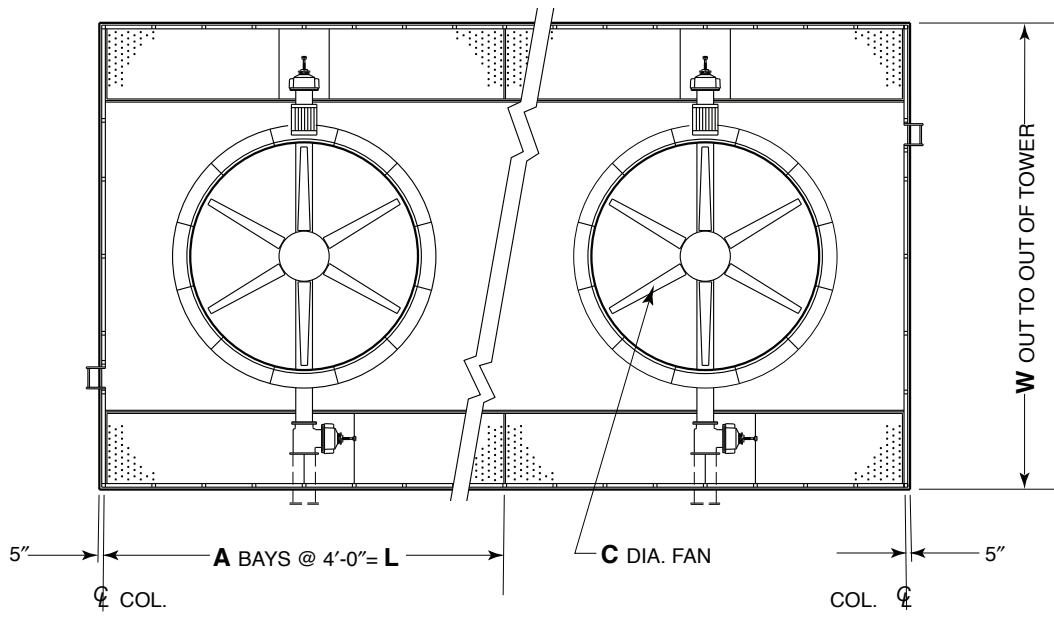
In areas prone to dust and sedimentation, you should consider installing some means for keeping the cold water basin clean. Typical devices include side stream filters and a variety of filtration media.

You should also plan ahead to develop a consistent, effective program of water treatment. A good water treatment program will help to assure long service life, while keeping your tower free of potentially harmful biological growths.

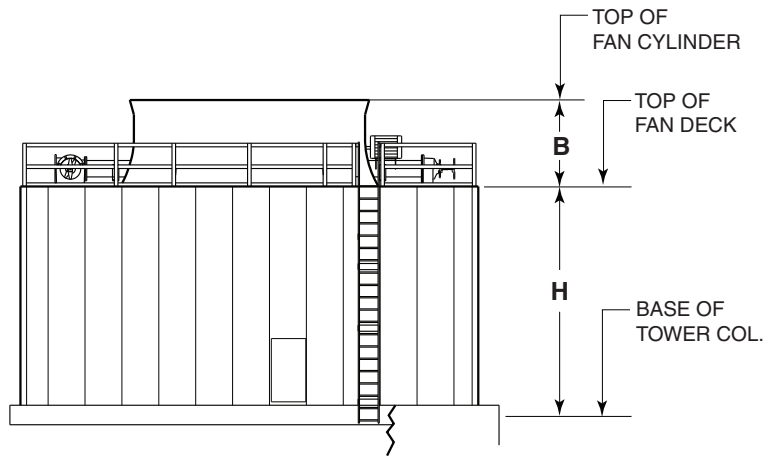
Caution

The cooling tower must be located at such distance and direction to avoid the possibility of contaminated tower discharge air being drawn into building fresh air intake ducts. The purchaser should obtain the services of a Licensed Professional Engineer or Registered Architect to certify that the location of the tower is in compliance with applicable air pollution, fire, and clean air codes.

/ Tower Schematic /



Tower Plan



Endwall Elevation

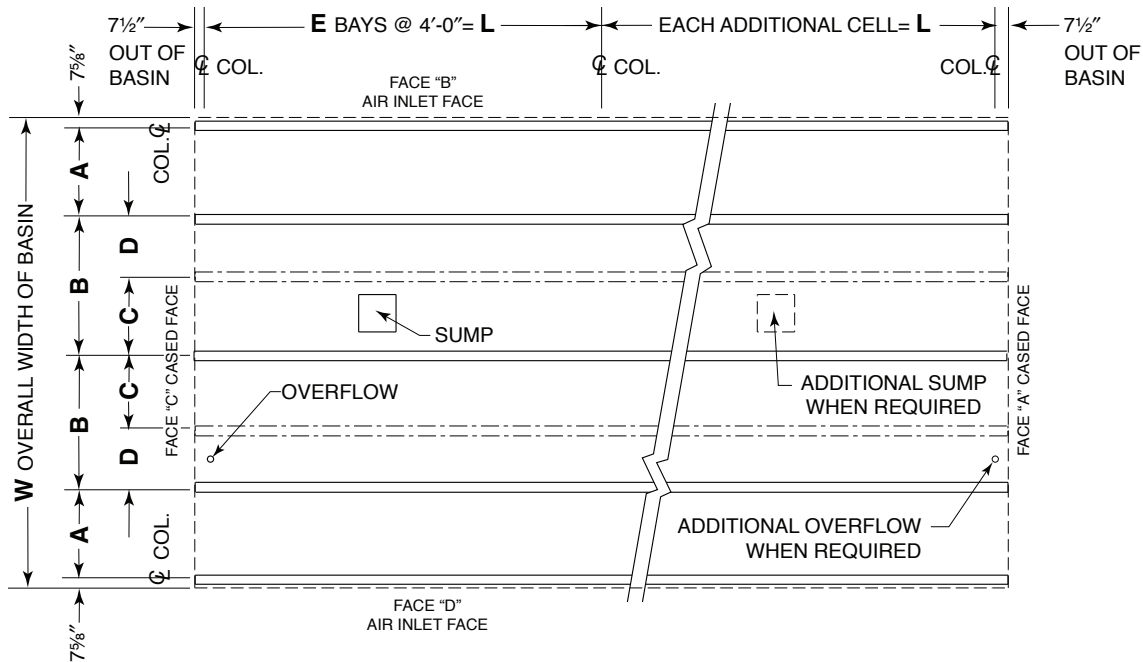
Tower Model	GPM per Cell	Width	Length	Height	Dimensions			Maximum Motor hp	Static Lift
		W	L	H	A	B	C		
1611	1,500-8,640	37'-1 3/4"	24'-0"	19'-3 1/8"	6	7'-0"	216"	125	19.4'
1621	1,850-10,080	37'-1 3/4"	28'-0"	19'-3 1/8"	7	7'-0"	216"	125	19.4'
1631	2,120-11,520	37'-1 3/4"	32'-0"	19'-3 1/8"	8	7'-0"	216"	125	19.4'
1641	2,390-11,660	37'-1 3/4"	36'-0"	19'-3 1/8"	9	7'-0"	216"	125	19.4'
1651	2,390-11,660	40'-1 3/4"	36'-0"	19'-3 1/8"	9	6'-0"	240"	150	19.4'
1661	2,390-11,660	42'-1 3/4"	36'-0"	19'-3 1/8"	9	6'-0"	264"	150	19.4'

1. Last number of model indicates number of cells. Change as appropriate for your selection. Primary engineering data is per cell.

2. Fan hp is usually less than shown here.

3. Height shown is from base of tower columns to fan deck. Wood basin, if used, elevates tower 6 1/4". If concrete basin is used, subtract 1'-6" for height above top of basin curb.

/ Steel Basin Support /

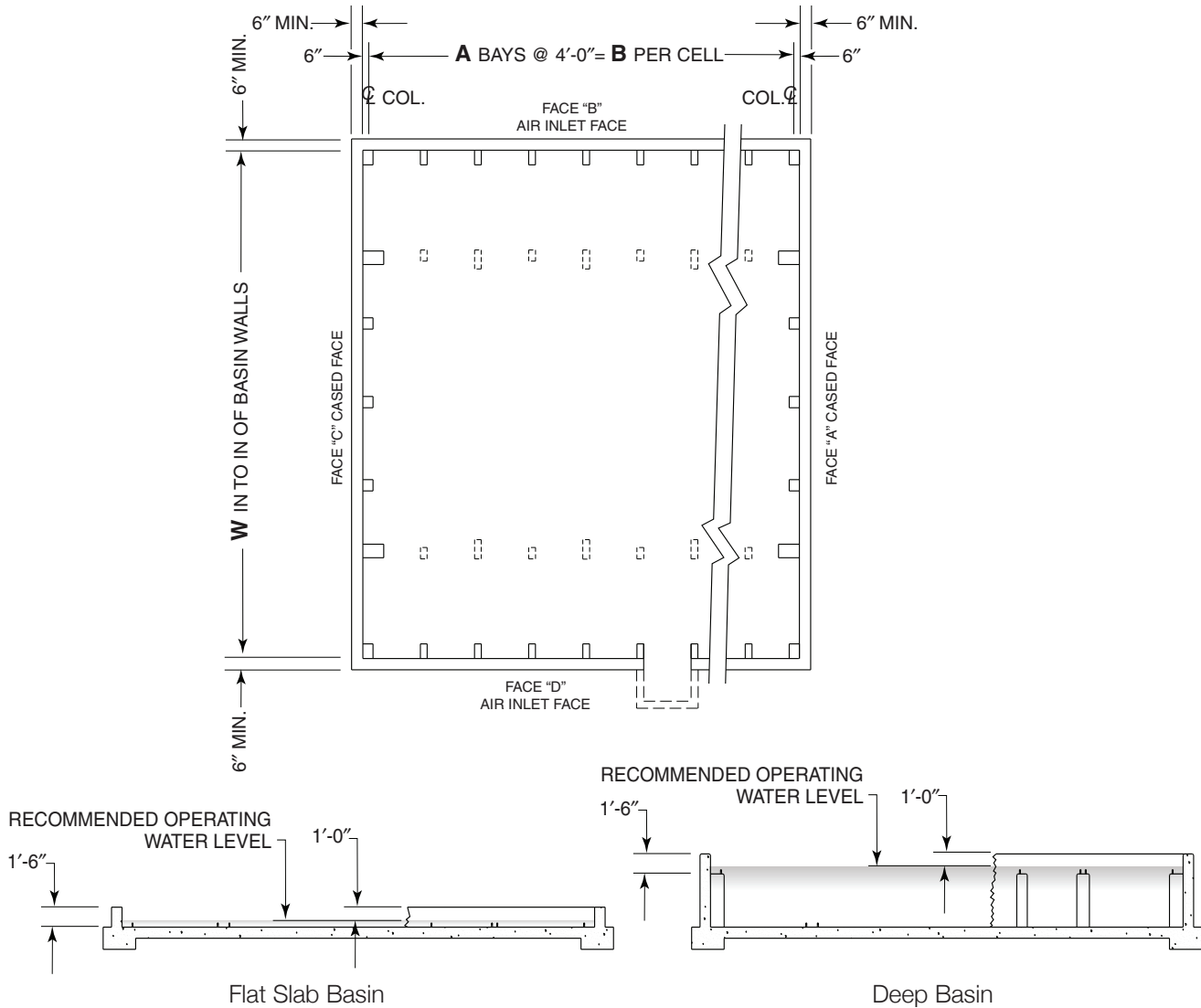


Note: Two beams shown phantom are required on Models 1651 and 1661 only. All dimensions are to centers of **tower columns**—not centers of anchor bolts or beams.

Tower Model	Dimensions							Operating Weight lb	
	W	A	B	C	D	E	L	Single Cell	Each Cell Add
1611	37'-10"	7'-5 3/8"	10'-10"			6	24'-0"	110,865	104,830
1621	37'-10"	7'-5 3/8"	10'-10"			7	28'-0"	127,440	121,305
1631	37'-10"	7'-5 3/8"	10'-10"			8	32'-0"	143,565	137,830
1641	37'-10"	7'-5 3/8"	10'-10"			9	36'-0"	158,800	153,115
1651	40'-10"	7'-5 3/8"		6'-11 7/8"	5'-4 1/8"	9	36'-0"	175,740	169,640
1661	42'-10"	7'-5 3/8"		7'-6 1/2"	5'-9 1/2"	9	36'-0"	181,620	175,390

1. **Use this bulletin for preliminary layouts only.** All dimensions show *column* locations, *not* anchor bolt locations. Obtain current drawings from your Marley sales representative before designing supports.
2. Other contractors or purchaser must design and erect supporting steel.
3. If steel beams are used, they must include 7/8" dia. holes to accept anchor bolts provided by Marley. If concrete beams or pilasters are used, 3/4" dia. anchor bolts imbedded in the concrete must be provided by others.
4. Maintain no less than 2'-0" of clear space at cased faces for construction purposes. Air inlet faces must have unobstructed air supply. Consult your Marley sales representative if nearby obstructions may interfere.
5. Operating weight is wet weight of tower and wood basin, including 6" of water in the cold water basin. This is the recommended operating water level for all models.
6. For collection basin accessories information request Marley drawing 90-3231 from your Marley sales representative.

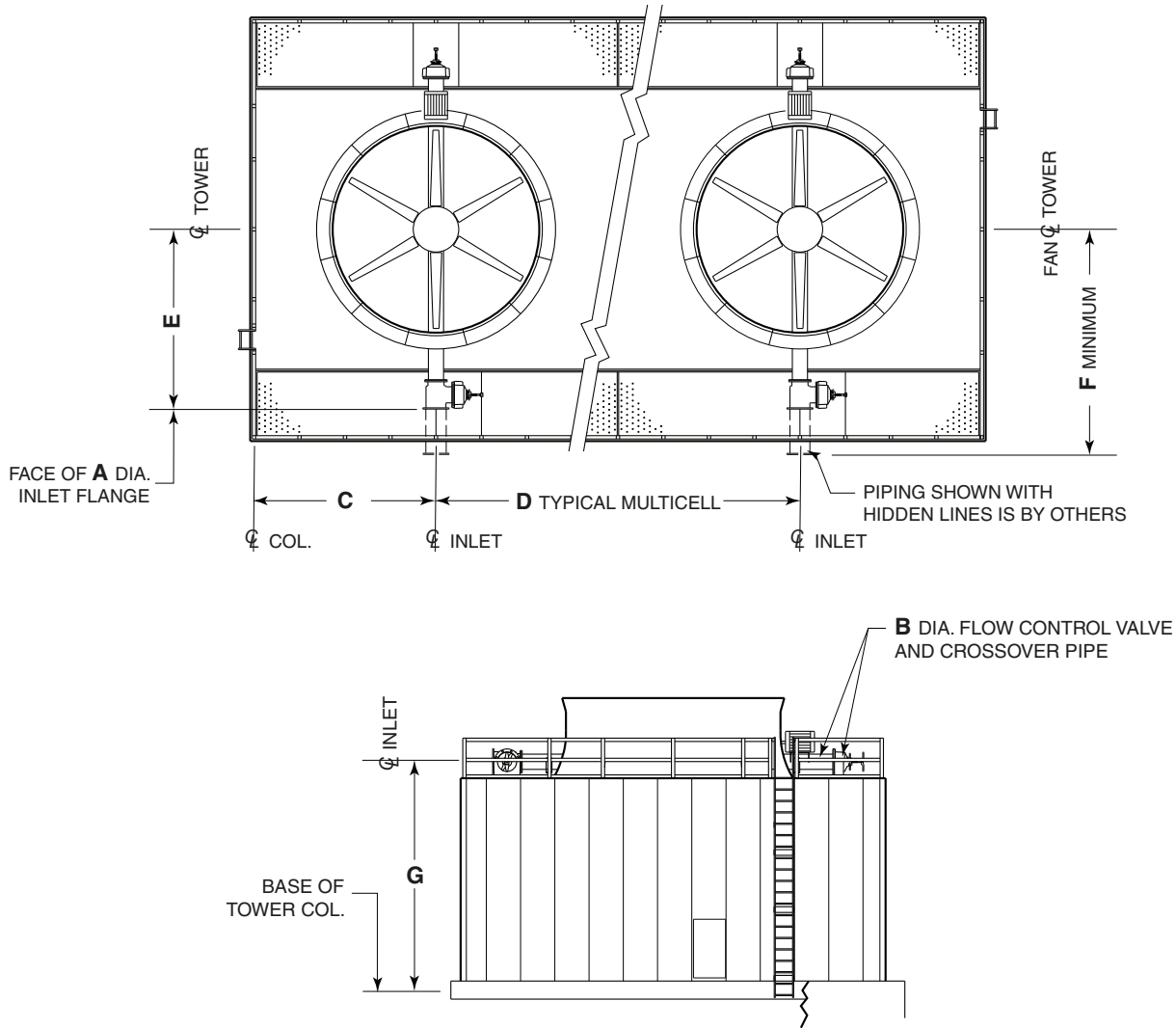
/ Concrete Basin /



Tower Model	Dimensions			Operating Weight lb	
	W	A	B	Single Cell	Each Cell Add
1611	37'-6 3/4"	6	24'-0"	70,970	67,980
1621	37'-6 3/4"	7	28'-0"	80,840	77,850
1631	37'-6 3/4"	8	32'-0"	90,075	86,855
1641	37'-6 3/4"	9	36'-0"	98,910	95,900
1651	40'-6 3/4"	9	36'-0"	105,570	102,540
1661	42'-6 3/4"	9	36'-0"	108,700	105,590

- Use this bulletin for preliminary layouts only. Do not use for construction. Obtain current drawings from your Marley sales representative. Concrete basin design and construction are by other contractors or purchaser.
- Operating weight is total wet operating weight of tower only, excluding water in concrete basin.
- Maintain at least 2'-0" of clear space at cased faces for construction purposes. Air inlet faces must have unobstructed air supply. Consult your Marley sales representative for recommendations if nearby obstructions may interfere.
- Minimum basin depth is 1'-6". Maximum basin depth is 5'-6". Marley will provide (at extra cost) extended interior columns for deep basins. Perimeter columns remain at 1'-6" below top of basin curb.
- All anchor bolts, complete with nut and washer, must be furnished by others. Bolts must be 3/4" diameter with 2" all-thread projection.
- Other contractors or purchaser must design, locate, construct, and furnish sump(s) and overflow(s) to suit requirements. The sump(s) should be designed according to the pump manufacturer's recommendations. Other design sources: ANSI/HI specifications 1.1-1.5 for centrifugal pumps, 2.1-2.5 for vertical pumps, and 9.8 for pump intake design.

/ Inlet Piping Plan /



Tower Model	GPM per Cell	Dimensions						
		A	B	C	D	E	F	G
1611	1,500-7,050	16"	12"	12'-0"	24'-0"	16'-2 3/4"	19'-6 3/8"	20'-4 3/8"
	7,051-8,640	20"	16"			16'-5 3/4"		20'-6 3/8"
1621	1,850-7,050	16"	12"	14'-0"	28'-0"	16'-2 3/4"	19'-6 3/8"	20'-4 3/8"
	7,051-10,080	20"	16"			16'-5 3/4"		20'-6 3/8"
1631	2,120-7,050	16"	12"	16'-0"	32'-0"	16'-2 3/4"	19'-6 3/8"	20'-4 3/8"
	7,051-11,520	20"	16"			16'-5 3/4"		20'-6 3/8"
1641	2,390-7,050	16"	12"	18'-0"	36'-0"	16'-2 3/4"	19'-6 3/8"	20'-4 3/8"
	7,051-11,660	20"	16"			16'-5 3/4"		20'-6 3/8"
1651	2,390-7,050	16"	12"	18'-0"	36'-0"	17'-8 3/4"	21'-0 3/8"	20'-4 3/8"
	7,051-11,660	20"	16"			17'-11 3/4"		20'-6 3/8"
1661	2,390-7,050	16"	12"	18'-0"	36'-0"	18'-8 3/4"	22'-0 3/8"	20'-4 3/8"
	7,051-11,660	20"	16"			18'-11 3/4"		20'-6 3/8"

1. Use this bulletin for preliminary layouts only. Obtain current drawings from your Marley sales representative.
2. Pumping head contributed by the tower is static lift shown on page 7. Actual pumping head will vary according to tower circulating GPM. Total pumping head will be furnished at time of proposal.
3. If your application requires a bypass system, recommended location is through tower endwall into plenum area. Review of the system by Marley engineering is required.
4. Marley piping terminates at face of a cast iron flat face flange. Bolt circle conforms to class 125 lb. ANSI B16.1 specifications.
5. Supports on tower for crossover piping are furnished by Marley. Do not support the riser's dead load or operating load from the tower. Do not brace the riser's seismic or thrust loads against the tower.
6. On Models 1611 through 1641 with a 32 or 3200 Geareducer the inlet diameter must be 20".

/ Available Options /

■ Cell Partition Options

Every Class 160 tower includes plenum partitions and hot water distribution basin partitions between adjacent cells. Plenum partitions keep air from entering an operating cell through an adjacent idle fan—assuring consistent 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 in all operating modes.
- Complete watertight partitions let you use adjacent cells to serve separate loads having incompatible system temperatures. Watertight partitions 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, Marley drawings specify the appropriate design dimensions.

Optional weir gates in wood basin partitions let you mix or segregate the water in the basin to meet your operating needs.

■ Cold Water Collection Basins

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

The standard wood basin includes at least one or more depressed, side-outlet sumps, complete with plugged drains and hot dip galvanized or stainless steel debris screens. Standard sumps are FRP construction or galvanized steel depending on outlet size.

Each basin includes an overflow/cleanout connection consisting of a galvanized full coupling and normally-installed standpipe which removes easily for flush-out basin cleaning.

A float operated, mechanical makeup valve 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.

■ Fire Safety Options

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 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 consist of pressure-treated fir plywood between cells. Plywood thickness (and cost) vary according to the specified containment time.
- FRP casing having a flame spread rating of 25 or less.

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 Class 160 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 are TEFC, 1.15 service factor (appropriate to the applied load), 1800 RPM. Other enclosures (such as Explosion Proof) and motors specially wound for nonstandard voltages are available at extra cost.

Two-speed motors are also available, and their advantages are discussed on page 6.

/ Available Options /

Accessory	Description and Remarks	Accessory	Description and Remarks
Plywood Collection Basin	Pressure-treated Douglas fir plywood collection basin for towers located above grade. See page 11.	Fire Protection	Sprinkler systems and overlay materials let you choose from a range of fire protection options. See page 11.
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.	Ladder Extension	Used when tower is elevated appreciably above working level. Extensions attach to the normal ladder and may require foot anchorage (depending on length).
Cell Partition	Extra partitions between fan cells for specific operating considerations. See page 11.	Stainless Steel Hardware	All hardware, including assembly hardware and some specialty items, are series 300 stainless steel
Vibration Limit Switches	Robertshaw or Metrix single-pole, double-throw vibration switches in NEMA 4 housing. Double-pole, double-throw models are also available.	Oil Level Gauge	A brass oil level sight glass replaces the dip stick on the external oil fill and drain system. Permits easy reading of oil level and also provides access for Geareducer oil changes.
Air Inlet Screen	Galvanized wire mesh screens over the air inlets keep leaves and debris out of the tower. Easily removable. Choose either treated fir frames or galvanized steel U-edge frames.	Distribution Basin Cover	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.
Fan Cylinder Extension	Optional flared fan cylinder extensions improve fan efficiency to reduce your operating costs.		



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