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NX cooling towers are field-erected, crossflow cooling towers, designed to serve air conditioning and refrigeration systems as well as light to medium industrial process loads on clean water. The Marley NX cooling tower has been designed specifically for sound control and tonnage density and incorporates field-proven, industrial-quality components.

The specifications portion of this publication not only relates the language to use in describing an appropriate NX cooling tower—but also defines why certain items and features are important enough to specify and to insist upon compliance by all bidders. The left hand column of pages 15 thru 23 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 15 thru 20 indicate those paragraphs which will result in the purchase of a basic cooling tower—one that accomplishes the specified thermal performance, but which will lack many operation—and maintenance-enhancing accessories and features that are usually desired by those persons who are responsible for the operation of the system. It will also incorporate those standard materials which testing and experience has proven to provide acceptable longevity in normal operating conditions.

Pages 21 thru 23 provide paragraphs intended to add those features, components and materials that will customize the cooling tower to meet the user's requirements.

THE NX-QUIET BY DESIGN

The NX is the result of extensive design studies focused on cooling tower sound control. These studies were complicated by the fact that the cooling tower market is typically driven by one of two powerful, yet often conflicting requirements. The most common is for a cooling tower that provides the required heat rejection capacity with a high level of reliability at low cost. Sound control, while important, is not the primary consideration for this application.

The other requirement, which is becoming ever more important in our crowded, fast-paced society, is driven by conditions that demand the lowest practical sound level. Energy efficiency, reliability, and ease of maintenance, while still extremely important, are not the highest priorities

In the first case, sound is important, while in the second case it is extremely important. To best satisfy these two competing market requirements we created choices through key mechanical equipment selections, to control sound.

The result is a line of towers capable of meeting all but the most restrictive noise limitations—and that will react favorably to natural attenuation. Where the tower has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance—by about 6 dBA each time the distance doubles.

All standard NX cooling towers are equipped with low sound fans. This in combination with zero-splash crossflow film-fill results in a line of towers capable of meeting most noise limitations.

CTI CERTIFIED SOUND PERFORMANCE

Sound performance matters especially in noise-sensitive environments. All published sound data for Marley NX cooling towers is CTI Certified, providing confidence that specified sound levels will be met. Each unit comes standard with a low-sound fan, with additional fan and attenuation options available to address more demanding sound requirements.

ENCLOSURES

Occasionally, cooling towers are located inside architectural enclosures for aesthetic reasons. Although NX towers adapt well

to enclosures, the designer must realize the potential impact of a poorly arranged enclosure on the tower's performance and operation. The designer must take care to provide generous air inlet paths, and the tower's fan cylinder discharge height should not be lower than the elevation of the top of the enclosure. *Marley Technical Report #H-004 "External Influences on Cooling Tower Performance"* is available at spxcooling.com or from your Marley sales representative.

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.

WATER TREATMENT

To control the buildup of dissolved solids resulting from water evaporation, as well as airborne impurities and biological contaminants including Legionella, an effective consistent water treatment program is required. Simple blowdown may be adequate to control corrosion and scale, but biological contamination can only be controlled with biocides.

An acceptable water treatment program must be compatible with the variety of materials incorporated in a cooling tower—ideally the pH of the circulating water should fall between 6.5 and 8.0. Batch feeding of chemicals directly into the cooling tower is not a good practice since localized damage to the tower is possible. Specific startup instructions and additional water quality recommendations can be found in the *NX User Manual* which accompanies the tower and also is available from your local Marley sales representative. For

▲ CAUTION

The cooling tower must be located at such distance and direction to avoid the possibility of contaminated 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 cooling tower is in compliance with applicable air pollution, fire and clean air codes.

complete water treatment recommendations, consult a competent, qualified water treatment supplier.

TYPICAL APPLICATIONS

The NX tower is an excellent choice for normal applications requiring cold water for the dissipation of heat. This includes condenser water cooling for air conditioning, refrigeration, and thermal storage systems, as well as their utilization for free-cooling in all of those systems. The NX can also be used in the cooling of jacket water for engines and air compressors, and are widely applied to dissipate waste heat in a variety of industrial, power and manufacturing processes.

APPLICATIONS REQUIRING ALTERNATIVE COOLING TOWER SELECTIONS

Certain types of applications are incompatible with any cooling tower with film fill—whether NX or a competitive tower of similar manufacture. Film fill is subject to distortion in high water temperatures, and the narrow passages are easily clogged by turbid or debris-laden water. Some of the applications, which call for alternative tower designs are:

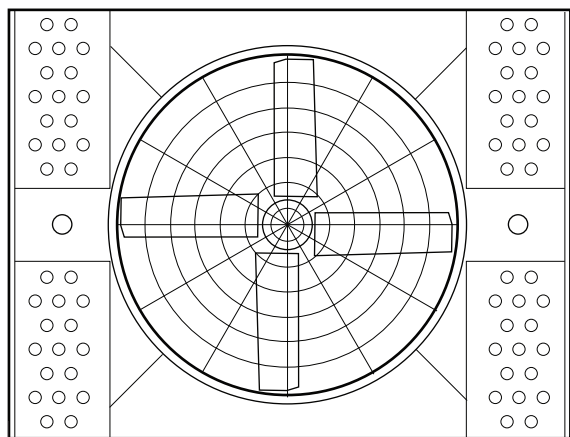
- **Water temperatures exceeding 52°C**—adversely affects the service life and performance of normal PVC fill.
- **Ethylene glycol content**—can plug fill passages as slime and algae accumulate to feed on the available organic materials.
- **Fatty acid content**—found in processes such as soap and detergent manufacturing and some food processing—fatty acids pose a serious threat for plugging fill passages.
- **Particulate carry over**—often found in steel mills and cement plants—can both cause fill plugging, and can build up to potentially damaging levels on tower structure.
- **Pulp carry over**—typical of the paper industry and food processing where vacuum pumps or barometric condensers are used. Causes fill plugging which may be intensified by algae.

ALTERNATIVE SELECTIONS

In addition to the NX, SPX Cooling offers a full scope of products in various designs and capacities to meet the special demands of specific applications.

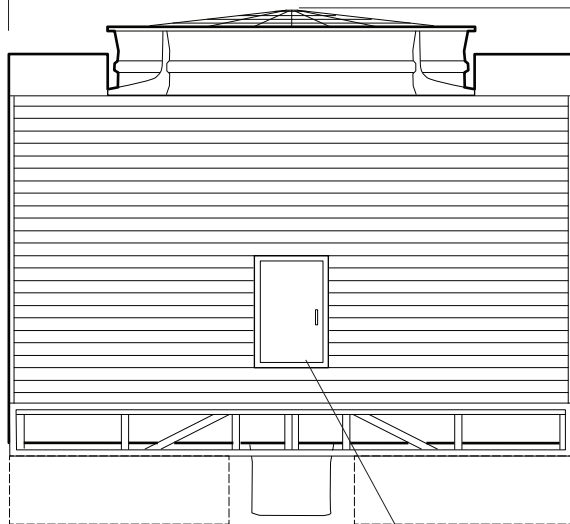
spxcooling.com—visit us on the web for a complete list of products, services, publications and to find your nearest sales representative.

NX1000



PLAN

W

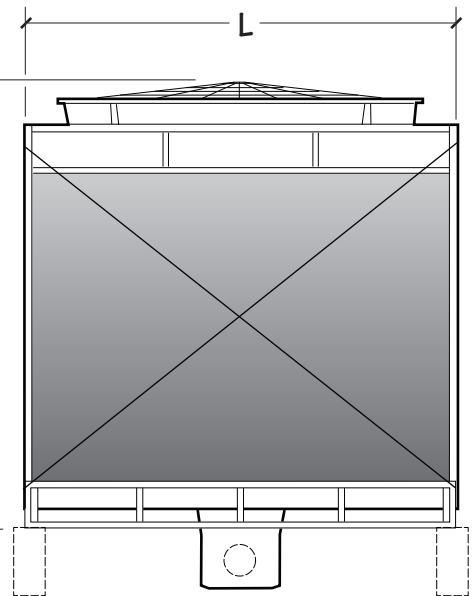


SIDE ELEVATION

HINGED ACCESS DOOR

Use this data for preliminary layouts only. Obtain current drawing from your Marley sales representative.

CoolSpec™ web-based selection software, available at coolspec.com provides NX model recommendations based on customer's specific design requirements.



AIR INLET ELEVATION

H
INSTALLED
HEIGHT

L

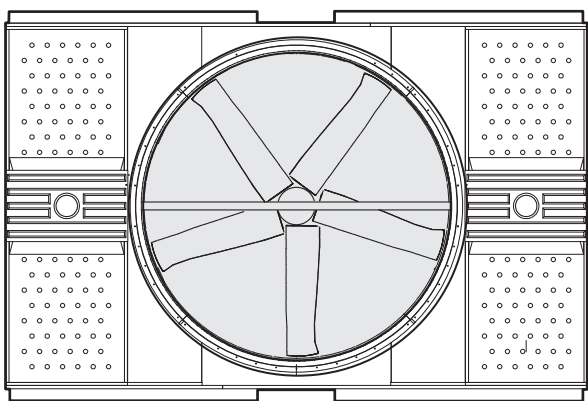
NX1000

| Model note 2 | Nominal Capacity tons note 3 | Motor kW | Design Operating Weight kg | Dimensions mm | | |
|-----------------|---------------------------------------|-------------|-------------------------------------|------------------|------|------|
| | | | | L | W | H |
| NX1010H-1 | 101 | 2.2 | 2271 | 1728 | 3244 | 3225 |
| NX1010K-1 | 121 | 3.5 | | | | |
| NX1010M-1 | 139 | 5.5 | | | | |
| NX1010N-1 | 154 | 7.5 | | | | |
| NX1010P-1 | 174 | 11 | | | | |
| NX1015H-1 | 150 | 2.2 | 3275 | 2522 | 3860 | 3302 |
| NX1015K-1 | 182 | 4 | | | | |
| NX1015M-1 | 200 | 5.5 | | | | |
| NX1015N-1 | 220 | 7.5 | | | | |
| NX1015P-1 | 249 | 11 | | | | |
| NX1020K-1 | 210 | 4 | 4093 | 2808 | 4130 | 3528 |
| NX1020M-1 | 229 | 5.5 | | | | |
| NX1020N1 | 243 | 7.5 | | | | |
| NX1020P-1 | 286 | 11 | | | | |
| NX1020Q-1 | 317 | 15 | | | | |
| NX1025K-1 | 244 | 4 | 5259 | 3494 | 4504 | 3548 |
| NX1025M-1 | 271 | 5.5 | | | | |
| NX1025N-1 | 304 | 7.5 | | | | |
| NX1025P-1 | 337 | 11 | | | | |
| NX1025Q-1 | 372 | 15 | | | | |

NOTE

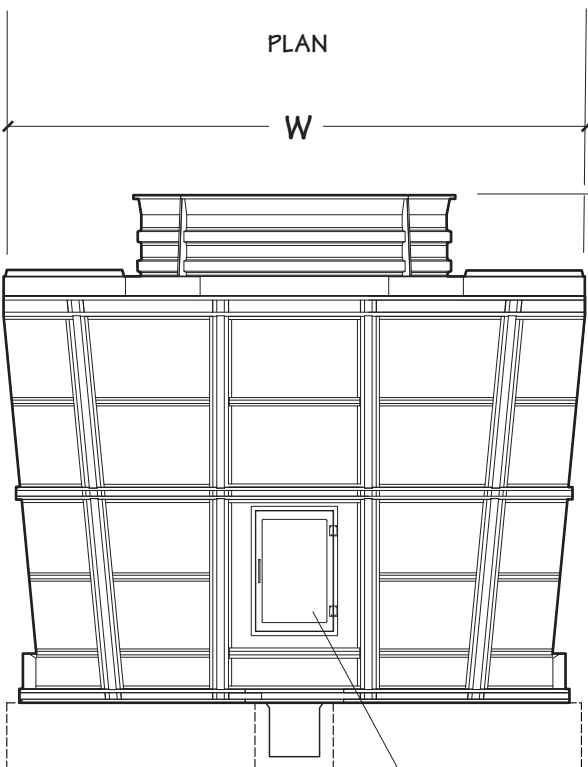
- 1 Use this bulletin for preliminary layouts only. Obtain current drawings from your Marley sales representative. All table data is per cell.
- 2 Last numeral of model number indicates number of cells. Change as appropriate for your selection.
- 3 Nominal cooling capacity based upon 35°C HW, 29.4°C CW, 25.5°C WB and .68 m³/hr per ton. The CoolSpec web-based selection software provides NX model recommendations based on specific design requirements.
- 4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining.
- 5 Outlet sizes vary according to flow and arrangement. See page 10 for sump outlet sizes and details.
- 6 Makeup water connection is 1", see page 8 for additional information.
- 7 A 1" quick makeup connection is also included in the collection to allow for quick fill of the tower.

NX2000



PLAN

W

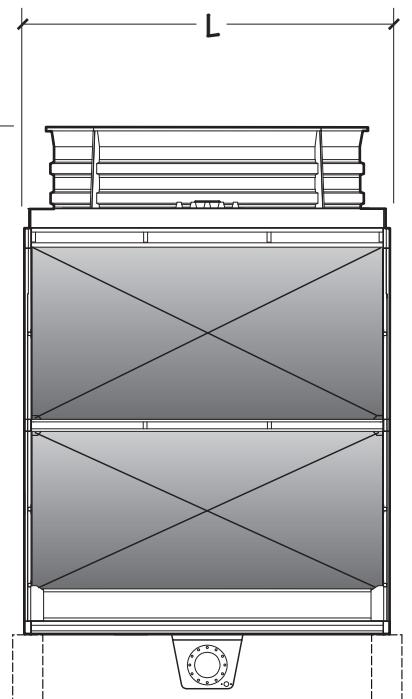


SIDE ELEVATION

HINGED ACCESS DOOR

Use this data for preliminary layouts only. Obtain current drawing from your Marley sales representative.

CoolSpec™ web-based selection software, available at coolspec.com provides NX model recommendations based on customer's specific design requirements.



AIR INLET ELEVATION

H
INSTALLED
HEIGHT

L

NX2000

| Model note 2 | Nominal Capacity tons note 3 | Motor kW | Design Operating Weight kg | Dimensions mm | | |
|-----------------|---------------------------------------|-------------|-------------------------------------|------------------|------|------|
| | | | | L | W | H |
| NX2030M-1 | 292 | 5.5 | 7902 | 3470 | 5542 | 4016 |
| NX2030N-1 | 323 | 7.5 | | | | |
| NX2030P-1 | 359 | 11 | | | | |
| NX2030Q-1 | 394 | 15 | | | | |
| NX2030R-1 | 420 | 18.5 | | | | |
| NX2030S-1 | 443 | 22 | 9084 | 3641 | 5799 | 5050 |
| NX2040N-1 | 402 | 7.5 | | | | |
| NX2040P-1 | 464 | 11 | | | | |
| NX2040Q-1 | 510 | 15 | | | | |
| NX2040R-1 | 544 | 18.5 | | | | |
| NX2040S-1 | 573 | 22 | 10617 | 3895 | 6049 | 5888 |
| NX2050N-1 | 474 | 7.5 | | | | |
| NX2050P-1 | 542 | 11 | | | | |
| NX2050Q-1 | 594 | 15 | | | | |
| NX2050R-1 | 634 | 18.5 | | | | |
| NX2050S-1 | 668 | 22 | 12286 | 4143 | 6299 | 6526 |
| NX2060P-1 | 618 | 11 | | | | |
| NX2060Q-1 | 679 | 15 | | | | |
| NX2060R-1 | 724 | 18.5 | | | | |
| NX2060S-1 | 764 | 22 | | | | |
| NX2060T-1 | 840 | 30 | | | | |

NOTE

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- 2 Last numeral of model number indicates number of cells. Change as appropriate for your selection.
- 3 Nominal cooling capacity based upon 35°C HW, 29.4°C CW, 25.5°C WB and .68 m³/hr per ton. The CoolSpec web-based selection software provides NX model recommendations based on specific design requirements.
- 4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining.
- 5 Outlet sizes vary according to flow and arrangement. See page 10 for sump outlet sizes and details.
- 6 Makeup water connection is 1", see page 8 for additional information.
- 7 A 1" quick makeup connection is also included in the collection to allow for quick fill of the tower.

Flanges are not required to make inlet connections. An appropriate sized opening with a sealing grommet is furnished on both inlet splash boxes. A single riser or dual riser may be used.

Every tower is equipped with an FRP outlet sump and that may be rotated 90° in order to line-up with customer's piping arrangement. The outlet is designed for a flanged connection that is field drilled to accommodate various universal piping standards. A drain connection is also located in the sump.

MAKEUP

The amount of water constantly evaporated from a cooling tower varies directly with the heat load applied. In addition to evaporation, water is normally lost to the blowdown (bleed-off) necessary to maintain dissolved solids concentration at an acceptable level in the circulating water system.

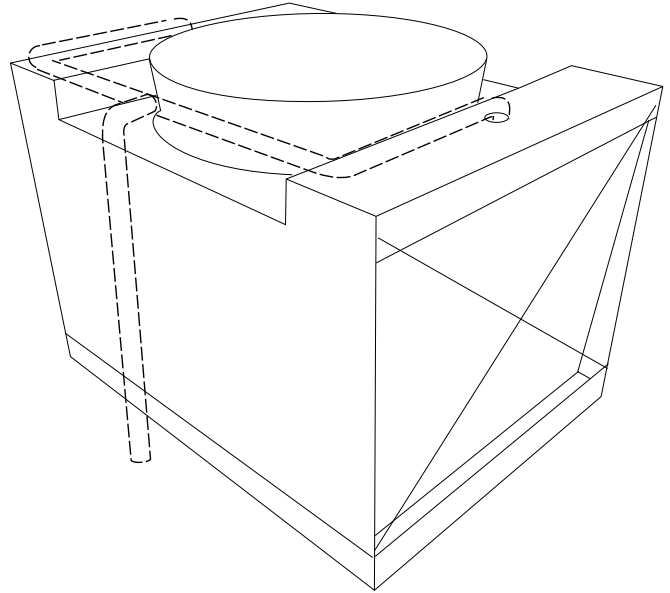
The NX is equipped with one or more float-operated, mechanical makeup valves to automatically replenish this lost water. The tables on this page, calculated for a concentration of 3 times normal, indicate the rate of water loss—and the size of valve(s) required. If your installation's cold water basin will drain by gravity to a remote storage tank—or if you plan a separate means of controlling makeup water—a price reduction is available for deleting the Marley valve(s).

An additional 1" quick makeup connection is provided to allow for quick fill of the tower. See **NX User Manual** for more information.

In most instances cooling towers will see the highest water usage at design heat load. Off design conditions (99% of the time) water usage will be less. For a better understanding of how much water your application will use throughout the year, consult our water usage calculator at:

spxcooling.com/water-calculator

If too much water is still being consumed consult your Marley sales representative for water saving alternatives.



| Tower m ³ /hr | Makeup Water Flow Required – m ³ /hr to Maintain Three (3) Concentrations | | | | | |
|--------------------------|--|-----|-----|------|------|------|
| | Cooling "Range" (hot water minus cold water) | | | | | |
| | 3°C | 6°C | 8°C | 12°C | 17°C | 24°C |
| 45 | .5 | .7 | .9 | 1 | 2 | 2 |
| 91 | .7 | 1 | 2 | 2 | 3 | 5 |
| 136 | .9 | 2 | 3 | 3 | 5 | 7 |
| 182 | 1 | 2 | 3 | 5 | 7 | 9 |
| 227 | 2 | 3 | 4 | 6 | 9 | 11 |
| 341 | 2 | 4 | 7 | 9 | 13 | 17 |
| 454 | 3 | 6 | 9 | 11 | 17 | 23 |

NOTE

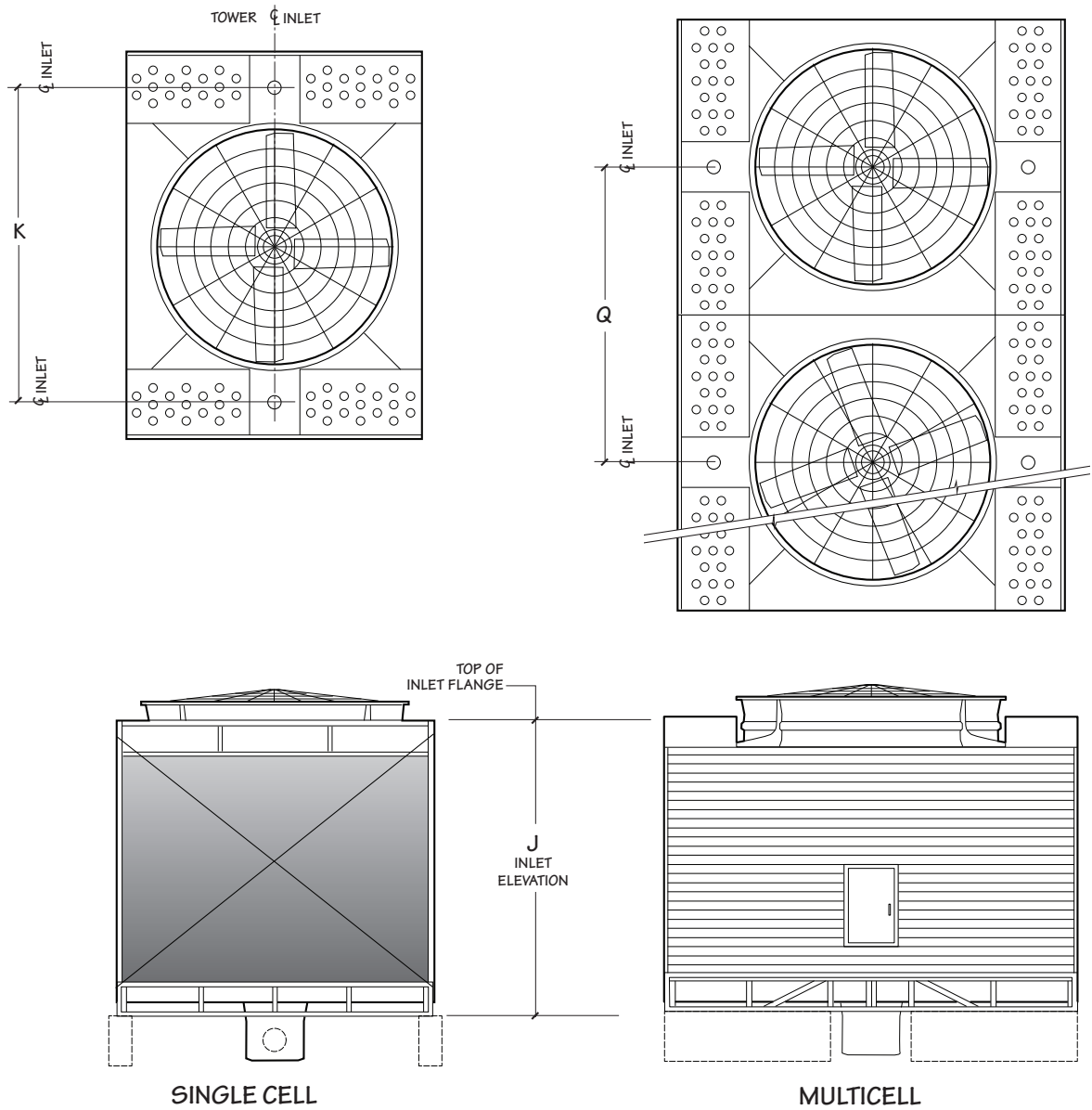
If circulating water is to be maintained at 2 concentrations instead of 3, multiply table m³/hr values by 1.36 before sizing makeup valve.

| Makeup Valve Flow Capacities – m ³ /hr | |
|---|-------------------|
| Pressure at Valve Inlet while flowing–kPa | 1" Diameter Valve |
| 69 | 13 |
| 138 | 18 |
| 207 | 21 |
| 276 | 24 |
| 345 | 27 |

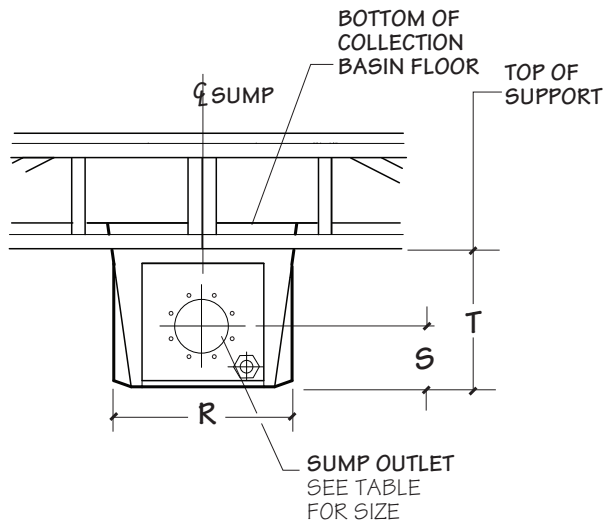
NOTE

- If makeup water pressure exceeds 345 kPa, use a pressure reducer ahead of valve.
- For flow requirements exceeding the above limitations, use multiples of the same size valve.

NX Cooling Tower — Piping Connections



| Model | Dimensions mm | | | Inlet Diameter |
|--------|---------------|------|------|----------------|
| | J | K | Q | size inches |
| NX1010 | 2955 | 2454 | 1634 | 2 at 5" |
| NX1015 | 2975 | 3070 | 2428 | 2 at 5" |
| NX1020 | 3210 | 3340 | 2714 | 2 at 6" |
| NX1025 | 3230 | 3716 | 3390 | 2 at 6" |
| NX2030 | 3272 | 4316 | 3402 | 2 at 6" |
| NX2040 | 4306 | 4574 | 3573 | 2 at 8" |
| NX2050 | 5144 | 4824 | 3827 | 2 at 8" |
| NX2060 | 5782 | 5074 | 4075 | 2 at 8" |



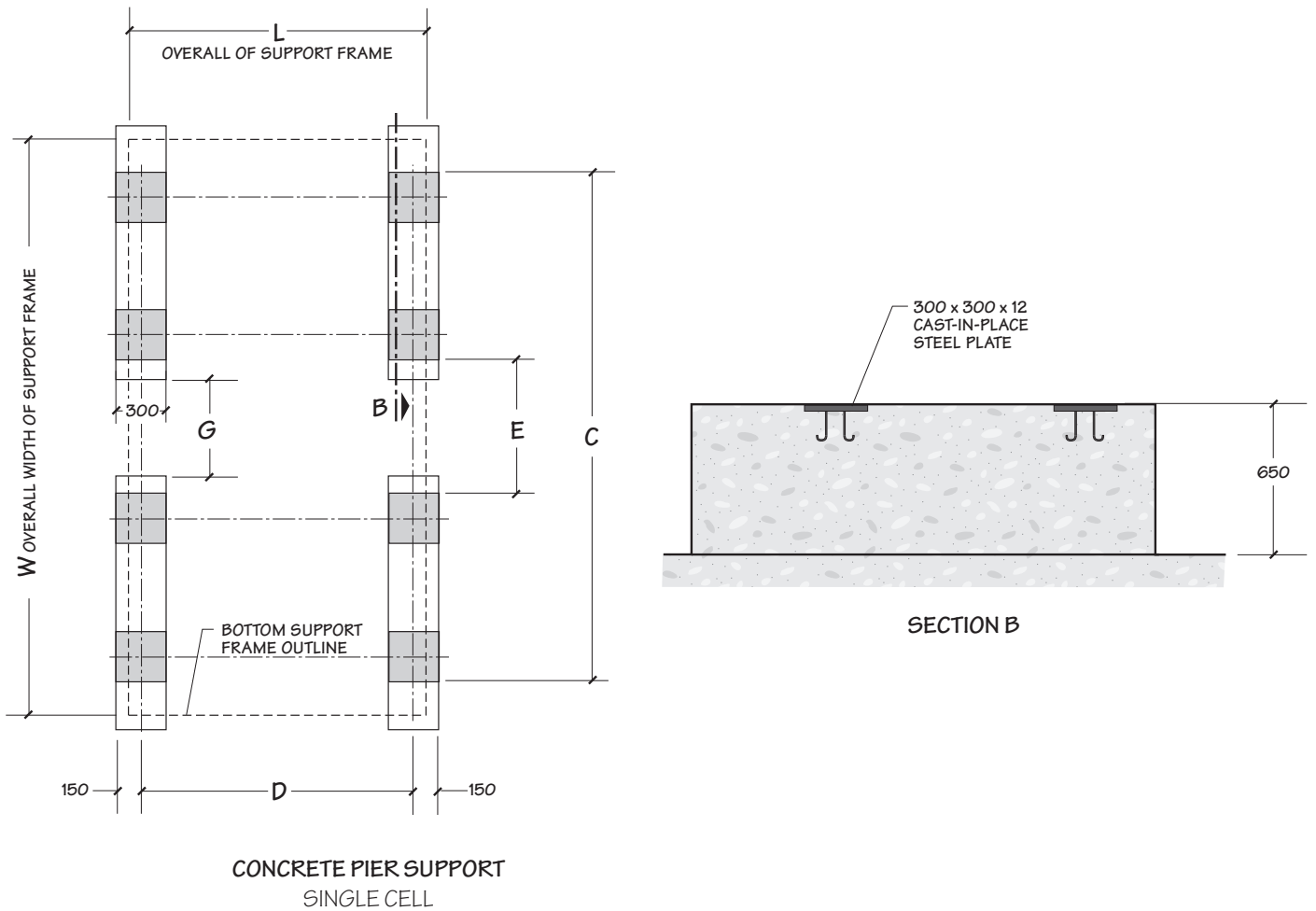
| Model | Dimensions mm | | |
|--------|---------------|-----|-----|
| | R | S | T |
| NX1010 | 472 | 200 | 483 |
| NX1015 | 472 | 200 | 463 |
| NX1020 | 630 | 220 | 503 |
| NX1025 | 630 | 220 | 483 |
| NX2030 | 500 | 235 | 536 |
| NX2040 | 500 | 235 | 536 |
| NX2050 | 500 | 235 | 521 |
| NX2060 | 500 | 235 | 501 |

**DEPRESSED SIDE-OUTLET
SUMP CONNECTION**

| Maximum Sump Flow Per Outlet Diameter m ³ /hr | | | | |
|---|-------------------------------|-----|-----|-----|
| Model | pump flow w/anti-vortex plate | | | |
| | 6" | 8" | 10" | 12" |
| NX1010 – NX1015 | 218 | | | |
| NX1020 – NX1025 | | 316 | | |
| NX2030 | | 356 | | |
| NX2040 – NX2050 | | | 556 | |
| NX2060 | | | | 801 |

NOTE

- Flow rate may be limited by the maximum flow for unit size.



| Model | Dimensions mm | | | | | | Design Operating Weight/Cell kg |
|--------|---------------|------|------|------|------|-----|---------------------------------|
| | L | W | C | D | E | G | |
| NX1010 | 1674 | 3244 | 3504 | 1634 | 570 | 570 | 2271 |
| NX1015 | 2468 | 3860 | 4120 | 2428 | 570 | 570 | 3275 |
| NX1020 | 2754 | 4130 | 4390 | 2714 | 570 | 570 | 4093 |
| NX1025 | 3440 | 4504 | 4754 | 3390 | 570 | 570 | 5259 |
| NX2030 | 3470 | 5254 | 3959 | 3402 | 1056 | 770 | 7902 |
| NX2040 | 3641 | 5314 | 4017 | 3573 | 1056 | 770 | 9084 |
| NX2050 | 3895 | 5406 | 4110 | 3827 | 1056 | 770 | 10617 |
| NX2060 | 4143 | 5536 | 4233 | 4075 | 1056 | 770 | 12286 |

NOTE

- 1 Use this bulletin for preliminary layouts only. Obtain current drawings from your Marley sales representative for final design.
- 2 Piers should be level. Adequate clearance for piping and maintenance must be provided.
- 3 See page 21 for optional steel foundation piers.
- 4 Design operating weight occurs with collection basin full to overflow level. Actual operating weight varies with flow and piping scheme.
- 5 Obtain current drawings from your Marley sales representative for final dimensions.

When the ambient air temperature falls below 0°C, the water in a cooling tower can freeze. Marley white paper *Thermal Science H-003 “Cooling Towers and Freezing Weather”* describes how to prevent freezing during operation. Available at spxcooling.com or ask your Marley sales representative for a copy.

During shutdown, water collects in the cold water basin and may freeze solid. You can prevent freezing by adding heat to the water left in the tower—or, you can drain the tower and all exposed pipework at shutdown.

INDOOR STORAGE TANK

With this type of system, water flows from an indoor tank, through the load system, and back to the tower, where it is cooled. The cooled water flows by gravity from the tower to the tank located in a heated space. At shutdown, all exposed water drains into the tank, where it is safe from freezing.


The table lists typical drain-down capacities for all NX tower models. Although we do not produce tanks, many of our representatives offer tanks supplied by reputable manufacturers.

The amount of water needed to successfully operate the system depends on the tower size and flow and on the volume of water contained in the piping system to and from the tower. You must select a tank large enough to contain those combined volumes—plus a level sufficient to maintain a flooded suction on your pump. Control makeup water according to the level where the tank stabilizes during operation.

| NX Drain-Down Capacity | | |
|------------------------|--|---------------------------|
| Model | Range of Tower Design m ³ /hr | Drain Down Maximum liters |
| NX1010 | 14-145 | 1275 |
| NX1015 | 23-218 | 2222 |
| NX1020 | 26-253 | 2775 |
| NX1025 | 32-316 | 3672 |
| NX2030 | 192-416 | 5080 |
| NX2040 | 192-419 | 5707 |
| NX2050 | 210-563 | 6524 |
| NX2060 | 227-680 | 7743 |

NOTE

Volumes shown are maximums for the flow ranges indicated. Actual volumes will usually be less. Contact your Marley sales representative for more specific information.

| Specifications | Specification Value |
|---|--|
| <p>1.0 Base:</p> <p>1.1 Provide an induced draft, crossflow type, field erected, film fill, industrial duty, fiberglass and hot dip galvanized steel cooling tower situated as shown on the plans. The limiting overall dimensions of the tower shall be _____ wide, _____ long, and _____ high. Total operating kW of all fans shall not exceed _____ kW, consisting of _____ @ _____ kW motor(s). Tower shall be similar and equal in all respects to Marley Model _____.</p> <p>2.0 Thermal Performance and Efficiency:</p> <p>2.1 The cooling tower shall be designed for quiet operation and shall produce an overall level of sound not higher than _____ dB(A) measured at _____ ft from the locations in the following table. Sound levels shall adhere to the Cooling Technology Institute (CTI) STD-204 Sound Certification Program when conditionally compliant with the (CTI) STD-201 Thermal Performance Certification Program. Certification must be current and verifiable with a listing in the online CTI Certification Directory. CTI certification documentation shall be submitted with product data and is subject to verification during procurement and commissioning. Equipment not covered by CTI sound and thermal certification programs must be clearly identified as non-conforming by the supplier or manufacturer.</p> <p>2.2 The tower shall be capable of a minimum _____ m³/hr per kW efficiency per ASHRAE Standard 90.1.</p> <p>3.0 Performance Warranty:</p> <p>3.1 CTI Certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the owner to compensate for the performance deficiency.</p> | <ul style="list-style-type: none"> ■ Your specification base establishes the type, configuration, base material and physical limitations of the cooling tower to be quoted. During the planning and layout stages of your project, you will have focused your attention on a cooling tower selection that fits your space allotment, and whose power usage is acceptable. Limitations on physical size and total operating kilowatts avoid the introduction of unforeseen operational and site-related influences. Specifying the number of cells and the maximum fan kW/cell will work to your advantage. <p>The benefit of crossflow towers is that they are inherently easy to operate, access and maintain. Compared to counterflow towers, crossflow towers have a spacious plenum between banks of fill for easy access to all of the tower's internal components, plus the water distribution system is adjacent to the fan deck and can be maintained during operation.</p> <ul style="list-style-type: none"> ■ CTI Certification means that the tower has been tested under operating conditions and found to perform as rated by the manufacturer under those circumstances. It assures the buyer that the tower is not intentionally or inadvertently undersized by the manufacturer. <div style="display: flex; align-items: center;">  <ul style="list-style-type: none"> ■ The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 12.24 m³/hr per kW @ 35/29.5/23.9. There are no efficiency requirements for non-comfort cooling applications. If you want greater efficiency you can require it by specifying a higher ASHRAE Standard 90.1 m³/hr per kW. </div> <p><i>Each model's ASHRAE Standard 90.1 rating can be viewed in our online sizing and selection software at spxcooling.com/update.</i></p> <ul style="list-style-type: none"> ■ Certification alone is not sufficient to assure you that the tower will perform satisfactorily in your situation. Certification is established under relatively controlled conditions, and towers seldom operate under such ideal circumstances. They are affected by nearby structures, machinery, enclosures, effluent from other towers, etc. Responsible and knowledgeable bidders will take such site-specific effects into consideration in selecting the tower—but the specifier must insist by the written specification that the designer/manufacturer guarantee this “real world” performance. Any reluctance on the part of the bidder should cause you some concern. <ul style="list-style-type: none"> ■ Recognizing how important sound control is and how difficult it is to measure cooling tower sound at various locations where background noise may interfere with testing, all published sound data for Marley NXcooling towers is CTI Certified so you can trust that the sound from your cooling tower will meet sound levels as specified. |

| Specifications | Specification Value |
|--|--|
| <p>4.0 Design Loading:</p> <p>4.1 The tower structure, anchorage and all its components shall be designed by licensed structural engineers per the International Building Code to withstand a wind load of 244kg/m² psf. The fan deck and hot water basin covers shall be designed for 2.4kPa live load or a 91kg concentrated load. Guardrails, where specified, shall be capable of withstanding a 450N concentrated live load in any direction. Conforms to ISO 14122 Aprt 3 standards 45 kgf.</p> | <p>■ It is important to understand the distinction between structure and anchorage. Specifying that only the anchorage meet these requirements means the tower can become non-functional, even fall down, yet remain attached to the foundation. Specifying structure will require the tower to remain operational. The indicated design values are the minimums allowed under accepted design standards. They give you assurance that the tower can be operated in a normal cooling tower environment. Most NX models will withstand significantly higher wind and seismic loads. If your geographic location dictates higher wind load or seismic load values, please make the appropriate changes, after discussion with your Marley sales representative.</p> <p>244kg/m² windload—applicable for most applications but consult the local code official for actual requirements. 2.4kPa live load, 450N concentrated load—ensures the tower can be safely accessed for routine maintenance when a guardrail is installed as well ensuring the end user complies with government safety laws.</p> |
| <p>5.0 Construction:</p> <p>5.1 Except where otherwise specified, all components of the cooling tower shall be fabricated of fiberglass and heavy-gauge steel, protected against corrosion by hot dip galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0; a chloride content (NaCl) up to 300 mg/L; a sulfate content (SO₄) up to 250 mg/L; a calcium content (CaCO₃) up to 500 mg/L; silica (SiO₂) up to 150 mg/L; and design hot water temperatures up to 52°C. The circulating water shall contain no oil, grease, fatty acids or organic solvents.</p> <p>5.2 The specifications, as written, are intended to indicate those materials that will be capable of withstanding the above water quality in continuing service, as well as the loads described in paragraph 4.1. They are to be regarded as minimum requirements. Where component materials peculiar to individual tower designs are not specified, the manufacturers shall take the above water quality and load carrying capabilities into account in the selection of their materials of manufacture.</p> | <p>■ In the history of cooling towers, no other coating for carbon steel has exhibited the success and longevity of galvanization in exposure to the normal cooling tower water quality defined at left. No paints, electrostatically-applied coatings or rubberized compounds, however exotic they may be, can approach galvanization's history of success.</p> <p>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 fill is a probability, reasonable attention to the construction materials and/or their coatings is all that is normally required.</p> |

Specifications

Specification Value

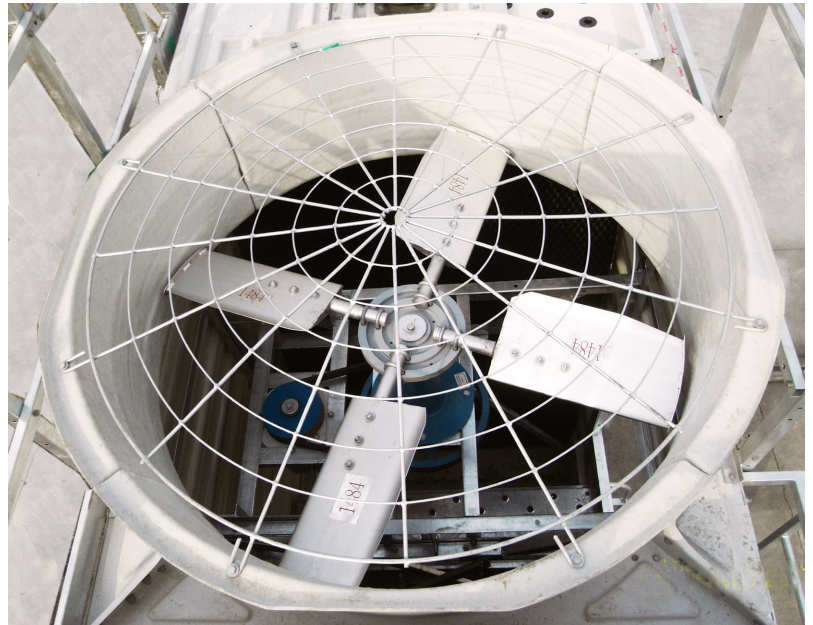
6.0 Mechanical Equipment:

6.1 Fan(s) shall be propeller-type, incorporating aluminum alloy blades and galvanized hubs. Blades shall be individually adjustable. Maximum fan tip speed shall be 66m/s. Fan(s) shall be driven through V-type belts, pulleys and fan shaft with tapered roller bearings with a minimum service factor of 1.0 based on full motor kW.

6.2 Motor(s) shall be ___ kW maximum, TEAO, 1.0 service and specially insulated for cooling tower duty. Speed and electrical characteristics shall be ___ RPM, single-winding, ___ phase, ___ hertz, ___ volts. Motor shall operate in the shaft-vertical position, and nameplate kW shall not be exceeded at design operation.

6.3 The complete mechanical equipment assembly for each cell shall be supported by a rigid steel structural support that resists misalignment between the motor and sheaves. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than eighteen (18) months following the date of tower shipment. This warranty is limited to the fan, fan shaft, bearings, sheaves and the mechanical equipment support. The electric motor, motor components and belt(s) are warranted by their manufacturer.

■ Propeller-type fans require only half the operating kW of blower-type fans. However, they should be readily adjustable to permit compensation for jobsite conditions.



| Specifications | Specification Value |
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7.0 Fill, Louvers and Drift Eliminators:

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

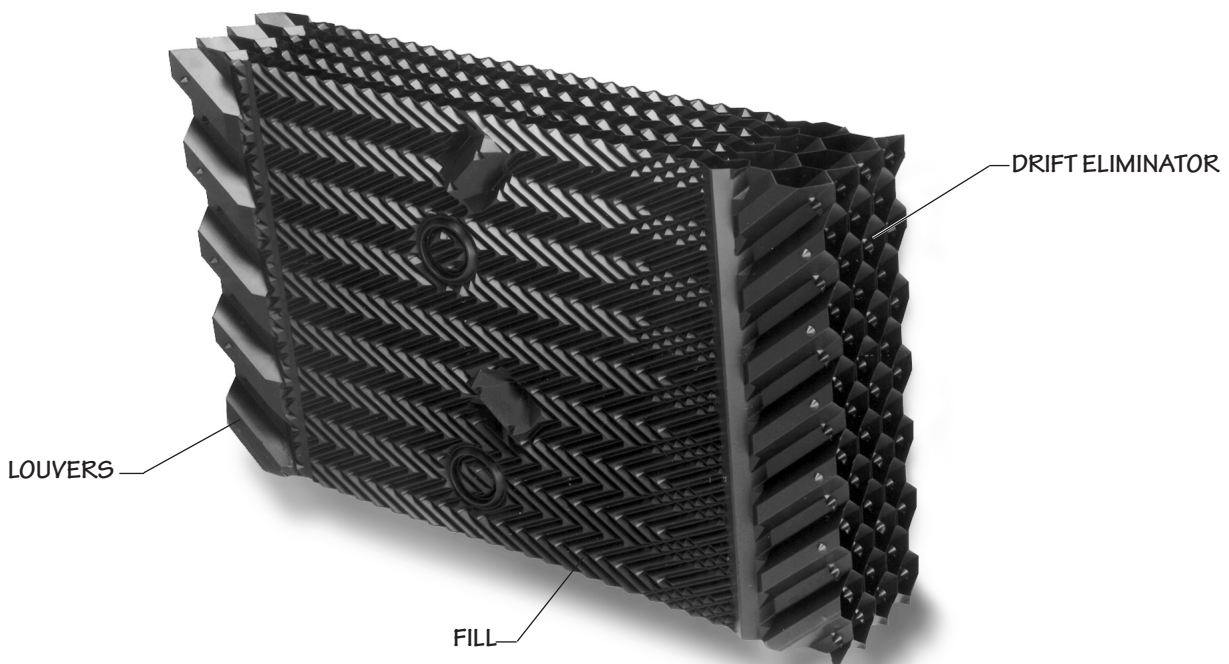
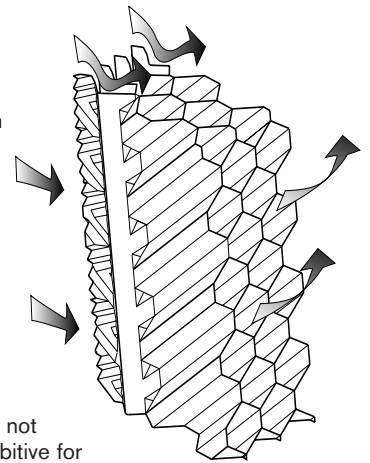
7.2 Drift eliminators formed as part of each fill sheet shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.

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

■ Drift rate varies with design water loading and air rate, as well as drift eliminator depth and number of directional changes. A drift rate of 0.001% is readily available on many standard models. If a lower rate is required, please discuss with your Marley sales representative.

Keep in mind...

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



Specifications

Specification Value

8.0 Hot Water Distribution System:

8.1 Two open basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. The water distribution system shall be accessible and maintainable during tower fan and water operation.

8.2 Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow.

9.0 Casing, Fan Deck and Fan Guard:

9.1 The casing and fan deck shall be FRP with steel sub-structure, and shall be capable of withstanding the loads described in paragraph 4.1. The top of the fan cylinder shall be equipped with a conical, non-sagging, removable fan guard and hot dip galvanized after fabrication. Fan cylinders 1.5m in height and over shall not be required to have a fan guard.

10.0 Access:


10.1 A large fiberglass, rectangular access door shall be located on the cased faces for entry into the cold water basin. Doors shall provide access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system.


■ Gravity-flow distribution basins are a feature of crossflow type towers, resulting in operating pump heads of 3 to 6 meters less than that encountered in counterflow towers with pressurized spray systems. Also, these basins are located where they can be easily inspected—even maintained—while the tower is in operation. Some manufacturers require shutting down the tower to clean the distribution system. Can you afford to do that?



■ The access doors are 70cm wide by 115cm high. Small access doors are prohibitive and discourage maintenance, which in turn can impact your operation. Specifying the size of the door will cause some bidders to take exception, alerting you to a potential maintenance headache.



| Specifications | Specification Value |
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| <p>11.0 Cold Water Collection Basin:</p> <p>11.1 The collection basin shall be fiberglass or Z725 galvanized steel supported by a hot dip galvanized structure and shall include the number and type of outlet connections required to accommodate the out-flow piping system shown on the plans. Outlet connections shall be equipped with debris screens. A factory installed, float operated, mechanical make-up valve shall be included. Additionally a quick-fill makeup connection shall also be supplied to initially fill the tower. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate. Towers of more than one cell shall include flumes for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. A factory-installed, steel walkway extending from one endwall access door to the other endwall shall be provided. The top of the walkway shall be at or above the cold water overflow level.</p> |  |
| <p>12.0 Scope of Work:</p> <p>12.1 The cooling tower manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site. Unless otherwise specified, all supply and return piping, pumps, controls and electrical wiring will be outside the cooling tower manufacturer's scope of work.</p> | <p>■ 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 contracts.</p> |

| Specifications | Specification Value |
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| <p>Convenience and Safety Options</p> | |
| <p>Guardrail and Ladder:</p> | |
| <p>10.2 Add the following paragraph in the Access section: The top of the tower shall be equipped with a sturdy guardrail, complete with kneerail and toeboard, designed according to ISO 14122 Part 3 standards. Posts, top rails and kneerails shall be 40mm x 25mm rectangular tubing. The guardrail assembly shall be hot dipped galvanized and capable of withstanding a 45 kgf concentrated live load in any direction. Posts shall be spaced on centers of 150cm or less. A 52cm wide HDG ladder shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.</p> | <ul style="list-style-type: none"> ■ The NX cooling tower has been designed to minimize the need for maintenance personnel to get on top of the tower to perform maintenance and inspections. ■ Many towers are installed such that the base of the tower is 61 cm or more above the roof or grade level. This makes it difficult to get up to the foot of the attached ladder. The ladder extension alleviates this problem. Marley ladder extensions are available in standard 1.5m and 3.3m lengths. ■ To meet ISO guidelines, towers whose fan decks are 6m or more above roof or grade, and which are equipped with ladders, should have safety cages surrounding the ladders, but with approximately 2m clear headroom. |
| <p>10.2 Add the following to the end of the above paragraph: Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the roof /grade level to the base of the tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the tower ladder; and anchoring it at its base.</p> | |
| <p>Ladder Extension:</p> | |
| <p>10.3 Add the following paragraph in the Access section: A heavy gauge galvanized steel safety cage shall surround the ladder, extending from a point approximately 2.6m above the foot of the ladder to the top of the handrail.</p> |  |

| Specifications | Specification Value |
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Access Door Ladder

10.2 **Add the following paragraph in the Access section:** A 38cm wide HDG ladder shall be permanently attached from the access door to the base of the tower.

Ladder Safety Gate:

10.2 **Add the following paragraph in the Access section:** A welded galvanized steel, self-closing gate shall be provided at the guardrail level of the ladder.

Miscellaneous Options

Sound Control

1.2 **Add the following paragraph under Base:** The cooling tower shall be quiet operation, and shall produce an overall level of sound not higher than _____ dB(A) measured at _____ m from the locations in the table below.

| Location | 63 | 125 | 250 | 500 | 1000 |
|------------|----|-----|-----|-----|------|
| Discharge | | | | | |
| Air Inlet | | | | | |
| Cased Face | | | | | |

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

■ A galvanized self-closing gate located at the guardrail level of the fan deck.

■ Sound produced by a standard NX Cooling Tower operating in an unobstructed environment will meet all but the most restrictive noise limitations—and will react favorably to natural attenuation. Where the cooling tower has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance—by about 5 or 6 dB(A) each time the distance doubles.

- Where only a slight reduction in noise will satisfy—and the source of concern is in a particular direction—merely turning the cooling tower may be the answer. Less sound emanates from the cased face of the cooling tower than does from the air intake face.

■ Tip Speed—unlike thermal performance, no certification program exists for sound. While Marley conducts actual sound tests on all its configurations there are only a few ways for the client to ensure they get a quiet tower.

- One is to conduct a field sound test after installation. On-site testing after installation can however be inaccurate depending on the environment.
- Specifying fan blade tip speed is one way to physically force the tower selection to be quiet. Tip speed is easily checked by multiplying the fan rpm by the fan circumference at the blade tip (π fan dia). Over 61m/s is considered high by most people. 51-61 is considered typical and expected. 41-51 would be considered low noise. Below 41 is difficult to hear above the water noise.



| Specifications | Specification Value |
|---|---|
| <p>Hot Water Distribution Basin Covers:</p> <p><u>81</u> <i>Add the following paragraph in the Hot Water Distribution System section:</i> Each Basin shall be equipped with removable, fiberglass covers capable of withstanding the loads described in paragraph 4.1.</p> | <ul style="list-style-type: none"> ■ Hot water basin covers keep most air borne debris out of the circulating water which can clog distribution nozzles. They also minimize algae growth in the basin. |
| <p>Steel Foundation Piers:</p> <p><u>111</u> <i>Add the following paragraph in the Cold Water Collection Basin section:</i> Welded hot dip galvanized support piers shall be provided to support the cooling tower to adequately clear the bottom outlet sump.</p> | <ul style="list-style-type: none"> ■ Eliminates the need for cast in place support piers. See photo on adjacent page. |

SPX COOLING TECHNOLOGIES MALAYSIA SDN BHD

UNIT 505, BLOCK B, PHILEO DAMANSARA 2
NO. 15 JALAN 16/11 OFF JALAN DAMANSARA
46350 PETALING JAYA, MALAYSIA
60 3 7947 7800 | th.my.enquiry@spx.com
spxcooling.com

sea_NX-TS-26 | ISSUED 06/2026

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