NC® fiberglass
COOLING TOWER

engineering data
and specifications

MARLEY®

NC Fiberglass towers are film fill, 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 NC Fiberglass 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 NC Fiberglass 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 25 thru 34 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 25 thru 30 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 have proven to provide acceptable longevity in normal operating conditions.

Pages 31 thru 34 provide paragraphs intended to add those features, components and materials that will customize the cooling tower to meet the user's requirements.

THE NC—QUIET BY DESIGN

The NC 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 more options than any other cooling tower on the market today.

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 NC 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. Where noise at a critical point is likely to exceed an acceptable limit, several other options are available—listed below in ascending order of cost impact:

- The Marley "Quiet Package" includes the affordable Quiet Fan mechanical option, optimized to achieve the lowest possible sound levels while maintaining efficiency.

ENCLOSURES

Occasionally, cooling towers are located inside architectural enclosures for aesthetic reasons. Although NC Class 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.

As suggested in the aforementioned Technical Report, it may also be advisable to specify a design wet-bulb temperature ½°C higher than normal to compensate for potential recirculation initiated by the enclosure. You'll benefit from discussing your project with your Marley sales representative.

FREEZE PROTECTION

When the ambient air temperature falls below 0°C, the water in a cooling tower can freeze. *Marley Technical Report #H-003* "Operating Cooling Towers in 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 on page 23 lists typical drain-down capacities for all NC 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.

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 NC User Manual which accompanies the tower and also is available from your local Marley sales representative. For complete water treatment recommendations, consult a competent, qualified water treatment supplier.

⚠ 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.

TYPICAL APPLICATIONS

The NC 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 NC 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.

Choosing the stainless steel sub-structure option, the NC can be confidently applied in unusually corrosive processes and operating environments. However, no single product line can answer all problems, and selective judgement should be exercised in the following situations

APPLICATIONS REQUIRING ALTERNATIVE COOLING TOWER SELECTIONS

Certain types of applications are incompatible with any cooling tower with film fill—whether NC 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. Higher temperature fill materials are available.
- 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

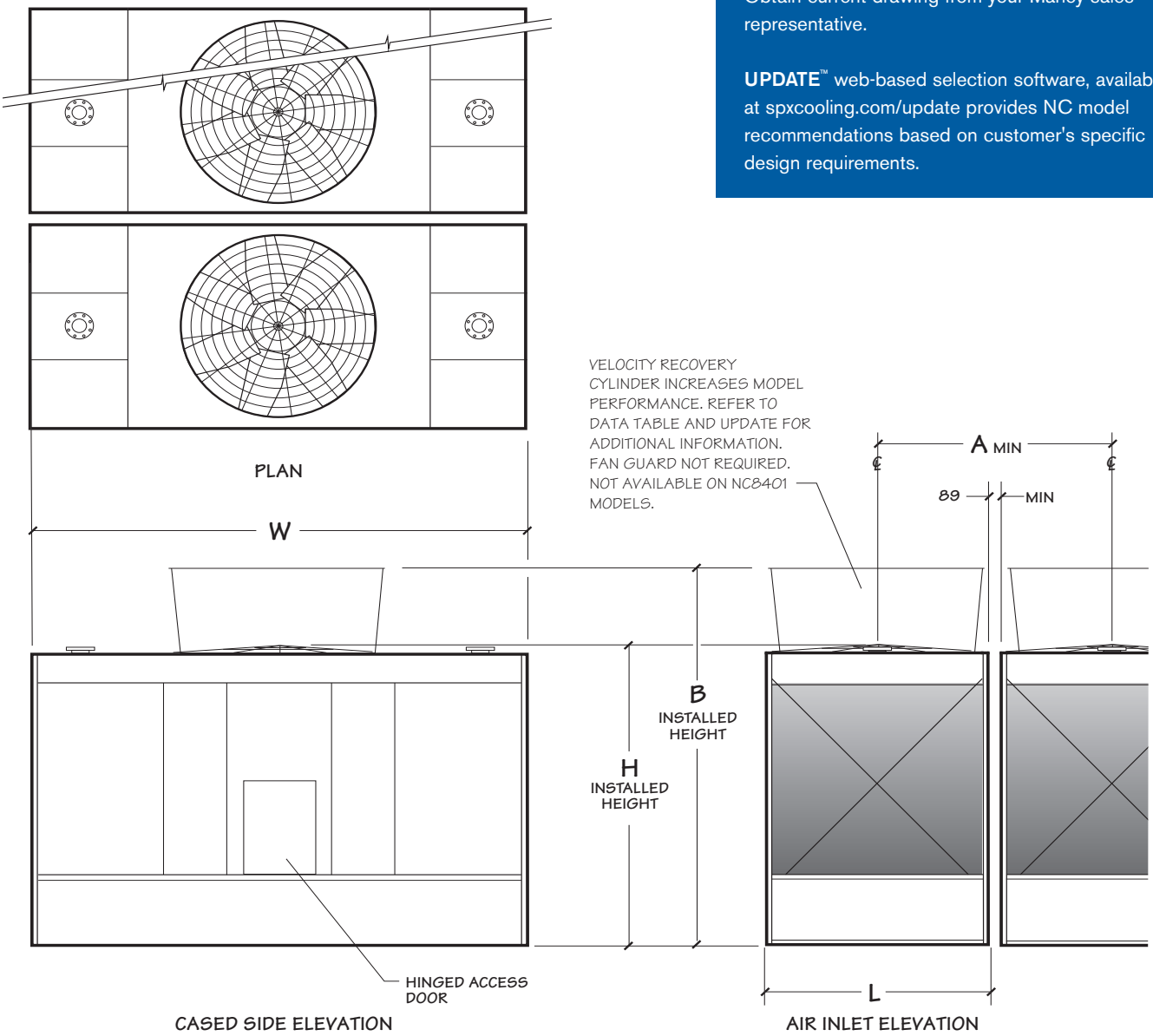
In addition to the NC, SPX Cooling Technologies offers a full scope of products in various designs and capacities to meet the special demands of specific applications.

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

NC8401 NC8402 NC8403 NC8405

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

UPDATE™ web-based selection software, available at spxcooling.com/update provides NC model recommendations based on customer's specific design requirements.



NC8401 NC8402 NC8403 NC8405

Model note 2	Nominal Tons note 3	Nominal Tons with VR Cylinder note 3	Motor kW	Design Operating Weight kg	Dimensions				
					L	W	H	B	A
NC8401G-1	101	–	1.5	3598	1988	3912	3105	–	2077
NC8401H-1	117	–	2.2						
NC8401K-1	139	–	3.7						
NC8401M-1	159	–	5.5						
NC8401N-1	175	–	7.5						
NC8401P-1	198	–	11						
NC8402H-1	156	168	2.2	4489	2559	4318	3124	4495	2648
NC8402K-1	186	199	3.7						
NC8402M-1	212	228	5.5						
NC8402N-1	236	252	7.5						
NC8402P-1	265	283	11						
NC8402Q-1	288	308	15						
NC8403H-1	196	214	2.2	6849	2559	5537	3638	5010	2648
NC8403K-1	237	256	3.7						
NC8403M-1	269	291	5.5						
NC8403N-1	297	320	7.5						
NC8403P-1	329	363	11						
NC8403Q-1	370	398	15						
NC8403R-1	391	422	18.5						
NC8403S-1	420	453	22						
NC8403T-1	448	489	30						
NC8405H-1	242	246	2.2	8068	3016	6071	3651	5023	3105
NC8405K-1	280	292	3.7						
NC8405M-1	318	332	5.5						
NC8405N-1	354	369	7.5						
NC8405P-1	403	420	11						
NC8405Q-1	442	461	15						
NC8405R-1	469	491	18.5						
NC8405S-1	491	513	22						
NC8405T-1	539	565	30						
NC8405U-1	566	591	37						

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, 29.5°C CW, 25.5°C WB, .681 m^3/hr per ton and standard low sound fans. The ***UPDATE*** web-based selection software provides NC 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. See page 20 for side overflow option.
5 Outlet sizes vary according to flow and arrangement. See pages 20 and 21 for outlet sizes and details.
6 Makeup water connection may be 1" or 2" dia., depending upon tower heat load, water pressure and desired connections. See page 15 for additional information.

NC8407 NC8409

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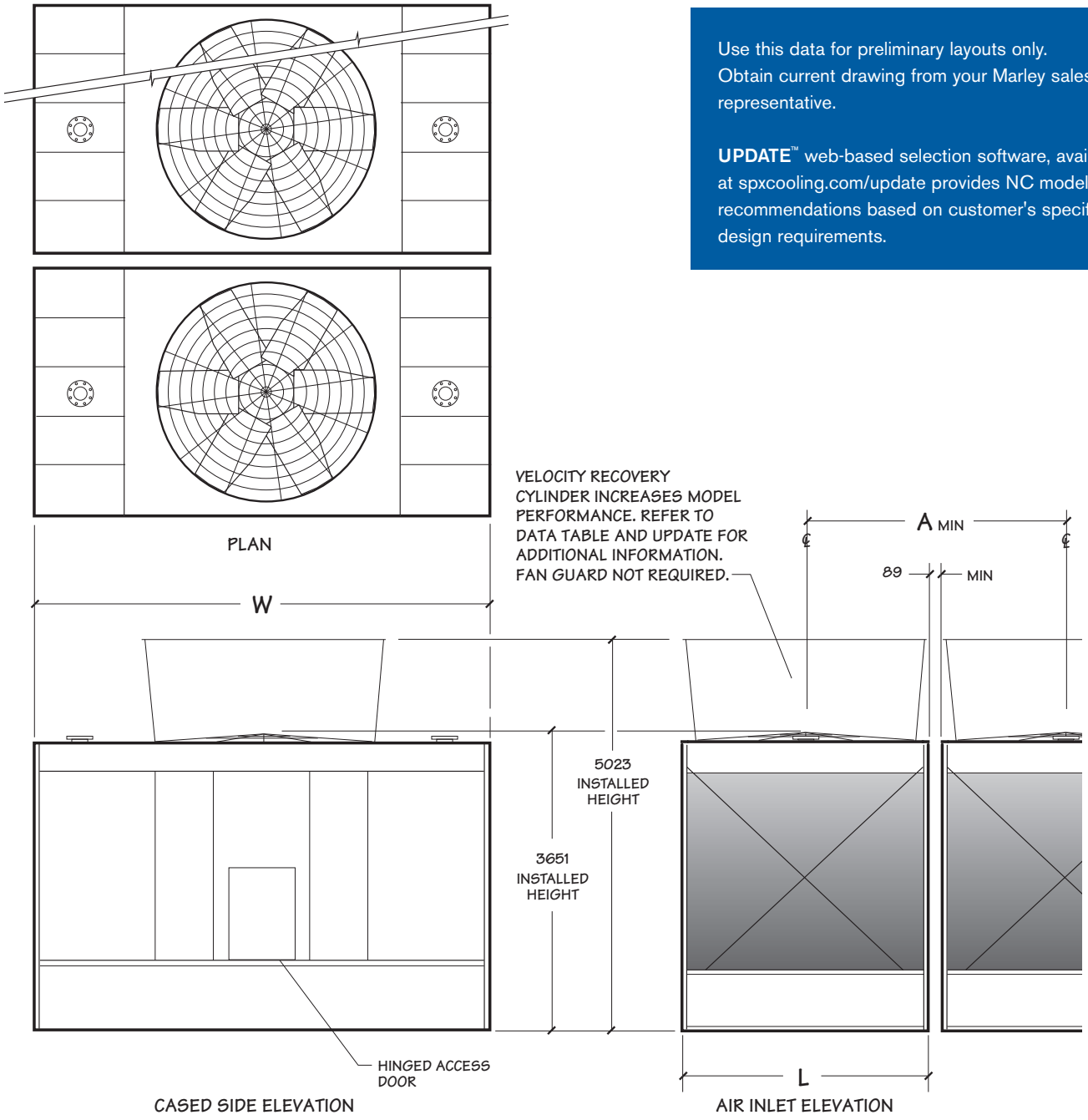
UPDATE™ web-based selection software, available at spxcooling.com/update provides NC model recommendations based on customer's specific design requirements.



NC8407 NC8409

Model note 2	Nominal Tons note 3	Nominal Tons with VR Cylinder note 3	Motor kW	Design Operating Weight kg	Dimensions		
					L	W	A
NC8407K-1	320	330	3.7	10529	3626	6401	3715
NC8407M-1	365	380	5.5				
NC8407N-1	401	418	7.5				
NC8407P-1	458	476	11				
NC8407Q-1	500	524	15				
NC8407R-1	540	564	18.5				
NC8407S-1	571	598	22				
NC8407T-1	623	652	30				
NC8407U-1	670	700	37				
NC8407V-1	703	736	45				
NC8409M-1	417	427	5.5	12313	4235	6833	4324
NC8409N-1	459	472	7.5				
NC8409P-1	524	538	11				
NC8409Q-1	575	591	15				
NC8409R-1	617	634	18.5				
NC8409S-1	650	673	22				
NC8409T-1	715	736	30				
NC8409U-1	768	790	37				
NC8409V-1	808	832	45				
NC8409W-1	841	865	55				

NOTE

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3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB, .681 m^3/hr per ton and standard low sound fans. The ***UPDATE*** web-based selection software provides NC 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. See page 20 for side overflow option.
5 Outlet sizes vary according to flow and arrangement. See pages 20 and 21 for outlet sizes and details.
6 Makeup water connection may be 1" or 2" dia., depending upon tower heat load, water pressure and desired connections. See page 15 for additional information.

NC8410 NC8411 NC8412

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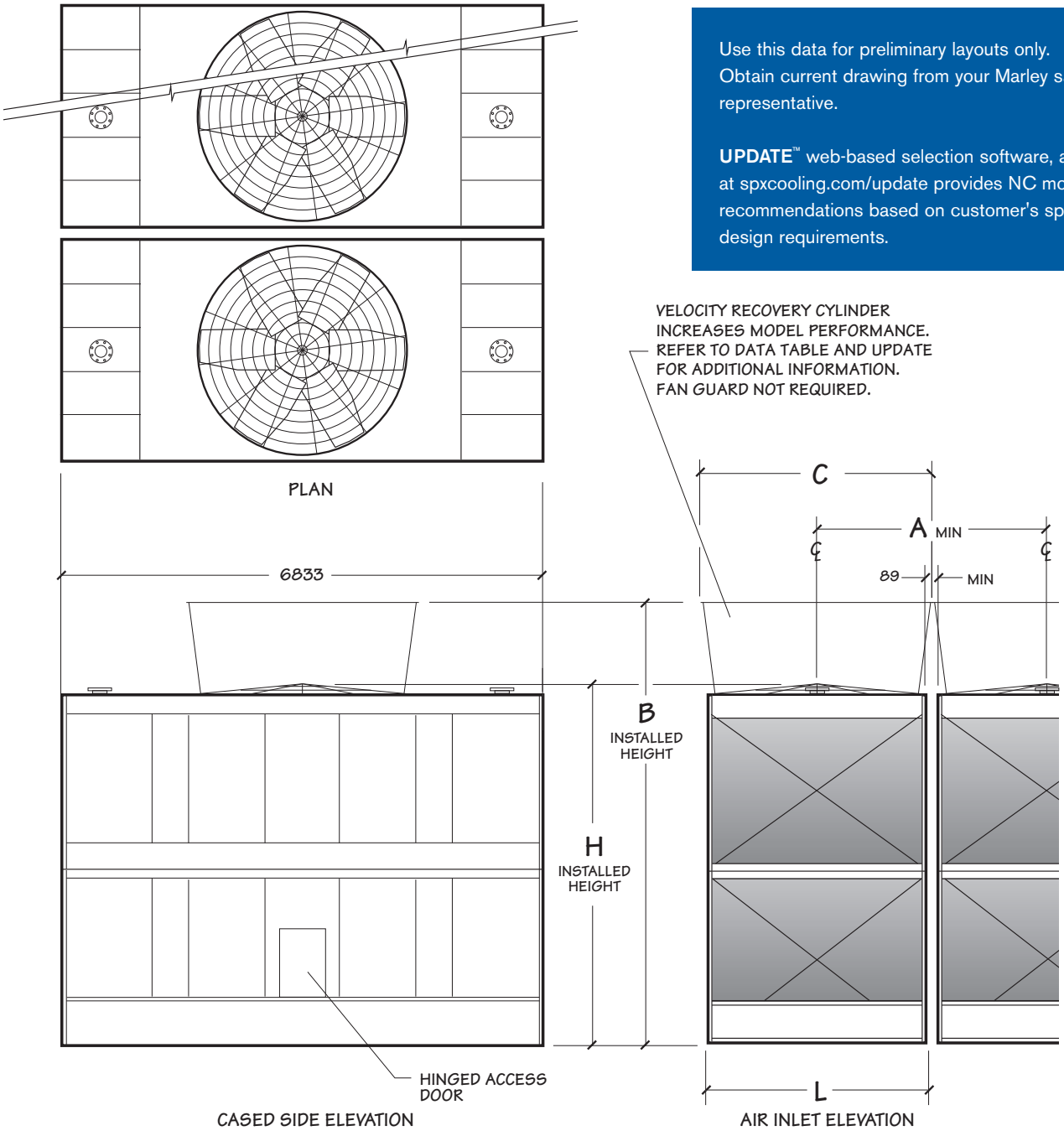

NC 8410 NC8411 NC8412

Model note 2	Nominal Tons note 3	Nominal Tons with VR Cylinder note 3	Motor kW	Design Operating Weight kg	Dimensions				
					L	H	B	A	C
NC8410N-1	498	522	7.5	13945	3626	4877	6248	3715	3585
NC8410P-1	566	593	11						
NC8410Q-1	620	654	15						
NC8410R-1	667	701	18.5						
NC8410S-1	708	744	22						
NC8410T-1	773	812	30						
NC8410U-1	828	872	37						
NC8410V-1	873	922	45						
NC8410W-1	927	966	55						
NC8411N-1	546	575	7.5	15402	3626	5742	7114	3715	3585
NC8411P-1	615	651	11						
NC8411Q-1	672	710	15						
NC8411R-1	717	761	18.5						
NC8411S-1	756	797	22						
NC8411T-1	822	864	30						
NC8411U-1	875	920	37						
NC8411V-1	920	973	45						
NC8411W-1	975	1032	55						
NC8412P-1	693	730	11	17579	4235	5742	7114	4324	4196
NC8412Q-1	757	793	15						
NC8412R-1	807	847	18.5						
NC8412S-1	852	893	22						
NC8412T-1	926	971	30						
NC8412U-1	988	1032	37						
NC8412V-1	1038	1085	45						
NC8412W-1	1107	1156	55						
NC8412X-1	1185	1240	75						

NOTE

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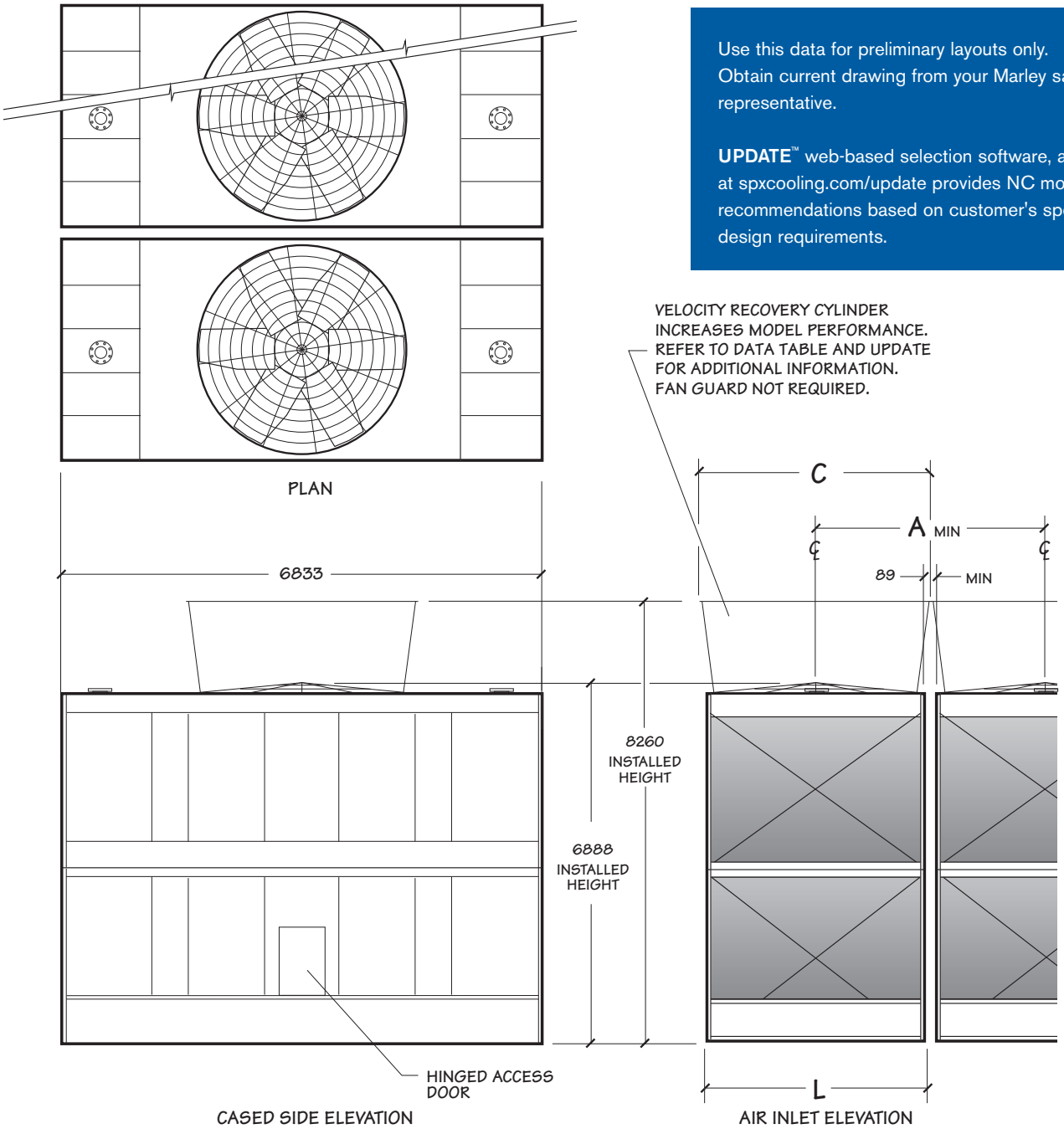
4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining. See page 20 for side overflow option.
5 Outlet sizes vary according to flow and arrangement. See pages 20 and 21 for outlet sizes and details.
6 Makeup water connection may be 1" or 2" dia., depending upon tower heat load, water pressure, and desired connections. See page 15 for additional information.

NC8413 NC8414



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

UPDATE™ web-based selection software, available at spxcooling.com/update provides NC model recommendations based on customer's specific design requirements.

NC8413 NC8414

Model note 2	Nominal Tons note 3	Nominal Tons with VR Cylinder note 3	Motor kW	Design Operating Weight kg	Dimensions		
					L	A	C
NC8413N-1	598	640	7.5	17321	3626	3715	3585
NC8413P-1	674	728	11				
NC8413Q-1	732	781	15				
NC8413R-1	782	835	18.5				
NC8413S-1	823	878	22				
NC8413T-1	893	957	30				
NC8413U-1	951	1013	37				
NC8413V-1	1001	1065	45				
NC8413W-1	1063	1130	55				
NC8413X-1	1144	1214	75				
NC8414P-1	761	806	11	19753	4235	4324	3729
NC8414Q-1	827	876	15				
NC8414R-1	883	933	18.5				
NC8414S-1	927	980	22				
NC8414T-1	1009	1066	30				
NC8414U-1	1074	1133	37				
NC8414V-1	1126	1185	45				
NC8414W-1	1201	1264	55				
NC8414X-1	1288	1358	75				
NC8414Y-1	1370	1455	90				

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4 Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining. See page 20 for side overflow option.
5 Outlet sizes vary according to flow and arrangement. See pages 20 and 21 for outlet sizes and details.
6 Makeup water connection may be 1" or 2" dia., depending upon tower heat load, water pressure, and desired connections. See page 15 for additional information.

Tired of having to design your piping and tower layout to accommodate the standards of cooling tower manufacturers? Marley's multiple variety of piping systems accommodates your design intentions to make your layout of the NC both expedient and economical.

- Single or dual hot water inlet connections
- Bottom inlet or top inlet connections
- Side or bottom cold water outlet connections
- A variety of makeup, overflow and drain options

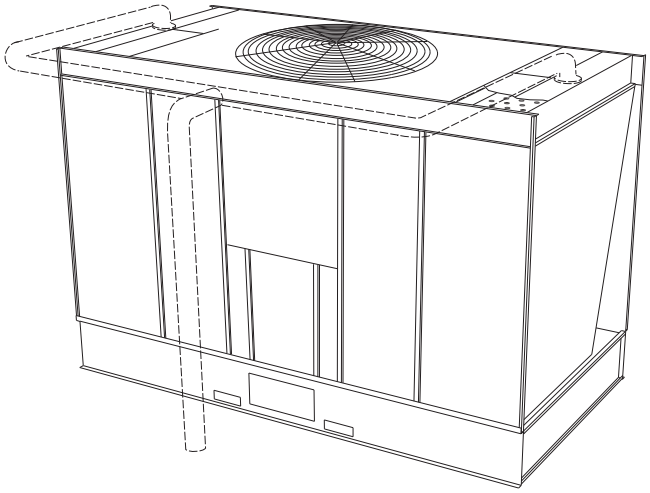
For the single inlet connection all piping to the distribution basins is part of the tower package. Installation and design costs are reduced and the need for extra piping and supports are eliminated. The single bottom inlet connection is perfect for multicell applications—keeping all the inlet piping below the tower.

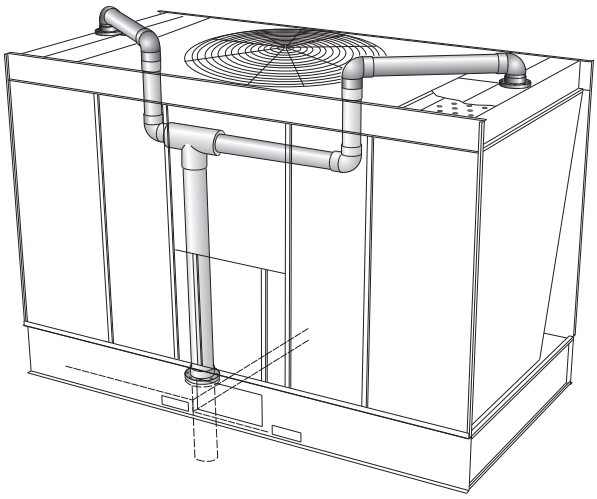
Unless otherwise specified, single-cell towers normally have a cased-face outlet appropriate for the design water flow rate—see pages 20 and 21. This usually assures the lowest possible installed tower elevation.

Outlet piping can be kept below the cold water basin level by choosing either a depressed sump or a bottom outlet connection in lieu of the cased-face outlet. Both outlet designs conform to standard class 125 ANSI pipe flange specifications. Easily removable debris screens are optional on bottom outlets and are standard on all other outlet arrangements. Depressed sumps are made of FRP.

Multicell towers, intended to operate together as a common unit, are joined by FRP flumes between the collection basins. These flumes equalize the operating water level between basins and also provide a flow passage from cells not equipped with outlets or makeup valves, often eliminating the need to specify an outlet and makeup valve for each cell on a multicell installation. Select the number of outlets required to maintain a maximum flow of 311 m^3/hr through each flume for NC8401 through NC8405 models and 500 m^3/hr for NC8407 through NC8414 models. Flow values are for cased-face outlets or bottom-outlets without trash screen. Refer to table on page 21 to obtain flow values for sumps and bottom outlets with trash screens.

If each cell is to be equipped with an outlet, cased-face outlets can be used on end cells of multicell towers, but not on interior cells. For direct outlet from each cell on installations of three or more cells, use either the depressed sump or bottom outlet on interior cells.





The best choice for a tower used with a remote or indoor storage tank—see page 24—or on a concrete cold water basin is usually a bottom outlet.

A cased-face outlet equipped tower can be installed on a flat concrete slab if a side drain and overflow are also specified—see page 20. Consult your Marley sales representative for complete information.

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 NC 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).

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/watercalc

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

Makeup Water Flow Required – m^3/hr to Maintain Three (3) Concentrations						
Tower m^3/hr	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
681	4	9	13	17	26	34
908	6	11	17	23	34	45
1135	7	14	21	28	43	57
1362	9	17	26	34	51	68
1816	11	23	34	45	68	91

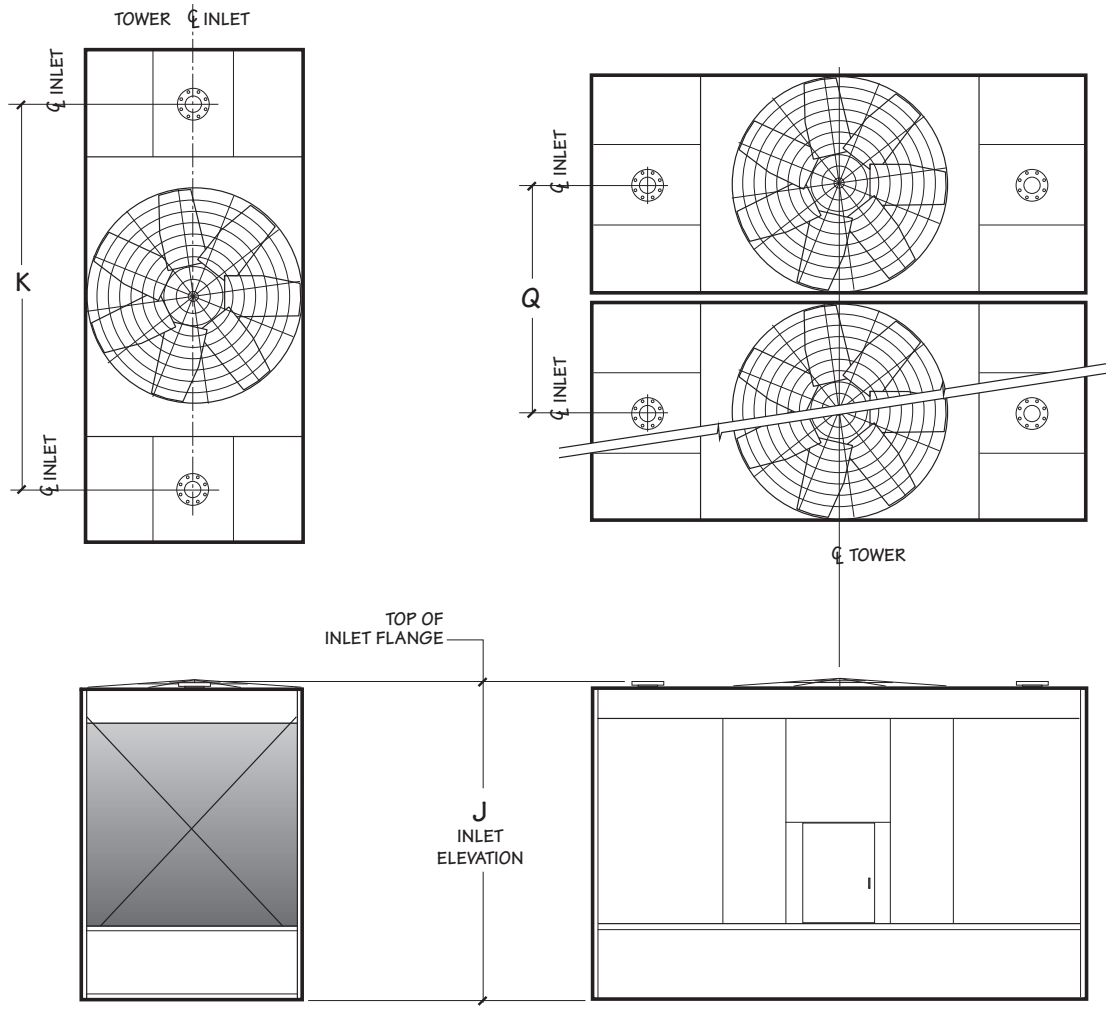
NOTE

- If circulating water is to be maintained at 2 concentrations instead of 3, multiply table m^3/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	2" Diameter Valve
69	13	20
138	18	27
207	21	33
276	24	36
345	27	38

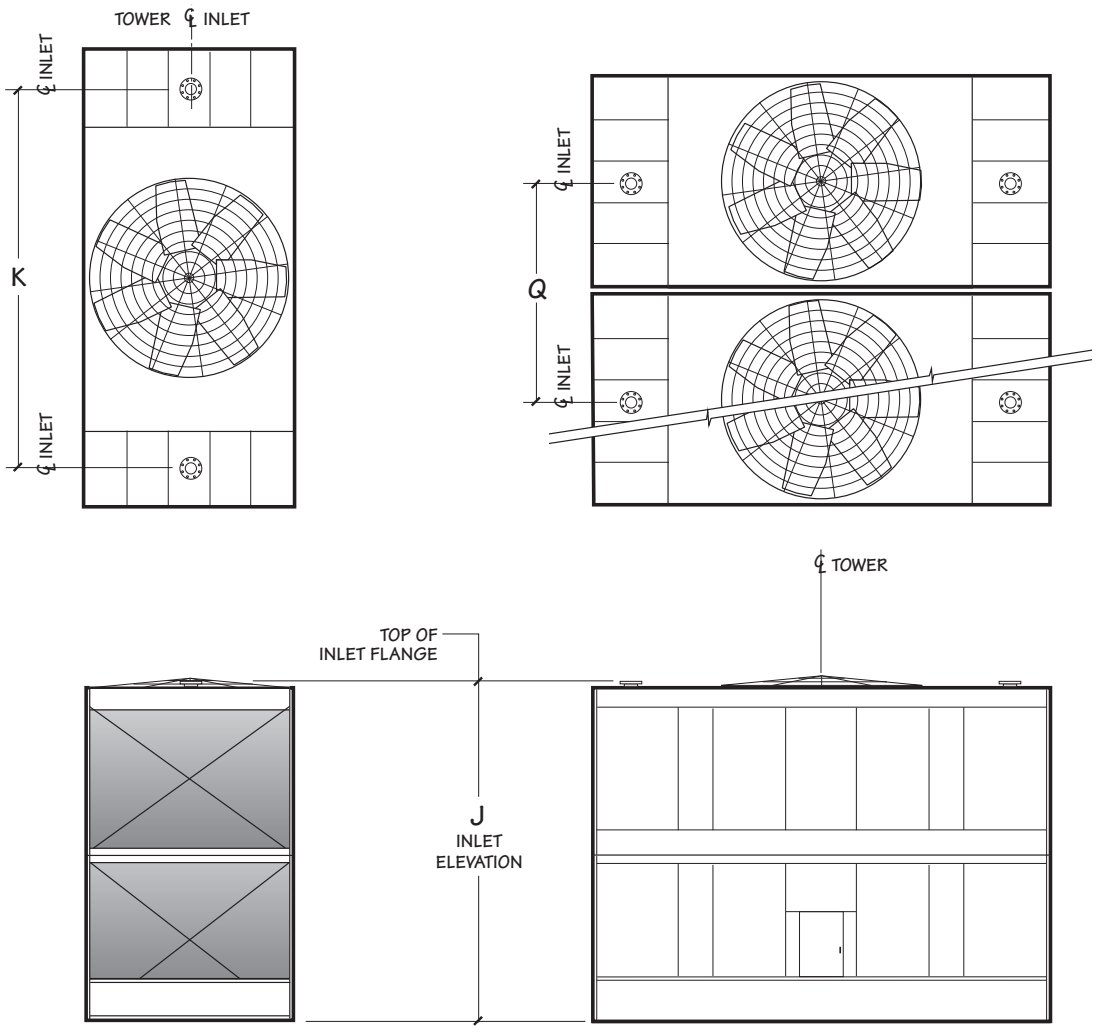
NOTE

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



Model	Dimensions		
	J	K	Q
NC8401	3070	2920	2076
NC8402	3080	3332	2648
NC8403	3606	3956	2648
NC8405	3606	4490	3105
NC8407	3606	4820	3715
NC8409	3606	5252	4324

Inlet Diameter	
flow m^3/hr	size in
110	2 at 4"
170	2 at 5"
240	2 at 6"
430	2 at 8"
670	2 at 10"
810	2 at 12"



SINGLE CELL

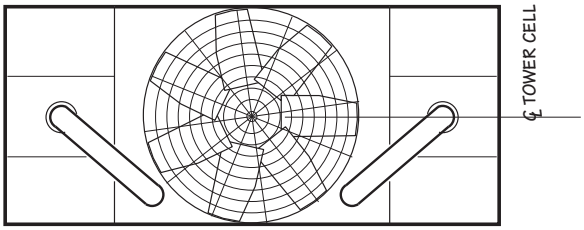
MULTICELL

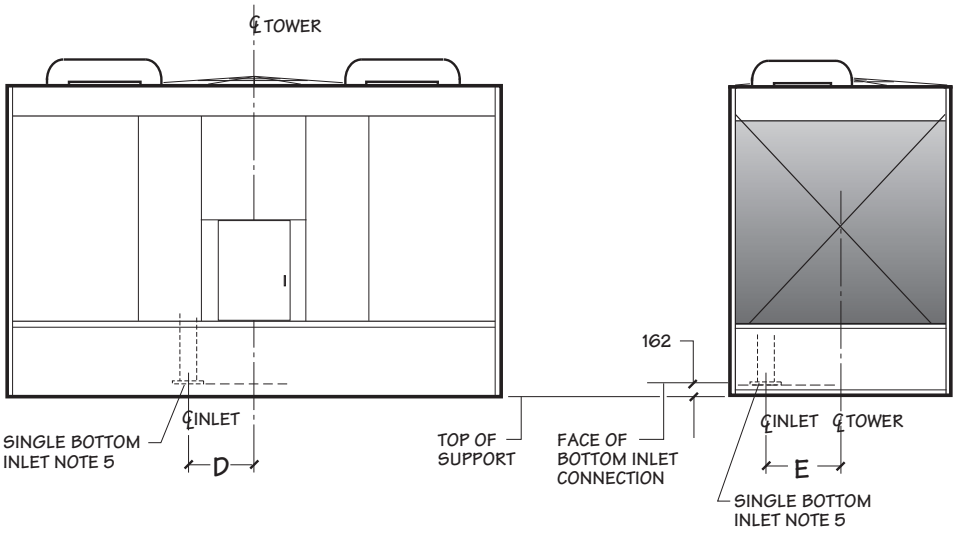
Model	Dimensions		
	J	K	Q
NC8410	4724	5252	3715
NC8411	5698	5252	3715
NC8412	5698	5300	4324
NC8413	6846	5252	3715
NC8414	6846	5300	4324

Inlet Diameter	
flow m^3/hr	size in
110	2 at 4"
170	2 at 5"
240	2 at 6"
430	2 at 8"
670	2 at 10"
960	2 at 12"
1080	2 at 14"

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative.
2 The tower will support the vertical weight of piping shown within the plan area of the tower only. All piping loads, including thrust and lateral loads of riser and horizontal piping must be supported independent of the tower. See inlet piping drawings for details.
3 All piping and supports–and their design–are by others.
4 Allow adequate clearance for entry to tower access doors and safe use of optional ladder. Refer to appropriate Marley drawings.

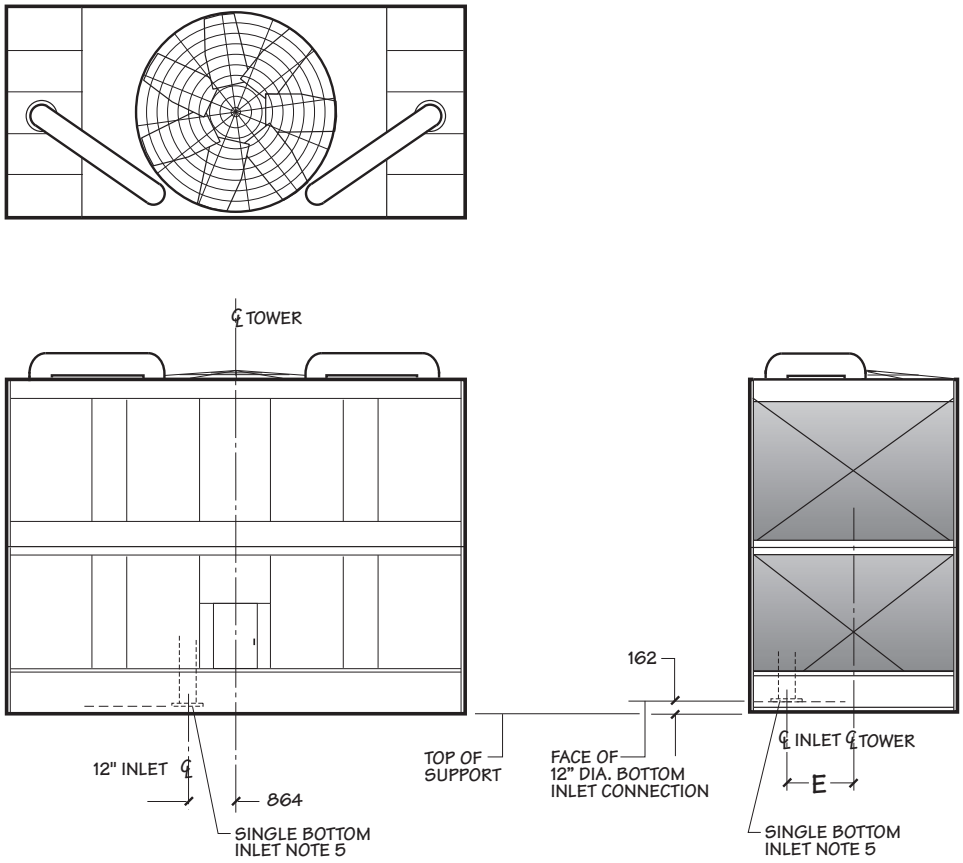




Model	Dimensions		Inlet Diameter
	D	E	in
NC8401	na	na	-
NC8402	722	739	8"
NC8403	725	465	8"
NC8405	810	630	10"
NC8407	816	866	10"
NC8409	869	1461	10"

NOTE

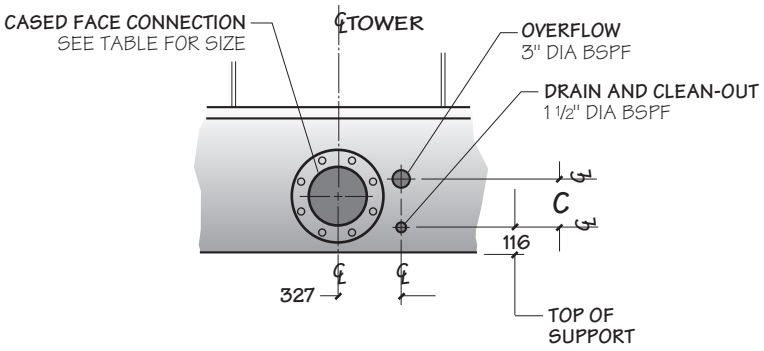
1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative.
2 All external piping loads, including weight, thrust and lateral loads of riser and horizontal piping plus the weight of water in the internal riser must be supported independent of the tower. Internal riser adds additional vertical operating loads to external piping at the bottom inlet flange.
3 All piping and supports beyond the inlet connection–and their design–are by others.
4 Allow adequate clearance for entry to tower access doors and safe use of optional ladder. Refer to appropriate Marley drawings.
5 The bottom inlet connects at the tower collection basin floor. Refer to appropriate Marley drawings.
6 Contact your Marley sales representative for the required pump head for single-inlet applications.
7 Weight of internal piping must be added to tower weights. Contact your Marley sales representative for combined tower weight information.



Model	Dimension	Inlet Diameter
	E	in
NC8410	866	10"
NC8411	866	12"
NC8412	1161	12"
NC8413	866	12"
NC8414	1161	12"

NOTE

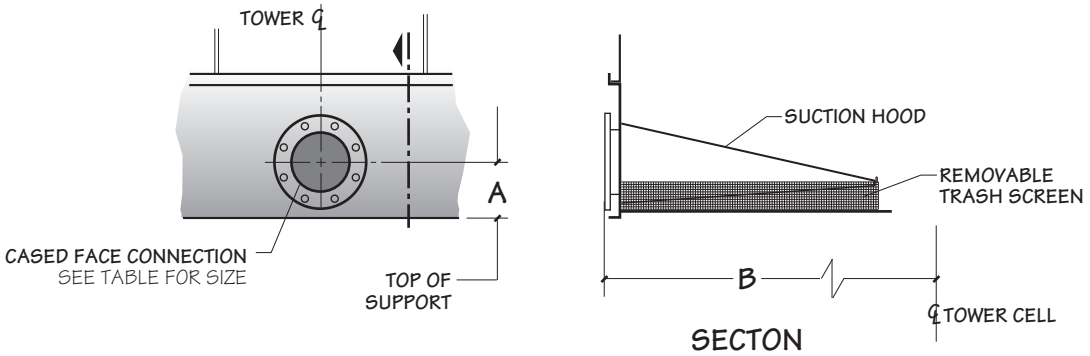
1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative.
2 All external piping loads, including weight, thrust and lateral loads of riser and horizontal piping plus the weight of water in the internal riser must be supported independent of the tower. Internal riser adds additional vertical operating loads to external piping at the bottom inlet flange.
3 All piping and supports beyond the inlet connection–and their design–are by others.
4 Allow adequate clearance for entry to tower access doors and safe use of optional ladder. Refer to appropriate Marley drawings.
5 The bottom inlet connects at the tower collection basin floor. Refer to appropriate Marley drawings.
6 Contact your Marley sales representative for the required pump head for single-inlet applications.
7 Weight of internal piping must be added to tower weights. Contact your Marley sales representative for combined tower weight information.



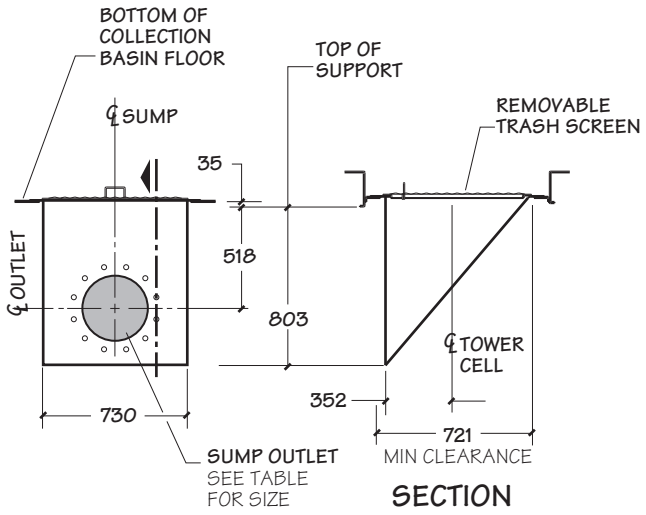
DRAIN AND OVERFLOW CONNECTION
OPTION

NOTE
- Standard overflow is a 4" dia. standpipe in the collection basin floor. The standpipe removes for flush-out and draining.

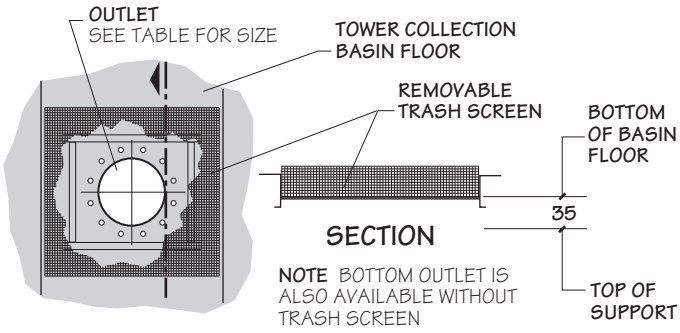
Model	Dimensions		
	A	B	C
NC8401	254	1019	206
NC8402	254	1305	206
NC8403	286	1305	227
NC8405	286	1534	227
NC8407	286	1838	227
NC8409	286	2143	227
NC8410	286	1838	292
NC8411	286	1838	338
NC8412	286	2143	338
NC8413	286	1838	338
NC8414	286	2143	338



CASED-FACE OUTLET CONNECTION



DEPRESSED SIDE-OUTLET SUMP CONNECTION

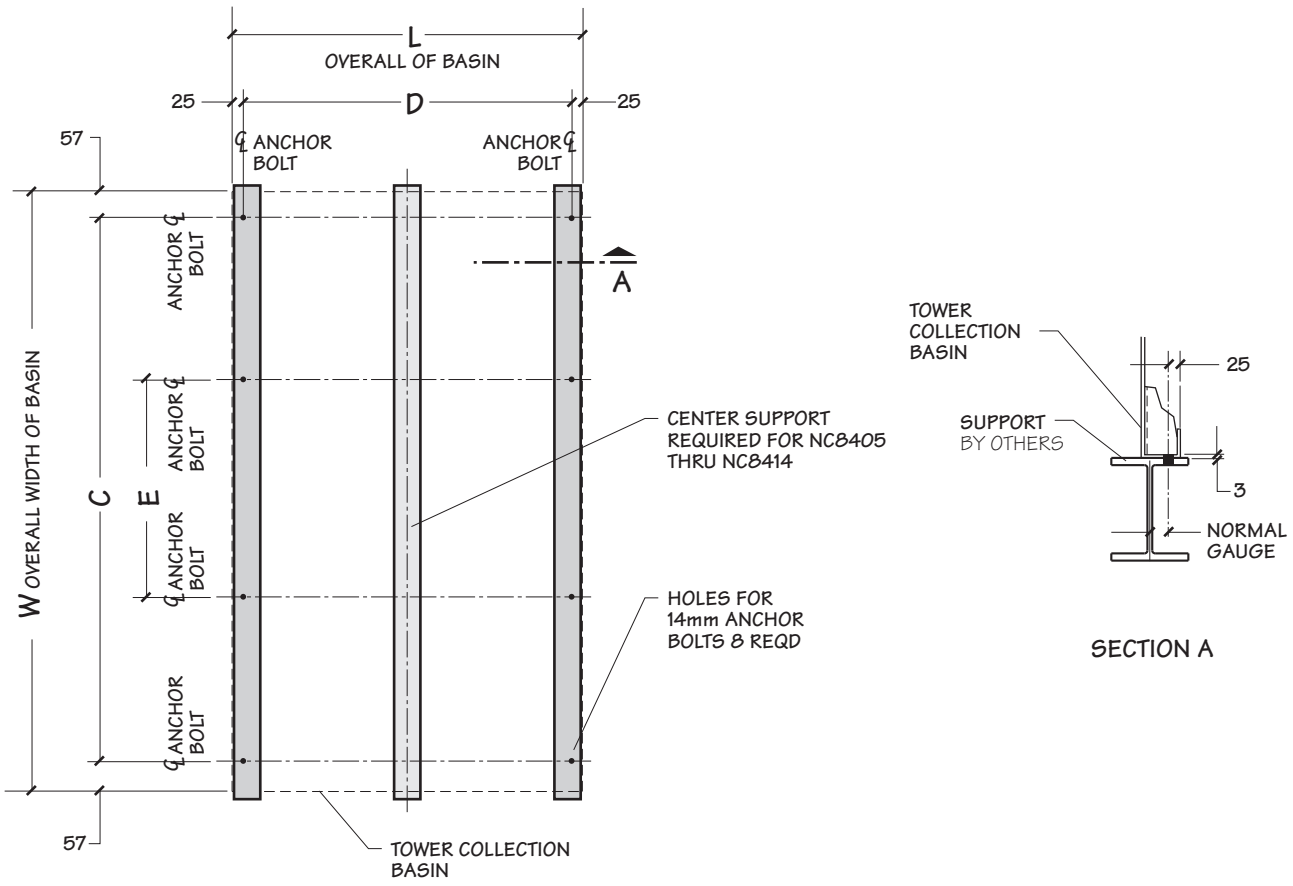


BOTTOM OUTLET CONNECTION

Maximum Flow Per Outlet Diameter m^3/hr											
Outlet Type	Flow Type	Model	Outlet Diameter								
			4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Bottom	pump flow w/ anti-vortex plate or gravity flow w/ or w/o anti-vortex plate	NC8401 thru NC8405	35.6	80.6	143	225.5	320.9	392.7	519	569.9	754.5	912.8
		NC8407 thru NC8414	37.9	86.3	152.8	241	342.9	419.7	554.6	718.6	869.7	1112
	pump flow w/o anti-vortex plate	NC8401 thru NC8414	16.1	36.8	65.2	102.8	146.2	179	236.7	306.4	380.7	552.6
Sump	pump flow w/ anti-vortex plate or gravity flow w/ or w/o anti-vortex plate	NC8401 thru NC8405		204.4	362.3	571.2	812.6	973				
		NC8407 thru NC8414		204.4	362.3	571.2	812.6	994.6				
	pump flow w/o anti-vortex plate	NC8401 thru NC8414		143	253.5	400	568.9	696.1				
Cased-Face Outlet	pump flow only	NC8401 thru NC8405		204.4	362.3	571.2	812.6					
		NC8407 thru NC8414		204.4	362.3	571.2	812.6	994.6				

NOTE

- Flow rate may be limited by the maximum flow for unit size.
- For gravity-flow situations (as to an indoor tank), use bottom outlet or depressed side outlet sump. Cased-face outlet is not recommended for gravity flow.
- Flow limits are the outlet capacities per outlet based on the design operating water level–216mm above the top of support on models NC8401 through NC8405–241mm on NC8407 thru NC8414.

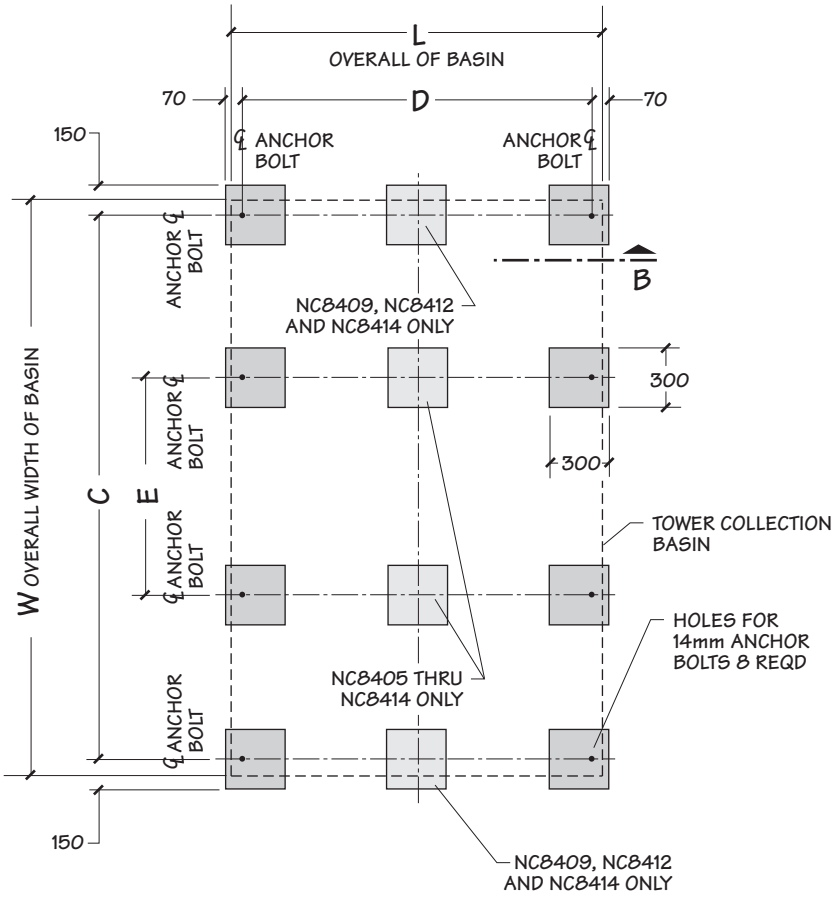


SUPPORTING STEEL
SINGLE CELL

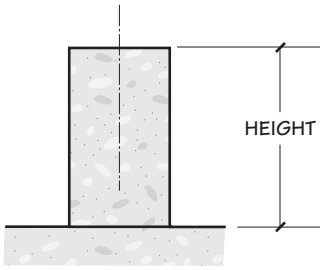
Model	Dimensions					Design Operating Weight/Cell kg	Maximum Design Operating Load at Anchor kg
	W	L	C	D	E		
NC8401	3912	1988	3798	1937	1104	3598	610
NC8402	4318	2559	4209	2508	1104	4489	730
NC8403	5537	2559	5420	2508	1104	6849	1048
NC8405	6071	3016	5953	2965	1138	8068	1061
NC8407	6401	3626	6283	3575	1202	10529	1380
NC8409	6833	4235	6715	4185	1202	12313	1612
NC8410	6833	3626	6715	3575	1202	13945	1789
NC8411	6833	3626	6715	3575	1202	15402	2042
NC8412	6833	4235	6715	4185	1202	17579	2325
NC8413	6833	3626	6715	3575	1202	17321	2323
NC8414	6833	4235	6715	4185	1202	19753	2637

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative for final design.
2 Purchaser to provide tower support complete with holes and anchor bolts. Do not use studs! Anchor points must be framed flush and level at top.
3 Tower may be supported from piers at each anchor bolt location, as a support alternative. Piers should be level. Adequate clearance for piping and maintenance must be provided.
4 Pier height is decided by the main outlet pipe diameter and installation elevation.
5 Design operating weight occurs with collection basin full to overflow level. Actual operating weight varies with flow and piping scheme.
6 Tower may be placed on a flat concrete slab. Side outlet and optional side drain and overflow must be specified. See pages 15 and 20 and consult your Marley sales representative.
7 Dimensions between anchor bolts may vary depending on the number of cells and options. Dimensions shown are for a standard single cell arrangement. Obtain current drawings from your Marley sales representative for final dimension.



CONCRETE PIER SUPPORT
SINGLE CELL



VIEW B

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative for final design.
2 Purchaser to provide tower support complete with holes and anchor bolts. Do not use studs! Anchor points must be framed flush and level at top.
3 Tower may be supported from piers at each anchor bolt location, as a support alternative. Piers should be level. Adequate clearance for piping and maintenance must be provided.
4 Pier height is decided by the main outlet pipe diameter and installation elevation.
5 Design operating weight occurs with collection basin full to overflow level. Actual operating weight varies with flow and piping scheme.
6 Tower may be placed on a flat concrete slab. Side outlet and optional side drain and overflow must be specified. See pages 15 and 20 and consult your Marley sales representative.
7 Dimensions between anchor bolts may vary depending on the number of cells and options. Dimensions shown are for a standard single cell arrangement. Obtain current drawings from your Marley sales representative for final dimension.

Specifications

1.0 **Base:**

1.1 Provide an induced draft, crossflow type, field erected, film fill, industrial duty, fiberglass and 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 _____.

1.2 The cooling tower shall be designed for quiet operation, and shall produce an overall level of sound not higher than _____ dB(A) measured at _____ m from the locations in the following table. Sound levels shall be independently verified by a CTI licensed sound test agency to ensure validity and reliability of the manufacturer's published values. Measurement and analysis of the sound levels shall be conducted by a certified Professional Engineer in Acoustical Engineering. Sound pressure levels are to be measured and recorded in the acoustic near-field and far-field locations using ANSI S1.4 Type 1 Precision instrumentation and in full conformance with CTI ATC-128 test code published by the Cooling Technology Institute (CTI). All low sound options shall be CTI Certified for thermal performance.

Location	63	125	250	500	1000
Discharge					
Air Inlet					
Cased Face					

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

Specification Value

- 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.

  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.

- 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 NC cooling towers has been independently verified by a CTI-licensed test agency so you can trust that the sound from your cooling tower will meet sound levels as specified.

INDEPENDENT SOUND VALIDATION

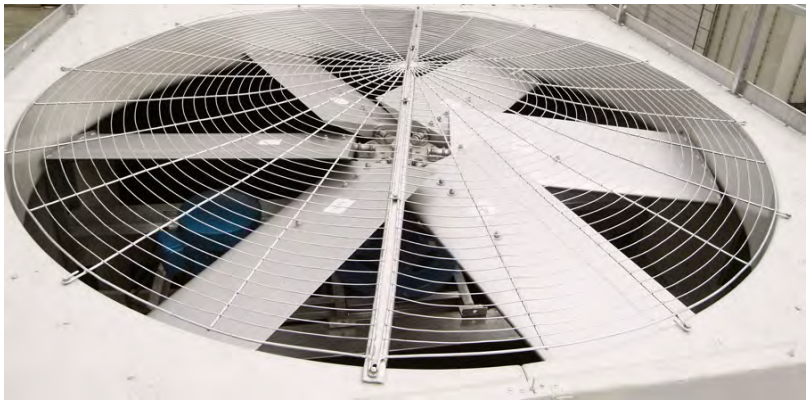
Published sound levels for this evaporative cooling product comply with CTI ATC-128 and have been independently verified by SSA Acoustics, a CTI-licensed sound test agency and industry leader in acoustical engineering.

MARLEY

SSA acoustics

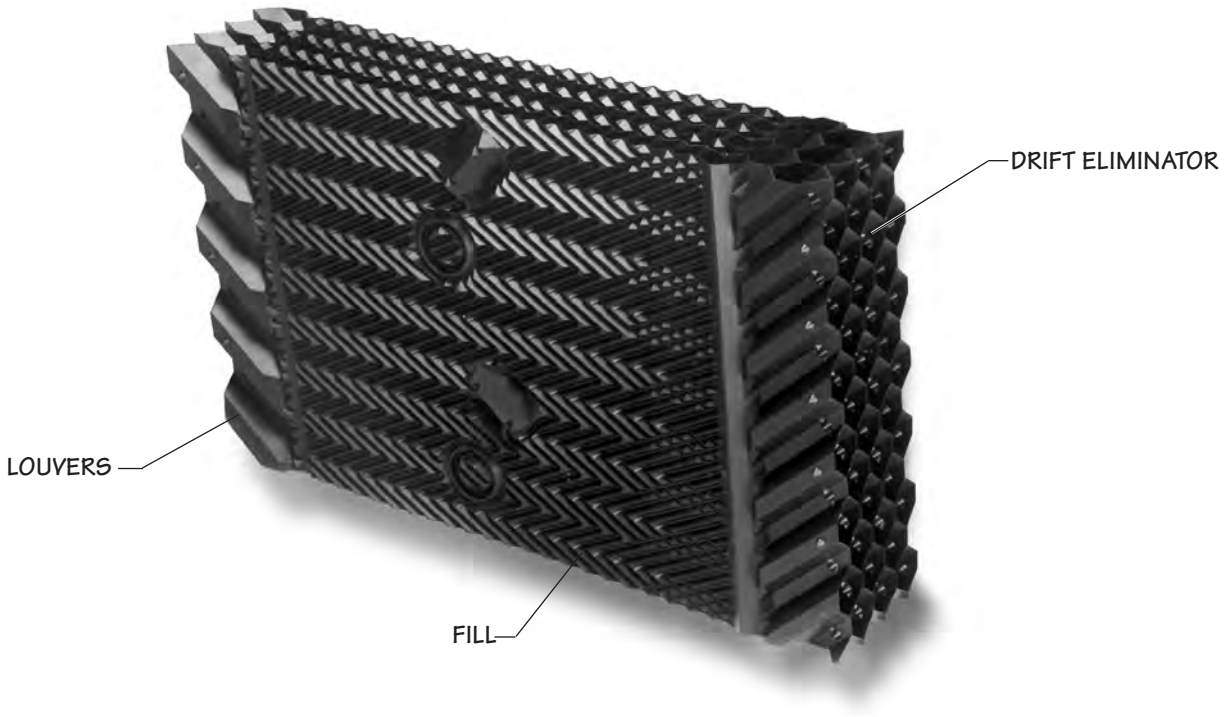
Z0927451_A

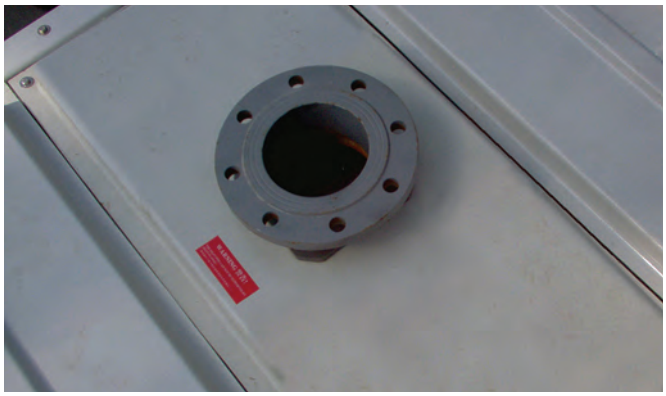
Specifications	Specification Value
2.0 **Thermal Performance and Efficiency:**	
2.1 The tower shall be capable of cooling _____ m^3/hr of water from ____ °C to _____ °C at a design entering air wet-bulb temperature of _____ °C, and its thermal rating shall be Certified by Eurovent and the Cooling Technology Institute.	■ 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.
2.2 The tower shall be capable of a minimum _____ m^3/hr per kW efficiency per ASHRAE Standard 90.1 and China Efficiency standards.	■ The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 8.68 m^3/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 m^3/hr per kW. ***Each model's ASHRAE Standard 90.1 rating can be viewed in our online sizing and selection software at spxcooling.com/update.***
3.0 **Performance Warranty:**	
3.1 CTI and Eurovent 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, Eurovent 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.	■ 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.
4.0 **Design Loading:**	
4.1 The structure and anchorage shall be designed to withstand a wind load of 244 kg/m^2 while operating, based on International Building Code ASCE7-10. 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.	■ 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. If your geographic location dictates higher wind load or seismic load values, please make the appropriate changes, after discussion with your Marley sales representative. ***Some countries and states, like Florida, require structure and anchorage to meet a given loading. Check with your local officials.*** **244 kg/m^2 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.

Specifications	Specification Value
5.0 **Construction:**	
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 Z725 galvanizing or 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 (SO_4) up to 250 mg/L; a calcium content ($CaCO_3$) up to 500 mg/L; silica (SiO_2) 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.	■ 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. 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. If extended longevity of the tower is required–or unusually harsh operating conditions are expected–consider specifying stainless steel as either the base construction material, or the material utilized for specific components of your choice. See Stainless Steel Options on page 25.
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.	
6.0 **Mechanical Equipment**:	
.1 Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 66 m/s. Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, pulleys and tapered roller bearings. Bearings and fan shaft shall be contained in a cast steel housing to ensure proper fan shaft alignment, pillow block bearings shall not be allowed. Bearings shall be rated at an L_{10A} service life of 40,000 hours or greater. *Currently available on all models with 45 kW motors or less.*	■ 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. Unless otherwise specified, motor speed will be 1500 RPM on standard models. Low sound models will use motor speeds appropriate for the specific model. If you prefer the operating flexibility of two-speed operation, please specify two-speed, single-winding or double-winding motors which offer full and half speeds for maximum energy savings. Incidentally, two speed, double-winding motors are a better choice than separate “pony” motors which simply double the problems indicated above and induce parasitic loads during operation for lower than nameplate efficiency.

	Specifications	Specification Value
6.1	*(alternate)* Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 66 m/s. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. All gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater and the gear sets shall have AGMA Quality Class of 9 or greater. The gearbox shall include any modifications to enable operation down to 10% of full speed.	
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 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.	

Specifications	Specification Value
7.0 **Fill, Louvers and Drift Eliminators:**	
7.1 Fill shall be film type, thermoformed of 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.	■ 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. Fill options are available for hot water temperatures up to 60°C.
7.2 Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.	■ Drift rate varies with design water loading and air rate, as well as drift eliminator depth and number of directional changes. The exclusive patent-pending MarKey™ drift eliminator achieves the lowest available drift rates. A drift rate of 0.0005% 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. Each basin shall be equipped with removable, fiberglass covers capable of withstanding the loads described in paragraph 4.1. The water distribution system shall be accessible and maintainable during tower fan and water operation.	■ 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?
8.2 Each basin shall include at least one cast-iron inlet flange for customer piping connection. 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, fabricated of welded 8mm and 7 gauge rods, 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.	■ The access doors on NC8401 and NC8402 towers are 77cm wide by 84cm high. On NC8403 thru NC8414 the access doors are 122cm 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
11.0 **Cold Water Collection Basin**:	
11.1 The collection basin shall be fiberglass supported by a Z725 heavy mill galvanized or 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 float operated, mechanical make-up valve shall be included. 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 steel flumes for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating.	■ The NC tower design offers cased-face outlets, side-outlet sumps and bottom outlets to accommodate a significant variety of piping schemes. Unless so specified, the tower you may be asked to approve may only be available with one type of outlet connection, requiring you to redesign your piping layout.
12.0 **Scope of Work**:	
12.1 The cooling tower manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site and for the erection of the tower over supports provided by others. Unless otherwise specified, all supply and return piping, pumps, controls and electrical wiring will be outside the cooling tower manufacturer's scope of work.	■ 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.

Specifications	Specification Value

Factory Assembly:
Currently available on models 8401 through 8407.

1.1 *Replace paragraph 1.1 with the following:* Provide an induced draft, crossflow type, film fill, industrial duty, fiberglass and 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 _____.

12.1 *Delete paragraph 12.1*

Steel Cold Water Collection Basin:

11.1 *Replace paragraph 11.1 with the following:* The collection basin shall be Z725 galvanized steel and assembled with bolted connections. Tap screws shall not be acceptable due to their potential to develop leaks. The basins shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with debris screens. A float operated, mechanical make-up valve shall be included. 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 that may accumulate. Towers of more than one cell shall include a method for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating.

Stainless Steel:

5.1 *Replace paragraph 5.1 with the following:* Except where otherwise specified, all components of the cooling tower shall be fabricated of fiberglass and heavy-gauge, series 300 stainless steel. The tower shall be capable of withstanding water having a chloride content (NaCl) up to 750 mg/L; a sulfate content (SO4) up to 1200 mg/L; a calcium content (CaCO3) up to 800 mg/; silica (SiO2) up to 150 mg/L; and design operating ranges up to 10°C. The circulating water shall contain no oil, grease, fatty acids, or organic solvents.

■ For pure resistance to corrosion–coupled with the capability to meet stringent fire and building codes–there is no substitute for fiberglass and stainless steel. No paints or electostatically-applied coatings, however exotic they may be, can match stainless steel's ability to withstand adverse operating conditions.

Specifications	Specification Value
Convenience and Safety Options	
Guardrail and Ladder:	
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, toprails 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 159cm or less. A 46cm 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.	■ The NC cooling tower has been designed to minimize the need for maintenance personnel to get on top of the tower to perform maintenance and inspections. For the comfort and safety of your operating personnel, we recommend that you specify a ladder and guardrail–and that you ***require it of all bidders!*** If you prefer a stainless steel guardrail and ladder, replace HDG with S300 stainless steel in the specification.
Ladder Extension:	
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.	■ Many towers are installed such that the base of the tower is 61cm 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.
Ladder Safety Cage:	
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 2150mm above the foot of the ladder to the top of the handrail.	■ To meet ISO guidelines, towers with fan decks of 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.
Additional Ladder	
10.2 *Replace the following paragraph in the Access section:* A 46cm wide HDG ladder shall be permanently attached to each endwall of the tower, rising from the base of the tower to the top of the guardrail.	■ If you prefer a stainless steel ladder, replace HDG with S300 stainless steel in the specification.
Access Door Ladder	
10.2 *Add the following paragraph in the Access section:* A 46cm wide HDG ladder shall be permanently attached from the access door to the top of the guardrail.	■ Ladder extensions are also available with this option. If you prefer a stainless steel ladder, replace HDG with S300 stainless steel in the specification.

Specifications	Specification Value
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.	■ A galvanized self-closing gate located at the guardrail level of the fan deck. Stainless steel is available with the stainless guardrail option.
Plenum Walkway	
10.2 *Add the following paragraph in the Access section:* Provide a factory-installed walkway extending from one endwall access door to the other endwall. This walkway shall be supported by a steel framework, and the top of the walkway shall be at or above the cold water overflow level. Walkway and framework to be equivalent material to tower basin structure.	■ Provides an elevated walkway within the tower plenum.
Interior Mechanical Equipment Access Platform	
10.2 *Add the following paragraph in the Access section:* A factory-installed, elevated platform convenient to the care and maintenance of the tower's mechanical equipment shall be provided. Walkway and framework to be equivalent material to tower sub-structure.	■ Provides an elevated walkway within the tower plenum to access the mechanical equipment.
Miscellaneous Options	
Quiet Fan	
6.1 *Replace paragraph 6.1 with the followig:* Fan(s) shall be propeller-type, incorporating a minimum of seven aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 56 m/s. Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, pulleys, and tapered roller bearings. Bearings and fan shaft shall be contained in a cast steel housing to ensure proper fan shaft alignment, pillow block bearings are not allowed. Bearings shall be rated at an L_{10A} service life of 40,000 hours or greater. *Currently available on all models with 45 kW motors or less.*	■ The Marley "Quiet Package" includes the affordable Quiet Fan mechanical option, optimized to achieve the lowest possible sound levels while maintaining efficiency. ■ 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.
6.1 *(alternate) Replace paragraph 6.1 with the following:* Fan(s) shall be propeller-type, incorporating a minimum of seven aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 56 m/s. Fan(s) shall	

Specifications	Specification Value

be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. The gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater. The gear sets shall have AGMA Quality Class of 9 or greater.

Ultra Quiet Fan:

6.1 *Replace paragraph 6.1 with the following:* Fan(s) shall be propeller-type, incorporating wide-chord acoustic geometry, corrosion and fire resistant marine grade aluminum blades and aluminum hubs. Blades shall be resiliently mounted to fan hub and individually adjustable. Fan blades shall be open cavity with suitable drainage to avoid accumulation of moisture. Foam filled blades are not allowed due to potential moisture contamination of the foam core causing an imbalance of the fan leading to vibration issues. Maximum fan tip speed shall be 51m/s. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. The gearbox bearings shall be rated at an L_{10A} service life of 100,000 hours or greater. The gear sets to have AGMA Quality Class of 9 or greater. *Available on models NC8402 through NC8414.*

■ For more severe cases requiring the lowest possible fan sound levels, the Marley "Ultra Quiet Fan" option is now available on all but the NC8401 NC models. Tower height may increase slightly–obtain current sales drawings from your Marley sales representative for accurate dimensions. If your requirement calls for inlet and outlet attenuation, you might consider the Ultra Quiet fan in lieu of attenuation. Outlet attenuators are not available with the Ultra Quiet Fan option.

Single Hot Water Inlet Connection per Cell:

8.2 *Replace this paragraph with the following:* Each cell of the tower shall include a single hot water inlet connection located below the cold water collection basin. An internal system of piping shall deliver water equally to the distribution basins without the need for balancing valves. This internal piping system shall require no scheduled maintenance, and shall be located such that it does not interfere with normal maintenance access. The internal piping must extend to the tower exterior. Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow.

■ This option reduces what might otherwise be a complex hot water piping layout to a simple, single connection per cell. It also avoids an unsightly (perhaps unsafe) maze of pipe exposed above the top deck of the tower.

Bottom inlet piping lends itself to close-spaced, multicell installations and to those situations where it is appropriate to keep all pipework below the level of the tower.

Specifications	Specification Value
0.38mm PVC Fill:	
7.1 *Replace the following paragraph in the Fill and Eliminator Section:* Fill shall be film type, thermoformed of 0.38 mm thick PVC, with louvers and drift 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.	■ Raises the hot water temperature limit to 52°C. Also offers greater UV stability.
Fan Cylinder Extension:	
9.1 *Add the following paragraph in the Casing, Fan Deck and Fan Guard section:* A fiberglass fan cylinder extension shall be provided to elevate the discharge to a height of_____above the existing fan cylinder.	■ Extensions may be considered necessary in order to elevate the discharge beyond the bounds of an enclosure. Fan cylinders extensions are available in 1m increments.
Motor out of the Airstream:	
6.1 *Add the following to the end of this paragraph:* The motor shall be mounted outside the casing of the tower, and shall be connected to the gear reducer by a dynamically balanced, stainless steel tube and flange driveshaft. *Available only with the Gear Drive option.*	■ For many years, a feature of Marley cooling towers was that the electric motors were located outside the fan cylinders, where they were easily accessible, and where they were not subjected to the constant humidity that exists inside the tower plenum.

NC fiberglass

ENGINEERING DATA AND SPECIFICATIONS

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