MD cooling tower

engineering data
and specifications

MARLEY®

MD towers are galvanized steel, factory assembled, counterflow cooling towers, designed to serve air conditioning and refrigeration systems as well as light to medium industrial process loads on clean water. The Marley MD evolved from a factory-assembled concept of towers pioneered by Marley some 85 years ago, and incorporate all of the design advancements that our customers have found valuable. MD towers represent the current state of the art in this cooling tower category.

The specifications portion of this publication not only relates the language to use in describing an appropriate MD cooling tower—but also defines why certain items and features are important enough to specify with the intention of insisting upon compliance by all bidders. The left hand column of pages 48 thru 62 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 48 through 54 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 continuing operation of the system of which the cooling tower is part. It will also incorporate those standard materials which testing and experience has proven to provide acceptable longevity in normal operating conditions.

Pages 55 through 62 provide paragraphs intended to add those features, components, and materials that will customize the cooling tower to meet the user's requirements.

AIR MOVEMENT PACKAGE

- High efficiency fan – wide-chord design for maximum efficiency at low fan tip speeds
- Eased inlet fan cylinder ensures full area, low turbulent airflow through the cylinder
- Spherical roller bearings are rated at an L_{10} life of 100,000 hours
- TEFC Fan Motor – 1.15 service factor, variable torque, and specially insulated for cooling tower duty
- The MD Series air movement package including the structural support is guaranteed against failure for a period of five full years.

WATER DISTRIBUTION SYSTEM

- Pressurized spray system distributes water evenly over the fill
- Low-clog polypropylene nozzles deliver precise distribution of water over the fill area
- Marley MC thermoformed PVC film fill assembled into packs for ease of removal and cleaning
- Marley XCEL TU drift eliminators limit drift losses to no more than .001% of the design flow rate

STRUCTURE

- Induced-draft, counterflow design may require less plan area than crossflow towers typically use
- Series 300 stainless steel, 316 stainless steel or heavy mill galvanized steel construction
- Factory assembled – ensures final field installation will be hassle-free
- Triple-pass PVC inlet louvers limit splash-out and eliminate sunlight from entering the collection basin

Engineering Data

Specifications / Base

Specifications / Options

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 9.0. 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 MD 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 MD 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. A low-clog fill option provides a high degree of clog resistance and makes the MD tower ideal for dirty water applications. The MD 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 all stainless steel construction option, the MD 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 MD 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 counterflow 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 MD, SPX Cooling offers a full scope of products in various designs and capacities to meet the special demands of specific applications.

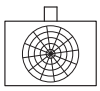
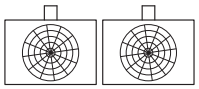
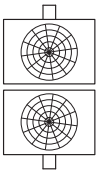
spxcooling.com—visit us on the web for a complete list of products, services, publications and to find your nearest sales representative.

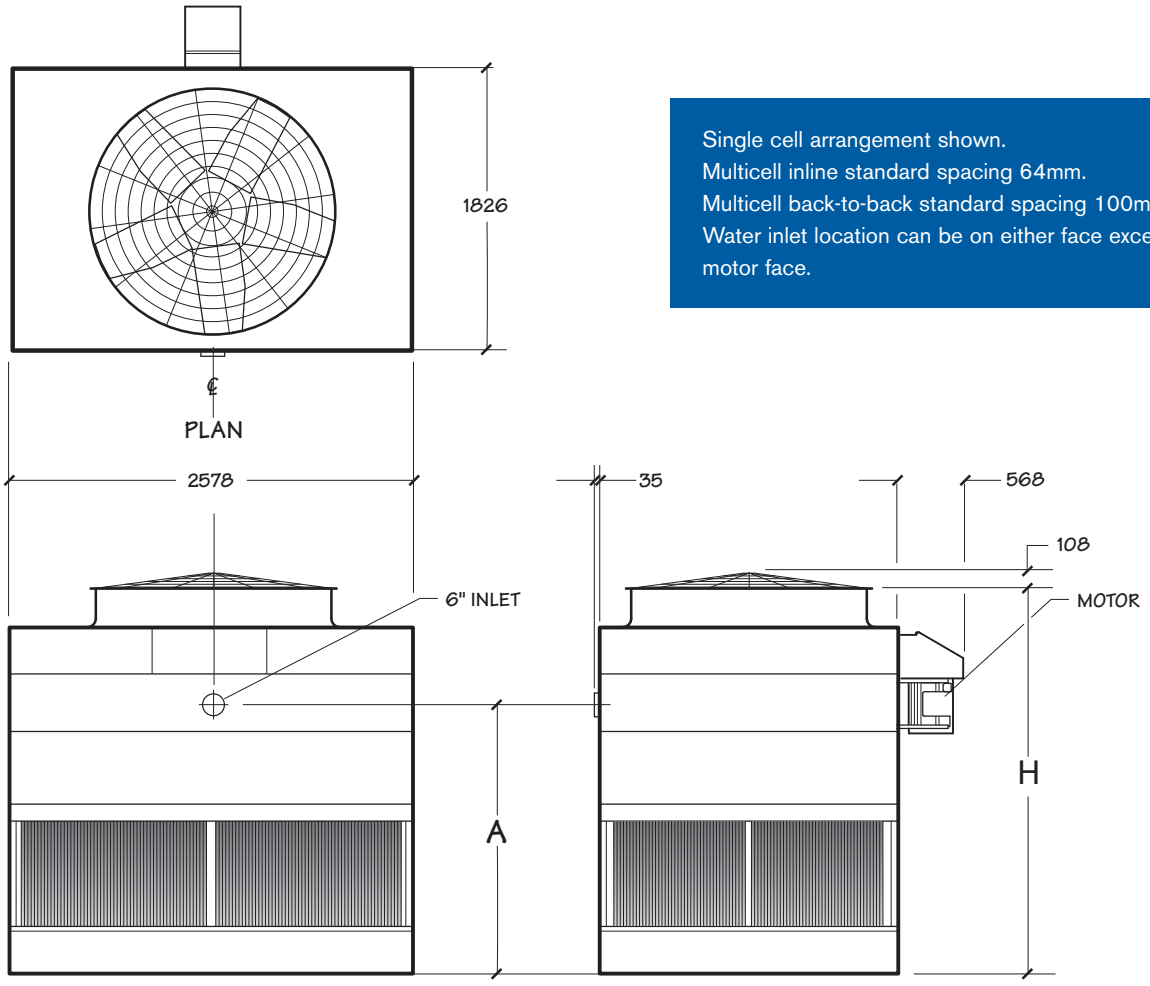
MD5006

1.8m x 2.6m Nominal Cell Size

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 MD model recommendations based on customer's specific design requirements.

DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR MORE INLINE CELLS — 2L+	
TWO CELLS BACK-TO-BACK — 2B	



Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.
Water inlet location can be on either face except motor face.

MD5006

1.8m x 2.6m Nominal Cell Size

Table Data Per Cell

Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5006HAC1L	391	2.2	3178	2188	2315	1306	740
MD5006KAC1L	475	3.7					
MD5006MAC1L	528	5.5					
MD5006NAC1L	585	7.5					
MD5006HAD1L	422	2.2	3483	2492	2404	1395	740
MD5006KAD1L	514	3.7					
MD5006MAD1L	580	5.5					
MD5006NAD1L	637	7.5					
MD5006HAF1L	440	2.2	3788	2797	2540	1532	788
MD5006KAF1L	532	3.7					
MD5006MAF1L	598	5.5					
MD5006NAF1L	659	7.5					
MD5006PAF1L	730	11					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR MORE INLINE CELLS	2L +	102	102	13	13
TWO CELLS BACK-TO-BACK	2B	102	102	13	13

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 two characters of the model number indicate number of cells and cell configuration.
3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB and 0.155 m^3/hr per kW. The **CoolSpec** web-based selection software provides MD model recommendations based on specific design requirements.
4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.

MD5008

2.6m x 2.7m Nominal Cell Size

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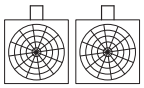
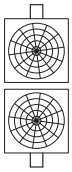
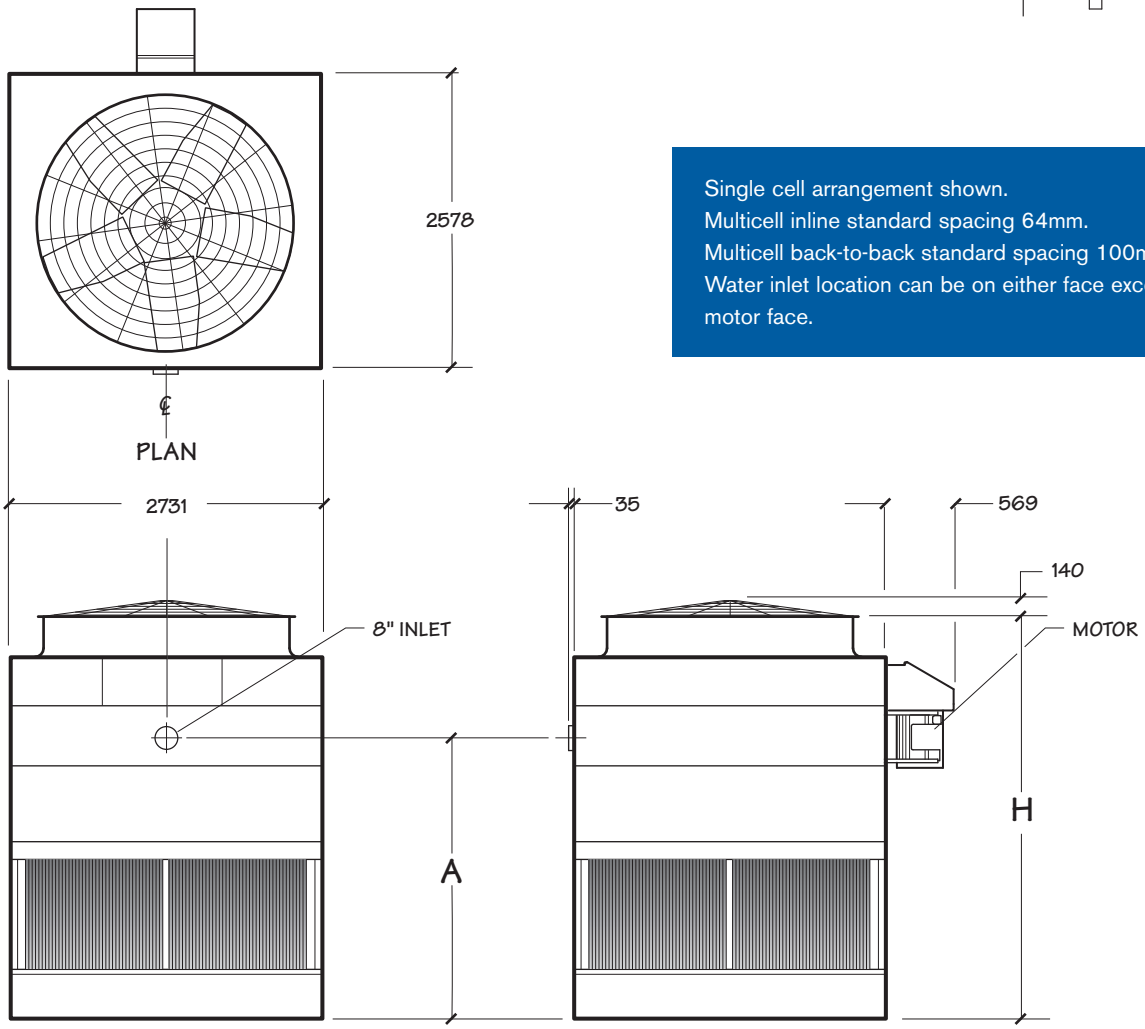
CoolSpec™ web-based selection software, available at coolspec.com provides MD model recommendations based on customer's specific design requirements.

DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR MORE INLINE CELLS — 2L+	
TWO CELLS BACK-TO-BACK — 2B	

Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.
Water inlet location can be on either face except motor face.



MD5008

2.6m x 2.7m Nominal Cell Size

Table Data Per Cell

Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5008KLC1L	655	3.7	3294	2181	3051	1702	891
MD5008MAC1L	725	5.5					
MD5008NAC1L	787	7.5					
MD5008PAC1L	888	11					
MD5008QAC1L	950	15					
MD5008KLD1L	708	3.7	3599	2486	3177	1828	936
MD5008MAD1L	791	5.5					
MD5008NAD1L	866	7.5					
MD5008PAD1L	980	11					
MD5008QAD1L	1051	15					
MD5008KLF1L	730	3.7	3904	2791	3302	1953	1062
MD5008MAF1L	831	5.5					
MD5008NAF1L	910	7.5					
MD5008PAF1L	1029	11					
MD5008QAF1L	1121	15					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR MORE INLINE CELLS	2L +	232	232	21	21
TWO CELLS BACK-TO-BACK	2B	232	232	21	21

NOTE

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3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB and 0.155 m^3/hr per kW. The **CoolSpec** web-based selection software provides MD model recommendations based on specific design requirements.
4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.

MD5010

2.6m x 3.6m Nominal Cell Size

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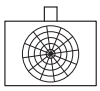
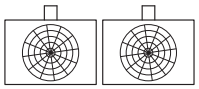
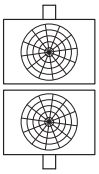
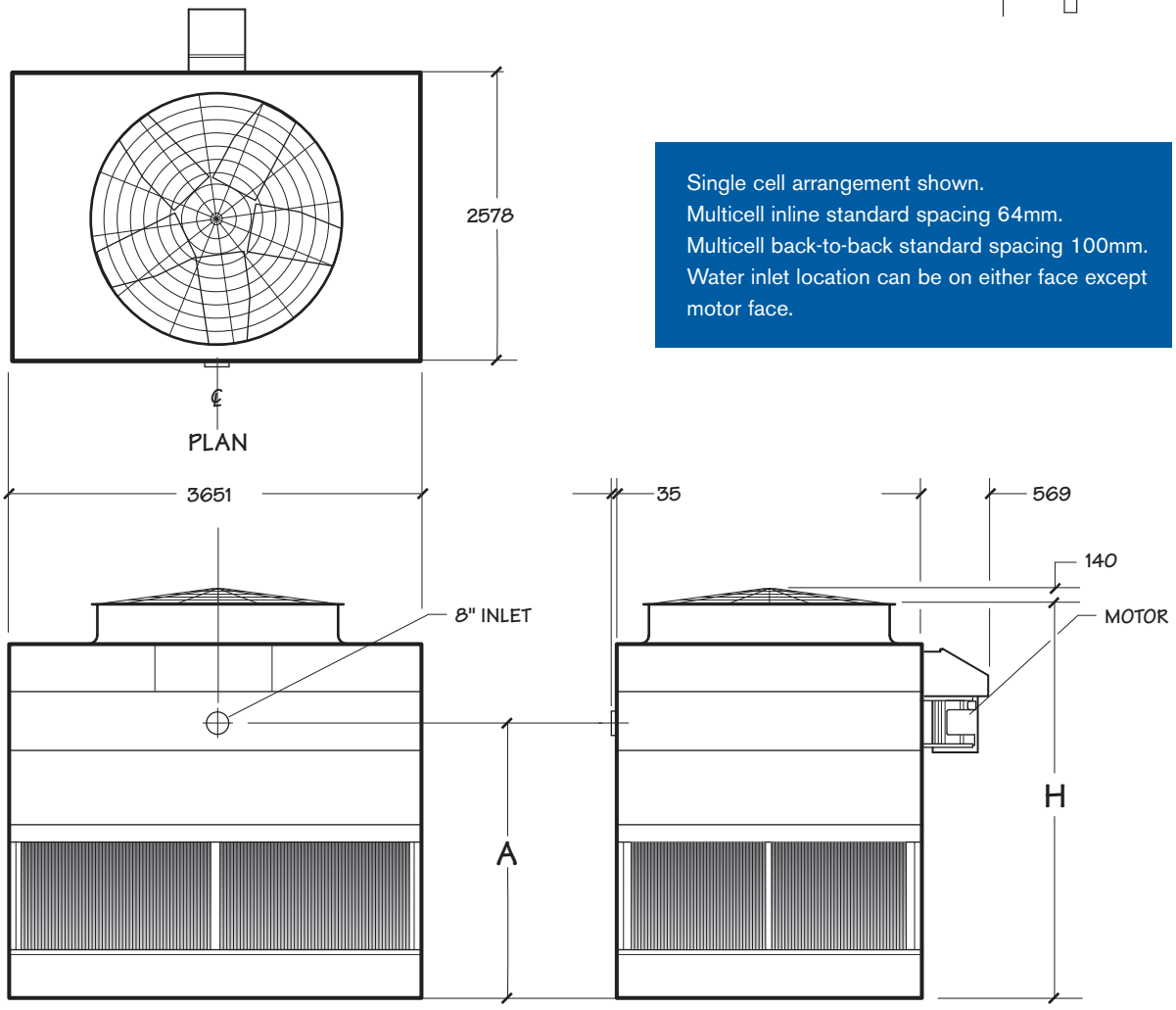
DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR MORE INLINE CELLS — 2L+	
TWO CELLS BACK-TO-BACK — 2B	

Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.
Water inlet location can be on either face except motor face.



MD5010

2.6m x 3.6m Nominal Cell Size

Table Data Per Cell

Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5010NLC1L	967	7.5	3412	2299	3883	2079	1052
MD5010PAC1L	1090	11					
MD5010QAC1L	1183	15					
MD5010RAC1L	1257	18.5					
MD5010NLD1L	1055	7.5	3716	2604	4046	2242	1190
MD5010PAD1L	1227	11					
MD5010QAD1L	1336	15					
MD5010RAD1L	1429	18.5					
MD5010NLF1L	1103	7.5	4021	2908	4234	2430	1353
MD5010PAF1L	1288	11					
MD5010QAF1L	1394	15					
MD5010RAF1L	1499	18.5					
MD5010SAF1L	1583	22					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR MORE INLINE CELLS	2L +	216	216	23	23
TWO CELLS BACK-TO-BACK	2B	216	216	23	23

NOTE

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4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.

MD5016

3.6m x 3.6m Nominal Cell Size

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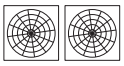
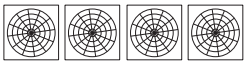
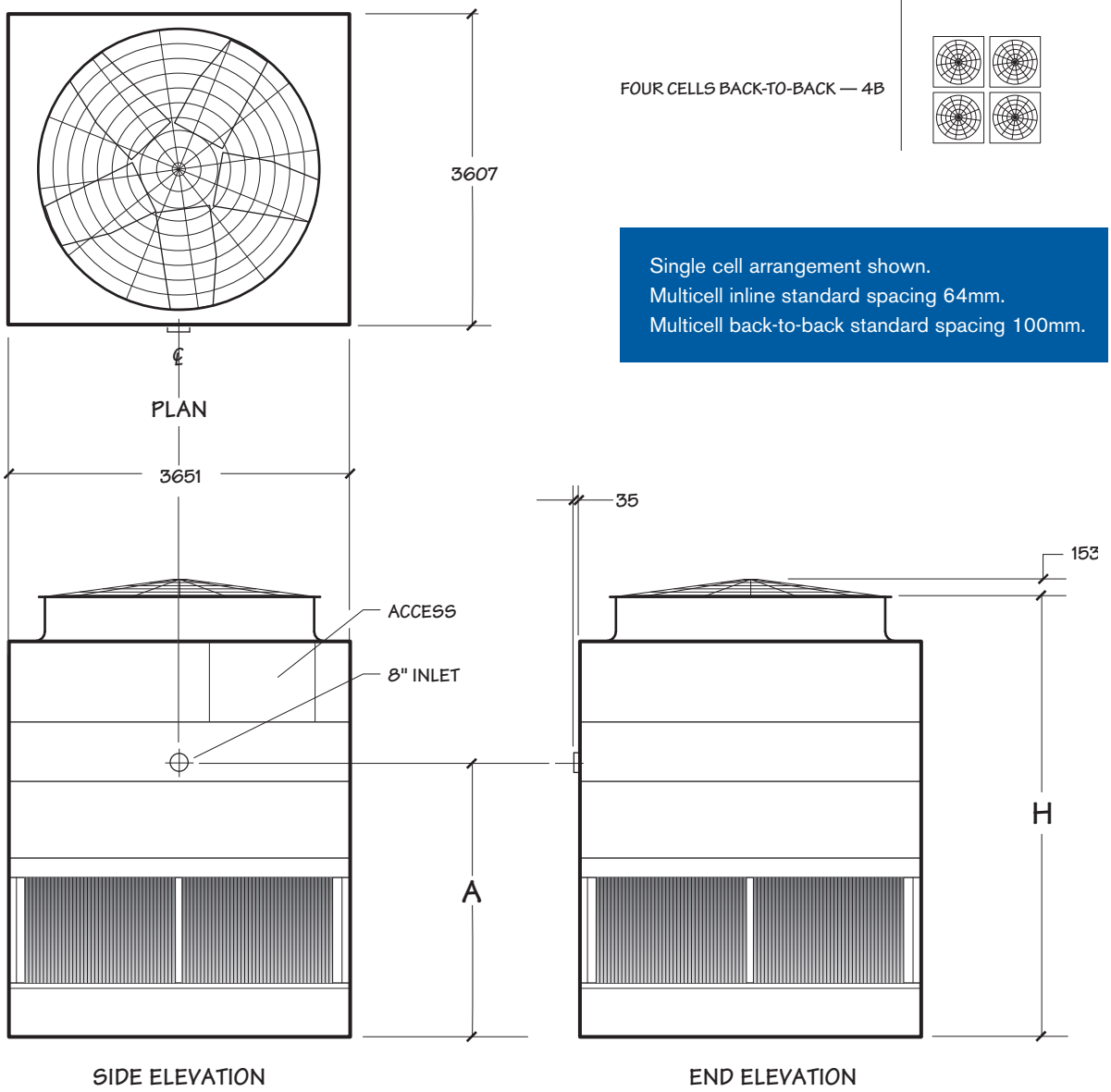
DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR THREE CELLS — 2L 3L	
FOUR OR MORE INLINE CELLS — 4L +	
TWO CELLS BACK-TO-BACK — 2B	
FOUR CELLS BACK-TO-BACK — 4B	

Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.



MD5016

3.6m x 3.6m Nominal Cell Size

Table Data Per Cell

Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5016NLC1L	1248	7.5	4239	2529	5805	3225	1710
MD5016PAC1L	1394	11					
MD5016QAC1L	1517	15					
MD5016RAC1L	1622	18.5					
MD5016SAC1L	1714	22					
MD5016NLD1L	1363	7.5	4543	2986	6089	3508	1763
MD5016PAD1L	1539	11					
MD5016QAD1L	1684	15					
MD5016RAD1L	1802	18.5					
MD5016SAD1L	1917	22					
MD5016TAD1L	2088	30					
MD5016NLF1L	1424	7.5	4848	3138	6320	3739	1977
MD5016PAF1L	1618	11					
MD5016QAF1L	1772	15					
MD5016RAF1L	1895	18.5					
MD5016SAF1L	2022	22					
MD5016TAF1L	2198	30					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR THREE INLINE CELLS	2L 3L	308	308	55	55
FOUR OR MORE INLINE CELLS	4L +	562	562	128	128
TWO CELLS BACK-TO-BACK	2B	308	308	55	55
FOUR CELLS BACK-TO-BACK	4B	562	562	128	128

NOTE

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3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB and 0.155 m^3/hr per kW. The **CoolSpec** web-based selection software provides MD model recommendations based on specific design requirements.
4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.

MD5017

3.6m x 4.3m Nominal Cell Size

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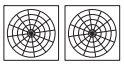
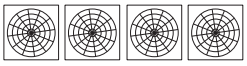
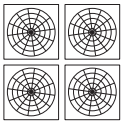
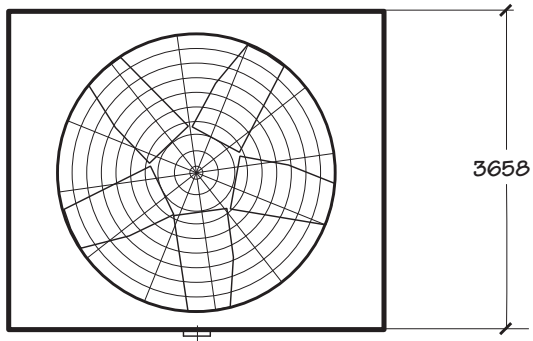
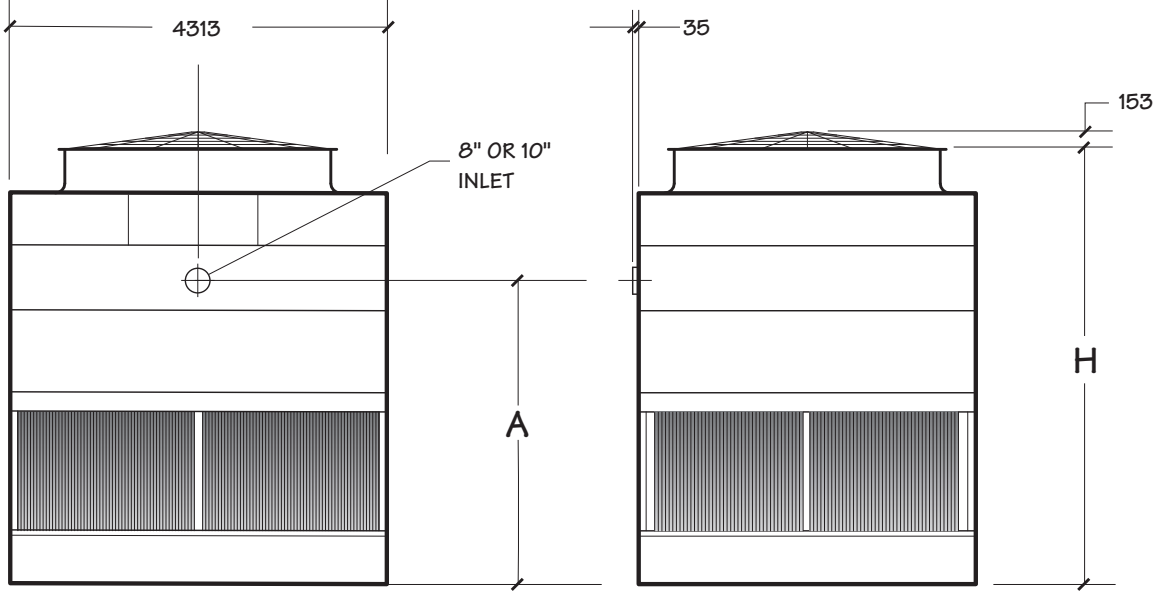
DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR THREE CELLS — 2L 3L	
FOUR OR MORE INLINE CELLS — 4L +	
TWO CELLS BACK-TO-BACK — 2B	
FOUR CELLS BACK-TO-BACK — 4B	

Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.





SIDE ELEVATION

END ELEVATION

MD5017

3.6m x 4.3m Nominal Cell Size

Table Data Per Cell

Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5017NAC1L	1424	7.5	4483	2700	7195	4179	2991
MD5017PAC1L	1583	11					
MD5017QAC1L	1732	15					
MD5017RAC1L	1860	18.5					
MD5017SAC1L	1961	22					
MD5017NAD1L	1534	7.5	4788	3005	7548	4531	3344
MD5017PAD1L	1719	11					
MD5017QAD1L	1886	15					
MD5017RAD1L	2040	18.5					
MD5017SAD1L	2150	22					
MD5017TAD1L	2321	30					
MD5017NAF1L	1596	7.5	5093	3310	7814	4798	3610
MD5017PAF1L	1789	11					
MD5017QAF1L	1974	15					
MD5017RAF1L	2132	18.5					
MD5017SAF1L	2242	22					
MD5017TAF1L	2435	30					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR THREE INLINE CELLS	2L 3L	305	305	77	77
FOUR OR MORE INLINE CELLS	4L +	610	610	154	154
TWO CELLS BACK-TO-BACK	2B	305	305	77	77
FOUR CELLS BACK-TO-BACK	4B	610	610	154	154

NOTE

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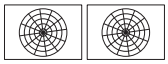
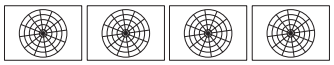
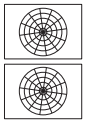
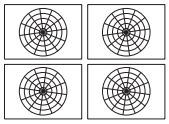
2 Last two characters of the model number indicate number of cells and cell configuration.
3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB and 0.155 m^3/hr per kW. The **CoolSpec** web-based selection software provides MD model recommendations based on specific design requirements.
4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.
5 Dimension A shown is for a 8" inlet diameter, add 45mm to this dimension for a 10" diameter inlet.

MD5018

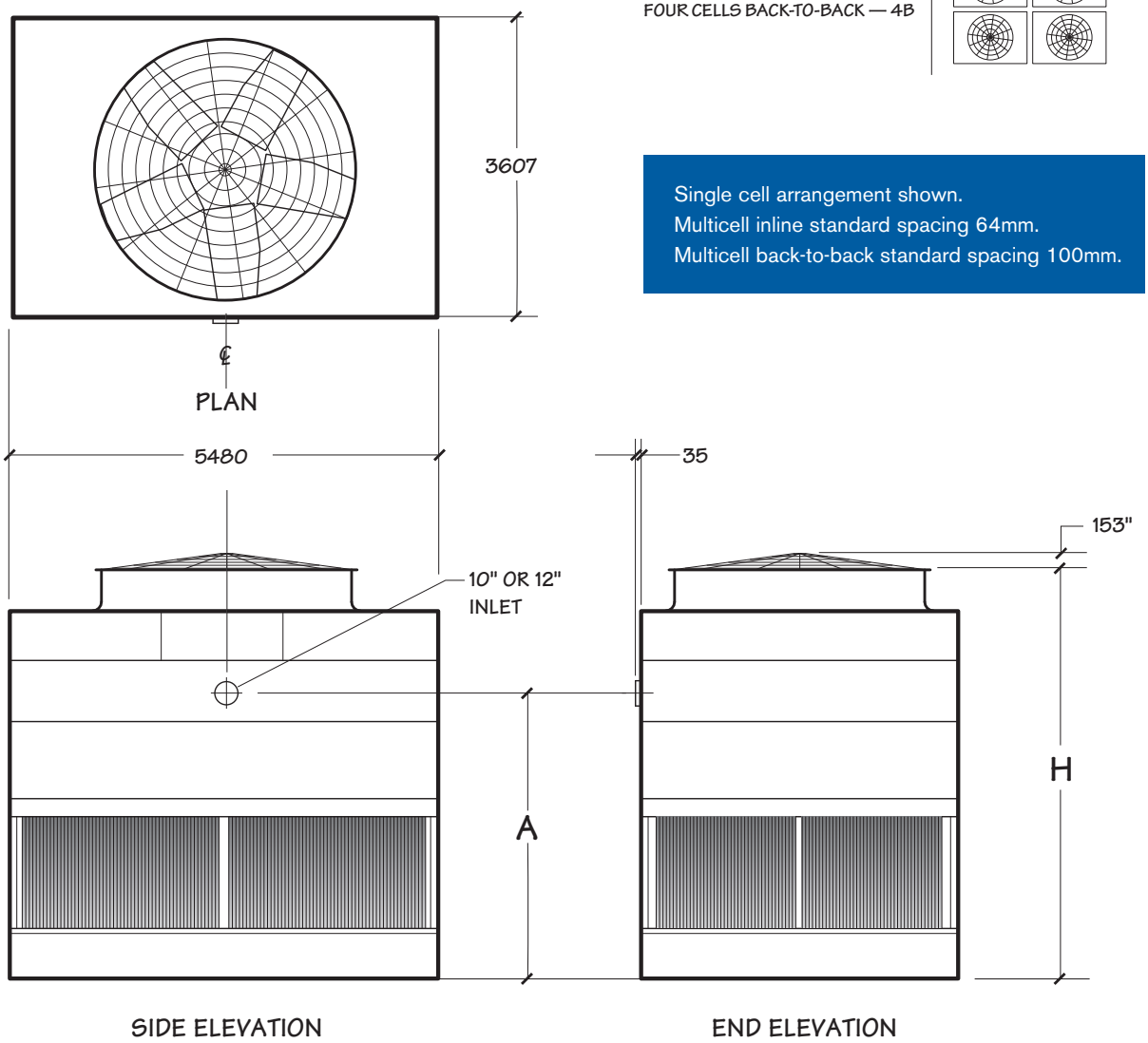
3.6m x 5.5m Nominal Cell Size

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 MD model recommendations based on customer's specific design requirements.

DESCRIPTION — MODEL SUFFIX	LAYOUT CONFIGURATION
SINGLE CELL — 1L	
TWO OR THREE CELLS — 2L 3L	
FOUR OR MORE INLINE CELLS — 4L +	
TWO CELLS BACK-TO-BACK — 2B	
FOUR CELLS BACK-TO-BACK — 4B	

Single cell arrangement shown.
Multicell inline standard spacing 64mm.
Multicell back-to-back standard spacing 100mm.



MD5018

3.6m x 5.5m Nominal Cell Size

Table Data Per Cell

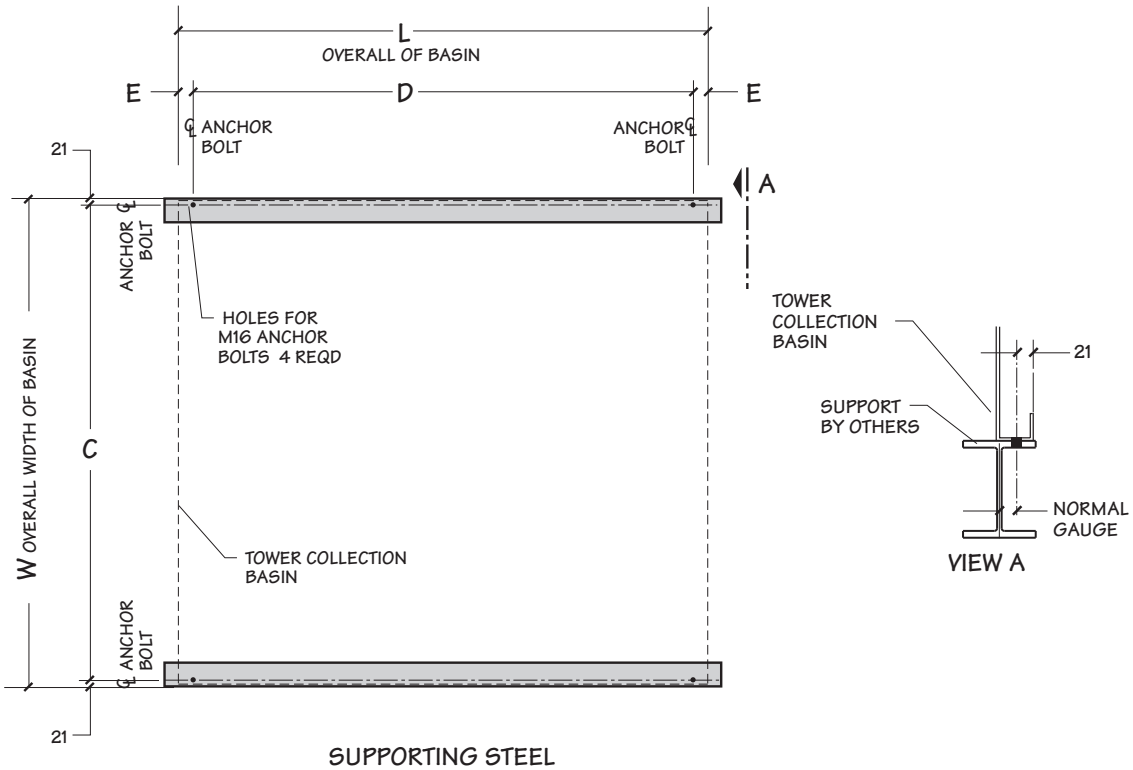
Model note 2	Nominal Capacity kW note 3	Motor kW	Dimensions		Design Operating Weight kg	Shipping Weight kg	
			H note 4	A		Weight/Cell	Heaviest Section
MD5018NLC1L	1653	7.5	4636	2853	9070	5180	3506
MD5018PLC1L	1882	11					
MD5018QAC1L	2066	15					
MD5018RAC1L	2198	18.5					
MD5018SAC1L	2321	22					
MD5018TAC1L	2550	30					
MD5018NLD1L	1785	7.5	4940	3158	9378	5488	3814
MD5018PLD1L	2049	11					
MD5018QAD1L	2268	15					
MD5018RAD1L	2427	18.5					
MD5018SAD1L	2576	22					
MD5018TAD1L	2831	30					
MD5018UAD1L	3033	37					
MD5018NLF1L	1855	7.5	5245	3462	9886	5995	4321
MD5018PLF1L	2132	11					
MD5018QAF1L	2374	15					
MD5018RAF1L	2528	18.5					
MD5018SAF1L	2704	22					
MD5018TAF1L	2972	30					
MD5018UAF1L	3187	37					
MD5018VAF1L	3323	45					

Standard Layout Configuration ***Adds*** Per Cell

Description	Model Suffix note 2	Dimensions		Design Operating Weight kg	Shipping Weight kg
		H note 4	A		Weight/Cell
SINGLE CELL	1L	–	–	–	–
TWO OR THREE INLINE CELLS	2L 3L	305	305	72	72
FOUR OR MORE INLINE CELLS	4L +	610	610	136	136
TWO CELLS BACK-TO-BACK	2B	305	305	72	72
FOUR CELLS BACK-TO-BACK	4B	610	610	136	136

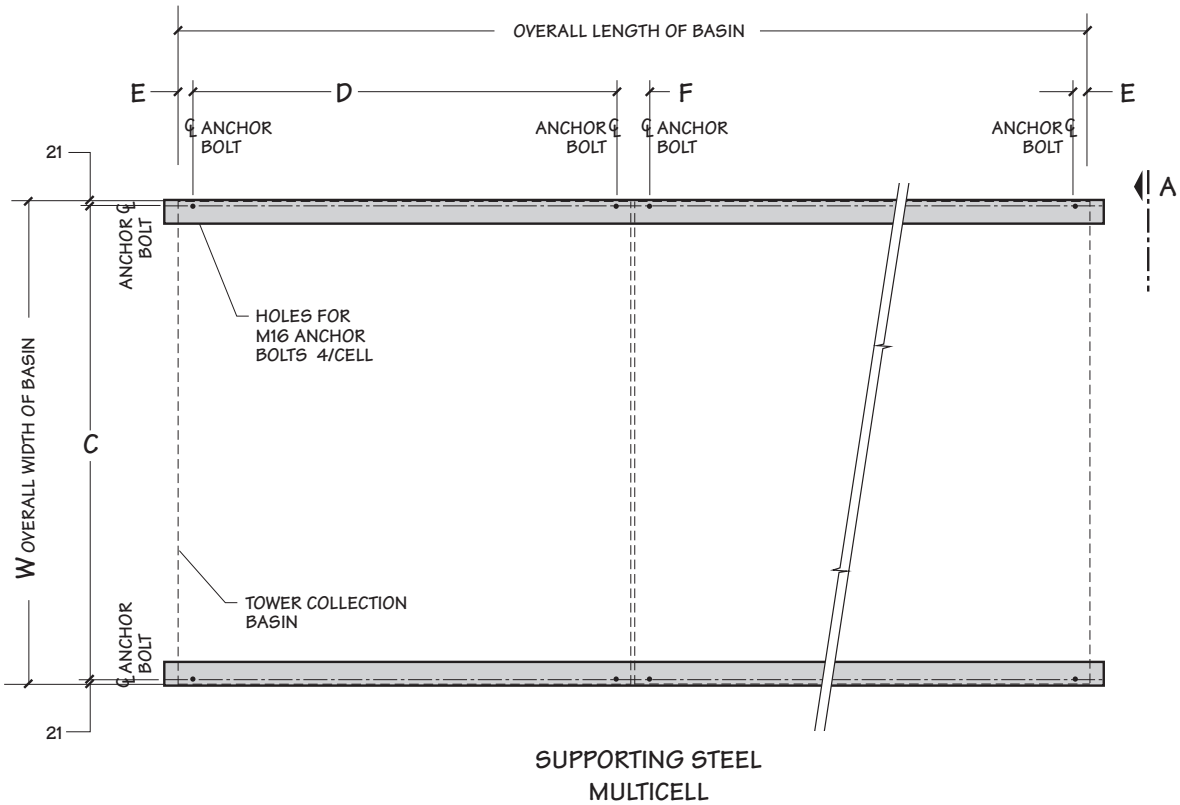
NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative. All table data is per cell.
2 Last two characters of the model number indicate number of cells and cell configuration.
3 Nominal cooling capacity based upon 35°C HW, 29.5°C CW, 25.5°C WB and 0.155 m^3/hr per kW. The **CoolSpec** web-based selection software provides MD model recommendations based on specific design requirements.
4 Models with an Ultra Quiet Fan option require a taller fan cylinder, add 597mm to this dimension for correct height.
5 Dimension A shown is for a 10" inlet diameter, add 45mm to this dimension for a 12" diameter inlet.



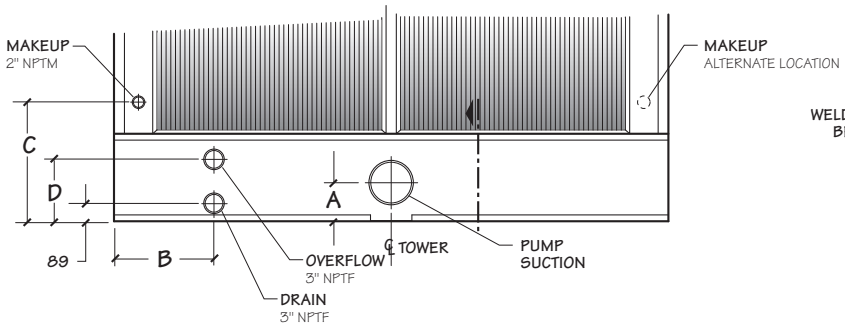
SUPPORTING STEEL
SINGLE CELL

Model	Dimensions						Design Operating Weight per cell kg	Design Operating Load at support beam kg/m
	W	L	C	D	E	F		
MD5006_C	1826	2578	1784	2477	51	165	2328	549
MD5006_D	1826	2578	1784	2477	51	165	2416	566
MD5006_F	1826	2578	1784	2477	51	165	2553	588
MD5008_C	2578	2731	2537	2629	51	165	3072	563
MD5008_D	2578	2731	2537	2629	51	165	3197	586
MD5008_F	2578	2731	2537	2629	51	165	3323	609
MD5010_C	2578	3651	2537	3550	51	165	3906	549
MD5010_D	2578	3651	2537	3550	51	165	4069	568
MD5010_F	2578	3651	2537	3550	51	165	4257	592
MD5016_C	3607	3651	3566	3550	127	318	5860	908
MD5016_D	3607	3651	3566	3397	127	318	6143	951
MD5016_F	3607	3651	3566	3397	127	318	6375	982
MD5017_C	3607	4261	3566	4007	127	318	7349	941
MD5017_D	3607	4261	3566	4007	127	318	7702	982
MD5017_F	3607	4261	3566	4007	127	318	7968	1013
MD5018_C	3607	5480	3566	5226	127	318	9206	976
MD5018_D	3607	5480	3566	5226	127	318	9514	1005
MD5018_F	3607	5480	3566	5226	127	318	10021	1054

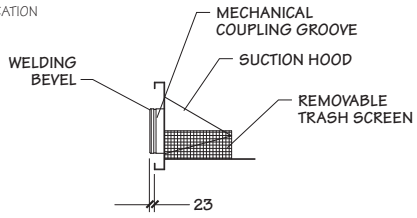


NOTE

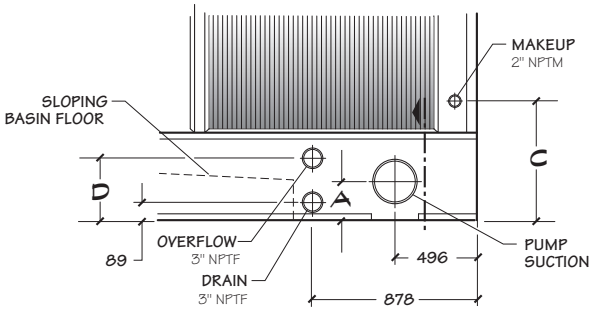
1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative for final design.
2 Purchaser to provide tower support complete with holes and anchor bolts. Do not use studs! Anchor points must be framed flush and level at top.
3 Design operating weight occurs with collection basin full to overflow level. Actual operating weight varies with m^3/hr and piping scheme.
4 Tower may be placed on a flat concrete slab. Side outlet and optional side drain and overflow must be specified.



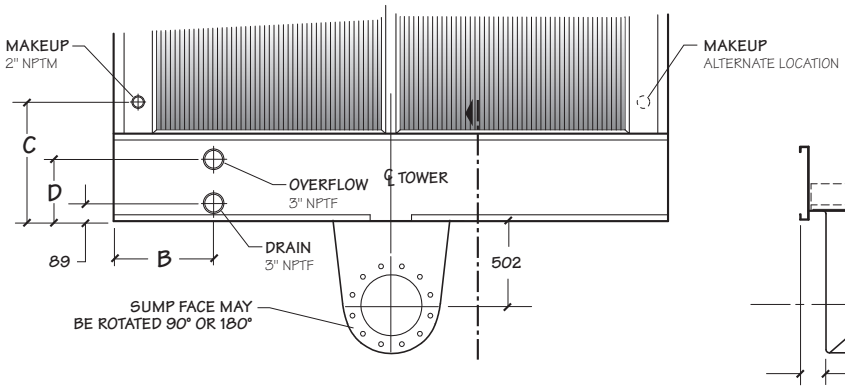
SIDE-OUTLET SUCTION CONNECTION



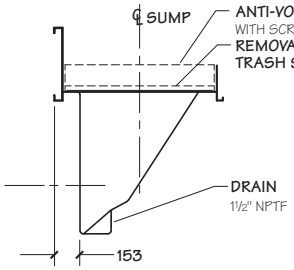
SUCTION SECTION



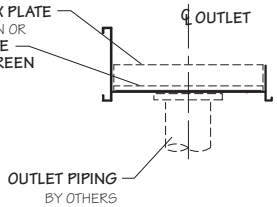
END-OUTLET SUCTION CONNECTION



SIDE-OUTLET SUMP CONNECTION



SUMP SECTION



BOTTOM OUTLET CONNECTION

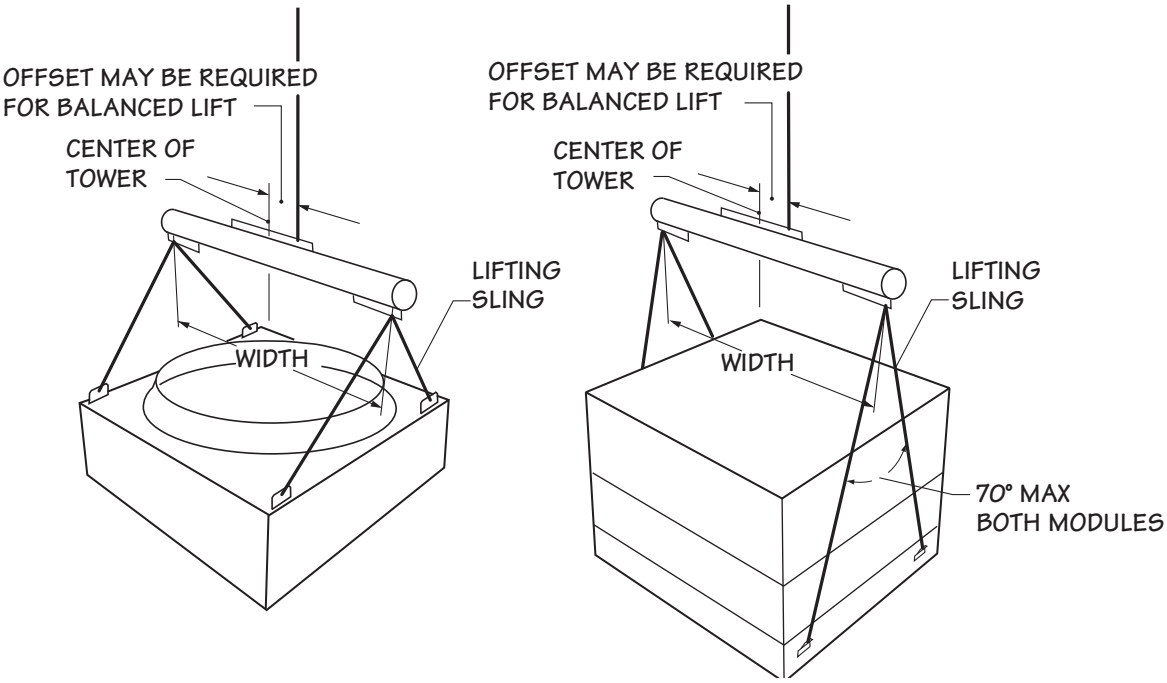
MD Steel Cooling Tower – Engineering Data: Outlet Connection

Model	Dimensions				
	Suction Diameter	A	B	C	D
MD5006	4"	–	492	587	305
	6"	191	492	587	305
	8"	–	492	587	305
MD5008	6"	–	492	587	305
	8"	191	492	587	305
	10"	–	492	587	305
MD5010	6"	–	476	587	305
	8"	191	476	587	305
	10"	–	476	587	305
MD5016	6"	–	476	638	330
	8"	191	476	638	330
	10"	216	476	638	330
	12"	–	476	638	330

Model	Dimensions				
	Suction Diameter	A	B	C	D
MD5017	6"	–	476	638	330
	8"	191	476	638	330
	10"	216	476	638	330
	12"	–	476	638	330
MD5018	6"	–	476	638	330
	8"	191	476	638	330
	10"	216	476	638	330
	12"	231	476	638	330
	14"	–	476	638	330

Maximum m^3/hr per Outlet																		
Outlet Diameter	Side or End Suction pump flow						Sump pump flow without anti-vortex plate						Sump pump flow with anti-vortex plate or gravity flow with or without anti-vortex plate					
	MD 5006	MD 5008	MD 5010	MD 5016	MD 5017	MD 5018	MD 5006	MD 5008	MD 5010	MD 5016	MD 5017	MD 5018	MD 5006	MD 5008	MD 5010	MD 5016	MD 5017	MD 5018
6"	185						143	143	143				185	204	204	204	204	204
8"		267	311	354	354	354	185	248	248	248	248	248	185	267	311	354	354	354
10"				533	533	533		267	311	391	391	391		267	311	533	498	558
12"						684				533	498	555				533	498	684
14"												671						
16"												684						

Maximum m^3/hr per Outlet												
Outlet Diameter	Bottom Outlet pump flow without anti-vortex plate						Bottom Outlet pump flow with anti-vortex plate or gravity flow with or without anti-vortex plate					
	MD 5006	MD 5008	MD 5010	MD 5016	MD 5017	MD 5018	MD 5006	MD 5008	MD 5010	MD 5016	MD 5017	MD 5018
6"							78					
8"	62						136	136	136			
10"	100	100	100				185	214	214	214	214	214
12"	143	143	143				185	267	304	304	304	304
14"	173	173	173	173	173		185	267	311	367	367	367
16"	185	225	225	225	225	225	185	267	311	480	480	480
18"		267	685	685	685	685		267	311	533	498	599
20"			311	354	354	354			311	533	498	667
24"				513	498	513				533	498	684



Model	Base Module			Top Module		
	Width	Sling Length Minimum	Weight kg	Width	Sling Length Minimum	Weight kg
MD5006	1.8m	2.7m	800	2.6m	1.5m	800
MD5008	2.6m	3.0m	1100	2.7m	2.5m	900
MD5010	2.6m	3.5m	1400	2.6m	3.0m	1100
MD5016	3.7m	3.5m	1800	3.7m	3.0m	2100
MD5017	3.7m	3.5m	1400	3.7m	3.7m	3600
MD5018	3.7m	4.5m	1700	3.7m	4.5m	4300

NOTE

1 Hoisting operations can be dangerous and suitable safety precautions should be taken to protect personnel and the equipment being hoisted.
2 All hoisting equipment should be certified and comply with local and national safety regulations.
3 Ensure that slings are of sufficient length so not to impose bending loads onto the casing—use of spreader bars is essential.
4 For overhead lifts or where additional safety is required, add slings beneath the tower unit

The MD cooling tower can be a very effective air washer. Atmospheric dust able to pass through the relatively small louver openings will enter the recirculating water system. Increased concentrations can intensify systems maintenance by clogging screens and strainers—and smaller particulates can coat system heat transfer surfaces. In areas of low flow velocity—such as the collection 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 collection basin clean. Typical devices include side stream filters and a variety of filtration media.

BLOWDOWN

Blowdown or Bleedoff is the continuous removal of a small portion of the water from the open recirculating system. Blowdown is used to prevent the dissolved solids from concentrating to the point where they will form scale. The amount of blowdown required depends on the cooling range—the difference between the hot and cold water temperatures of the closed circuit— and the composition of the makeup water.

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 recirculating water should fall between 6.5 and 9.0. Batch feeding of the chemicals directly into the cooling tower is not a good practice since localized damage to the cooling tower is possible. Specific startup instructions and additional water quality recommendations can be found in the *MD Cooling Tower User Manual* which accompanies the cooling tower and also is available at spxcooling.com.

FREEZE PREVENTION

When the ambient air temperature falls below 32°F, 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.

ELECTRIC BASIN HEATERS

An automatic basin water heater system is available consisting of the following components:

- Stainless steel electric immersion heater(s).

  —Threaded couplings are provided in the side of the collection basin.

- IP56 enclosure containing:

  —Magnetic contactor to energize heater.

  —Transformer to convert power supply to 24 volts for control circuit.

  —Solid state circuit board for temperature and low-water cutoff.

  Enclosure may be mounted on the side of the tower.

- Control probe in the collection basin to monitor water temperature and level.

Heater components are normally shipped separately for installation by others.

Note: any exposed piping that is still filled with water at shutdown—including the makeup water line—should be electrically traced and insulated (by others).

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 amount of water needed to successfully operate the system depends on the tower size, 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.

Specifications

1.0 **Base:**

1.1 Furnish and install an induced-draft, counterflow-type, factory assembled, film fill, industrial duty, cooling tower. Unit shall consist of _____ cell(s), as shown on plans. The limiting overall dimensions of the tower shall be _____ wide, _____ long, and _____ high. Total operating power of all fans shall not exceed _____ kW, consisting of_____ @ _____ kW motor(s). Tower shall be similar and equal in all aspects 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 shall 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
Air Inlet Side SPL					
Air Inlet End SPL					
Fan Discharge SPL					

Location	2000	4000	8000	Overall dB(A)
Air Inlet Side SPL				
Air Inlet End SPL				
Fan Discharge SPL				

2.0 **Thermal Performance:**

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. The thermal performance rating shall be certified by Eurovent and the Cooling Technology Institute.

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 horsepower avoid the introduction of unforeseen operational and site-related influences. Specifying the number of cells, and the maximum fan hp/cell will work to your advantage.
  You are specifying a counterflow tower, which is a type noted–and often specified–for its economical use of plan area. It effectively replaces most makes of older towers–both forced-draft and induced-draft–usually without major redesign of the existing site.

- 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 MD 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.

SPX participates in the ECP programme for Cooling Towers. Range – MD Series. Certification Diploma #12.02.006. Ongoing certificate validity: eurovent-certification.com

- Certification means that the cooling 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. A list of certified cooling towers can be found at ***cti.org*** and ***eurovent-certification.com.***

Specifications	Specification Value
2.2 The tower shall be capable of minimum _____ m^3/hr per kW efficiency at 35°C-29.5°C-23.8°C, per ASHRAE Standard 90.1.	■ The minimum efficiency per ASHRAE Standard 90.1 for induced draft open cooling towers applied to comfort cooling is 12.24 m^3/hr/kW @ 35/29.5/23.8. 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 8.68 m^3/hr/kW. ***Each model's ASHRAE Standard 90.1 rating can be viewed in our CoolSpec online sizing and selection software at coolspec.com.***
3.0 **Performance Warranty:** 3.1 CTI and Eurovent certification notwithstanding, the cooling tower manufacturer shall guarantee that the cooling tower supplied will meet the specified performance conditions when the tower is installed as shown on the plans. 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 cooling tower will perform satisfactorily in your situation. Certification is established under relatively controlled conditions, and cooling towers seldom operate under such ideal circumstances. They are affected by nearby structures, machinery, enclosures, effluent from other sources, etc. Responsible and knowledgeable bidders will take such site-specific effects into consideration in selecting the cooling 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, as well as a .3g seismic load. Maintenance platforms and guardrails, where specified shall be capable of withstanding a 890N concentrated live load in any direction and shall be designed in accordance with OSHA guidelines.	■ 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 shipped, handled, hoisted–and ultimately operated in a normal cooling tower environment. Most MD 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. ***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, .3g seismic load**–applicable for most applications but consult the local code official for actual requirements. **2.9kPa live load live load, 890N 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 heavy-gauge steel, protected against corrosion by EN10142:2000 grade Z725 galvanizing. After passivation of the galvanized steel (8 weeks at pH 7-8, and calcium hardness and alkalinity at 100-300 mg/L each), the cooling tower shall be capable of withstanding water having a pH of 6.5 to 9.0; a chloride content up to 500 mg/L as NaCl (300 mg/L as Cl-); a sulfate content (as SO_4) up to 250 mg/L; a calcium content (as $CaCO_3$) up to 500 mg/L; silica (as SiO_2) up to 150 mg/L; and design hot water temperatures up to 55°C. The circulating water shall contain no oil, grease, fatty acids, or organic solvents. Fiberglass casing, polyurethane barriers, and thermosetting hybrids and the components they are adhered to shall be considered non-recyclable and not allowed.	■ 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 or electrostatically-applied coatings, however exotic they may be, can approach galvanization's history of success. If extended longevity of the cooling 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 46.
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 unique 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**:	
6.1 Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, sheaves (pulleys), and tapered roller bearings. Bearings shall be rated at an L_{10A} life of 100,000 hours, or greater. Both motor and fan sheaves (pulleys) shall be all cast aluminum to prevent premature corrosion.	■ Propeller-type fans require only half the operating hp of blower-type fans. However, they should be readily adjustable to permit compensation for jobsite conditions. The Marley Power Belt drive system features all-aluminum sheaves, power band belts and long-life bearings for dependable service. TEFC motors offer additional benefits over TEAO motors whose only source of cooling is the flow of air produced by the cooling tower fan. This air rate is not always ideal due to motor position, blockage, variable speed operation, etc. TEFC ensures the motor will always be cooled properly. Motor speed will be 1500 RPM on standard models. Low sound models will use motor speeds appropriate for the specific model.

Specifications

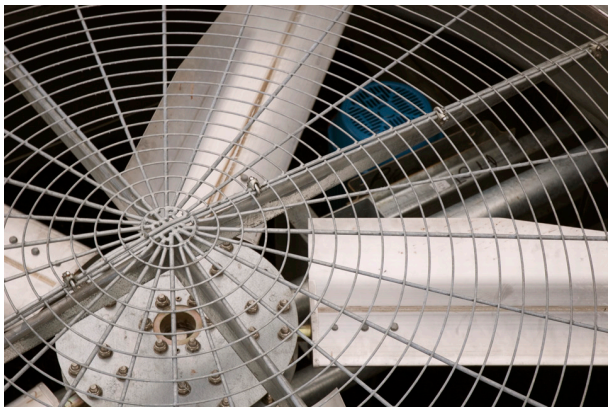
6.1 (alternate) Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Maximum fan tip speed shall be 66m/s. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer 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.

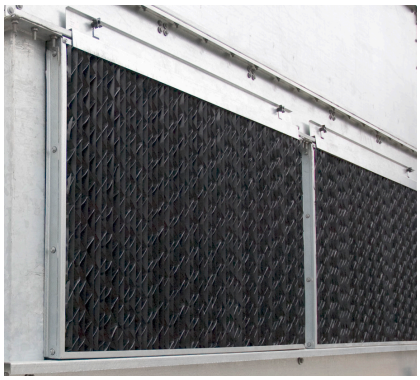
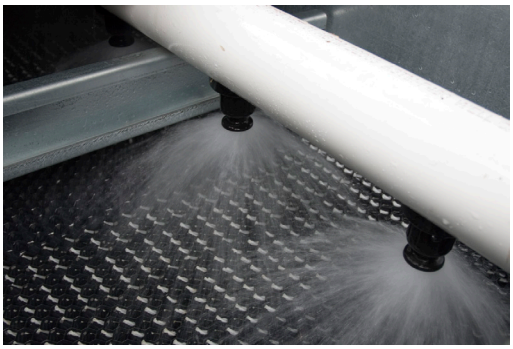
6.2 Motor(s) shall be ____ kW maximum, TEFC, 1.15 service factor, variable torque, inverter duty and insulated for cooling tower duty. Speed and electrical characteristics shall be _____ RPM, single-winding, 3 phase, ____ hertz, ____ volts. Motor shall operate shaft-down position for belt drive towers and in the shaft-horizontal position for geardrive towers. Nameplate power shall not be exceeded at design operation. TEAO motors are not acceptable.

6.3 The complete mechanical equipment assembly for each cell shall be supported by a rigid, hot-dip galvanized steel structural support that resists misalignment between the motor and sheaves (pulleys). For belt-drive towers with motors mounted outside the airstream, a protective cover shall be mounted over the motor and sheave to protect it from the weather and prevent inadvertent contact. The mechanical equipment assembly shall be warranted against any failure caused by defects in materials and workmanship for no less than five (5) years following the date of tower shipment. This warranty shall cover the fan(s), premium efficiency motor(s), speed reducer(s), drive shaft(s) and coupling(s), and the mechanical equipment support. Oil seals shall be warranted for eighteen (18) months with replacement oil seals furnished through the mechanical warranty. The bearing assemblies and V-belts shall be warranted for 18 months.

Specification Value

The value of a 5 year mechanical equipment warranty speaks for itself. Except for the motor, virtually all of the mechanical equipment on a Marley tower is designed and manufactured by SPX Cooling. Cooling tower vendors who purchase commercial fans, driveshafts, etc. may require that you deal directly with those commercial suppliers for warranty satisfaction.



Specifications	Specification Value
.0 **Fill, Louvers and Drift Eliminators:**	
7.1 Fill shall be cross-corrugated, counterflow film type, thermoformed from .30 mm thick PVC. Fill shall be supported on channel sections supported from the tower structure and have a flame spread rating less than 25.	■ Fill modules can be removed for inspection and cleaning in accordance with local anti legioinella guidelines.
7.2 Drift eliminators shall be .43 mm thick PVC with a minimum of three changes in air direction, 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. 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.
7.3 Air inlet louvers shall be a minimum of 127mm air travel, triple pass PVC to limit water splashout and prevent direct sunlight from entering the collection basin. For ease of service and long life of louvers, PVC louvers shall be enclosed in a removable frame that attaches to the air inlet without tools. Louvers with less than three changes in air direction are unacceptable.	■ Triple-pass inlet louvers 
8.0 **Hot Water Distribution System:**	
8.1 A pressured spray system shall distribute water evenly over the fill. The branch arms shall be corrosion resistant PVC with polypropylene spray nozzles attached to the branch arms with a rubber socket connection for ease of removal and cleaning. To ensure proper spray system operation, nozzles shall seat in branch arms without regard for direction or alignment.	■ The combination of PVC piping and polypropylene nozzles is very resistant to the build-up of scale and slime. 
9.0 **Casing and Fan Guard:**	
9.1 The casing shall be EN10142:2000 grade Z725 galvanized steel and shall be capable of withstanding the loads described in paragraph 4.1. Casing panels shall encase the fill on all four sides of the tower. The top of the fan cylinder shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 8 mm and 7 gauge rods, and hot dip galvanized after fabrication.	
10.0 **Access:**	
10.1 A large rectangular access door shall be located in the plenum on the motor side of the tower.	

Specifications	Specification Value
11.0 **Cold Water Collection Basin**:	
11.1 The collection basin shall be heavy-gauge galvanized steel and 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 factory installed, float operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the 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.	
13.0 **Warranty**:	
13.1 The MD cooling tower shall be free from defects in materials and workmanship for a period of eighteen (18) months from the date of shipment.	■ The MD tower design offers side-suction as standard. Bottom outlets may be supplied to accommodate a variety of piping schemes. Unless so specified, the tower you may be asked to approve may only be available with one type of suction connection requiring you to redesign your piping layout. The sloping floor and low-level drain is valuable because it provides a way to achieve flush-out cleanability.

Specifications	Specification Value
Stainless Steel Options	
Stainless Steel Collection Basin:	
11.1 *Replace paragraph 11.1 with the following:* The collection basin shall be welded 301L stainless steel construction. Only low-carbon stainless steel alloys will be accepted in order to minimize the risk of intergranular corrosion in the weld zones. The basin shall include the number and type of suction connections required to accommodate the out-flow piping system shown on the plans. Basin suction connections shall be equipped with debris screens. A factory installed, float operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate.	■ The cold water basin is the only part of the tower that is subject to periods of stagnant water, concentrated with treatment chemicals and customary contaminants. It is also the most expensive and difficult part of any tower to repair or replace. For these reasons, many customers–particularly those who are replacing older towers–choose to specify stainless steel cold water basins. ■ The 316 alloy was designed to increase resistance to chlorides. Generally, cooling towers in HVAC service utilize water sources, which do not approach the limits of 300 series stainless, even up to several cycles of concentration. Industrial cooling towers, generally circulating more aggressive water, use 300 series stainless as standard metallurgy, upgrading to 316 for situations such as estuary water or other significant source of chlorides. The vast majority of cooling tower water sources result in an acceptable environment for 300 series stainless steel, with HVAC systems typically being on the mild end of the spectrum. If you have one of the rare instances where water quality exceeds 900 mg/l Cl, talk to you Marley sales representative about 316SS.
All Stainless Cooling Tower:	
5.1 *Replace paragraph 5.1 with the following:* Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy-gauge, series 301L stainless steel. Only low-carbon stainless steel alloys will be accepted in order to minimize the risk of intergranular corrosion in the weld zones. The tower shall be capable of withstanding water having a chloride content (NaCl) up to 750 mg/L; a sulfate content (SO_4) up to 1200 mg/L; a calcium content ($CaCO_3$) up to 800 mg/L; silica (SiO_2) up to 150 mg/L; and design hot water temperatures up to 57°C. The circulating water shall contain no oil, grease, fatty acids, or organic solvents.	■ Where water quality falls outside the limits indicated in Paragraph 5.1, an all-stainless tower is worthy of your consideration. For pure resistance to corrosion–coupled with the capability to meet stringent fire and building codes–there is no substitute for 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	
Mechanical Access Platform:	
10.2 *Add the following paragraph in the Access section:* There shall be a mechanical access platform at the mechanical access door allowing access to the mechanical system, drift eliminators, distribution system and fill. The platform shall be galvanized steel bar grating, supported by galvanized steel framework attached to the tower. The platform shall be surrounded by a guardrail, kneerail, and toeboard designed according to OSHA guidelines and shall be capable of withstanding a 890N concentrated live load in any direction. A ladder shall be permanently attached to the platform and to the casing of the tower, rising from the base of the tower to the top of the handrail.	■ Periodic inspection and maintenance of a cooling tower distribution system is fundamental to preserving maximum cooling system efficiency. All cooling towers–crossflow or counterflow–are subject to clogging to varying degrees by waterborne contaminants such as pipe scale and sediment. Therefore, safe and easy access to these components is of significant value to the operator. Access can be provided in a number of ways, including portable ladders or scaffolding, but for maximum safety and convenience, a field installed Marley access platform with guardrails is available to make this task as safe and user-friendly as possible. Further, its location on the side of the tower does not add to the height of the unit, preserving architectural integrity. It also saves the owner time and money, in that maintenance personnel may devote their time to inspection rather than searching for ladders or erection of portable scaffolding.
Ladder Extension:	
10.2 *Add the following to the end of paragraph 10.2:* Provide a ladder extension for connection to the foot of the ladder. This extension shall be long enough to rise from the roof (grade) level to the base of the cooling tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the cooling tower ladder; and anchoring it at its base.	■ Many cooling towers are installed such that the base of the unit is 60 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 1.5 and 3.4m lengths.
Ladder Safety Cage:	
10.2 *Add the following to the end of paragraph 10.2:* A welded aluminum safety cage shall surround the ladder, extending from a point approximately 2m above the foot of the ladder to the top of the handrail. Maximum weight of welded subassemblies shall not exceed 10 kg for ease of installation.	
Ladder Safety Gate:	
10.2 *Add the following to the end of paragraph 10.2:* A steel, self-closing gate shall be provided at the guardrail level of the ladder.	■ A galvanized steel self-closing gate located at the guardrail level of the fan deck, exterior motor access platform and access door platform. Stainless steel is available with the stainless guardrail option.

Specifications	Specification Value
Motor Davit: 10.4 *Add the following paragraph in the Access section:* A powder coated davit crane with hot dipped galvanized mounting base shall be field installed on the motor face of the cooling tower and shall have a maximum capacity of 230 kg.	■ Simplify the removal of the fan motor when required. If you would prefer stainless steel construction change powder coated and hot dipped galvanized to stainless steel in the description. Available with this option is a zinc plated hand crank winch with 14m of 5mm diameter galvanized aircraft cable with swivel hook with swaged ball fitting.
Motor and Fan Davit: 10.4 *Add the following paragraph in the Access section:* A powder coated davit crane with hot dipped galvanized mounting base shall be field installed on the motor face of the cooling tower. The davit shall have maximum capacity of 230 kg at a 1.7m boom extension and 500kg at a 1m boom extension.	■ Simplify the removal of the fan motor or fan assemble when required.If you would prefer stainless steel construction change powder coated and hot dipped galvanized to stainless steel in the description. Available with this option is a zinc plated hand crank winch with 18m of 6mm diameter galvanized aircraft cable with swivel hook and swaged ball fitting. Also available with this options is an electric winch with a 1.8m pendant control. Includes 18m of 6mm diameter galvanized aircraft cable with swivel hook with swaged ball fitting.
Control Options **Fan Motor Starter Control Panel:** 6.4 *Add the following paragraph in the Mechanical Equipment section:* Each cell of the cooling tower shall be equipped with a UL / CUL 508 listed control panel in a IEC IP14 or IP56 outdoor enclosure capable of controlling single-speed or two-speed motors as required, and designed specifically for cooling tower applications. The panel shall include a main circuit breaker or main fused disconnect with an external operating handle, lockable in the off position for safety. Full voltage non-reversing magnetic starter shall be controlled with a thermostatic or solid-state temperature controller. Door mounted selector switches shall be provided to enable automatic or manual control and wired for 230VAC control. Control circuit to be wired out to terminal blocks for field connection to a remote vibration switch, overload trip alarms and remote temperature control devices. The temperature controller shall be adjustable for the required cold-water temperature. If a thermostatic controller is used it shall be mounted on the side of the tower with the temperature sensing bulb installed in the cold water basin using a suspension mounting bracket. If a solid-state temperature controller is used the controller will be door mounted on the control panel. The solid-state temperature controller will display two temperatures, one for outgoing water and the other for set point. Water temperature input shall	■ If it is your opinion that the control system for the cooling tower be part of the cooling tower manufacturer's responsibility, we are in wholehearted agreement with you. Who better to determine the most efficient mode and manner of a cooling tower's operation–and to apply a system most compatible with it–than the designer and manufacturer of the cooling tower? Marley variable speed drives are also available for the ultimate in temperature control, energy management, and mechanical equipment longevity. 

Specifications

be obtained using a three-wire RTD with dry well in the outlet water piping and wired back to the solid-state temperature controller in the control panel.

Vibration Limit Switch:

6.5 *Add the following paragraph in the Mechanical Equipment section:* A vibration limit switch in a IP 56 housing shall be installed on the mechanical equipment support and wired to the shutdown circuit of the fan motor starter or VFD. The purpose of this switch will be to interrupt control power voltage to a safety circuit in the event of excessive vibration causing the starter or VFD equipment to de-energize the motor. It shall be adjustable for sensitivity and include a means to reset the switch.

Basin Heater:

11.2 *Add the following paragraph in the Cold Water Basin section:* Provide a system of electric immersion heaters and controls for each cell of the tower to prevent freezing of water in the collection basin during periods of shutdown. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A IP 56 enclosure shall house a magnetic contactor to energize heaters; a transformer to provide 24-volt control circuit power; and a solid-state circuit board for temperature and low water cut-off. A control probe shall be located in the basin to monitor water level and temperature. The system shall be capable of maintaining 5°C water temperature at an ambient air temperature of _____ °C.

Water Level Control System:

11.2 *Add the following paragraph to the Cold Water Basin section:* Provide a water level control system including a IP56 control panel, water level probes and probe stilling chamber. The control system shall monitor the water level in the cold-water basin to determine level events used for cold-water make-up, high and low alarms or pump shut down. The control panel shall use electromechanical relays providing power for the make-up solenoid and electrical contacts for alarm and pump shutdown control circuits. Probes shall be

Specification Value

- Unless specified otherwise, an IMI Sensors mechanical vibration switch will be provided. The requirement for manual reset assures that the cooling tower will be visited to determine the cause of excessive vibration.

- The Marley basin heater components described at left represent our recommendation for a reliable automatic system for the prevention of basin freezing. They are normally shipped separately for installation at the jobsite by the installing contractor. When purchased in conjunction with the enhanced Control System option, however, they are customarily factory-mounted and tested.

Submerged in basin water, in which zinc ions are present, copper immersion heaters must not be used. Insist upon stainless steel.

The ambient air temperature that you insert in the specifications should be the lowest 1% level of winter temperature prevalent at site.

- Solid-state liquid level controls provide you with state-of-the-art systems to control and monitor the water level in your cooling tower collection basin. Relays operating in conjunction with suspended stainless steel electrode probes monitor basin water levels, providing simple solenoid-valve water makeup or discrete on/off signals to more sophisticated automation controls. Optional configurations might include makeup along with high and low water level alarm and cutoff, or pump cutoff. Packaged systems including any of these variations are available. Consult you Marley sales representative or download literature number ACC-NC-9 from spxcooling.com for additional information.

Specifications

contained in a vertical stilling chamber to stabilize the water in the cold-water basin. Probes shall have replaceable stainless steel tips and level height shall be field adjustable.

Fan Motor Variable Speed Drive:

ACH550 VFD System

6.4 *Add the following paragraph in the Mechanical Equipment section when VFD is used with customers Building Management System:* For fan control a complete UL listed variable speed drive system in a IP10 indoor, IP52 indoor or IP54 outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching. VFD output switching signal shall be programmed to not cause mechanical vibration issues with back-lash in gearbox teeth or vibration issues associated with long driveshafts. The VFD shall be programmed for variable torque applications and shall catch a fan spin-ning in the forward or reverse direction without tripping. VFD panel construction shall include a main disconnect with short circuit and thermal overload protection with external operating handle, lockable in the off position for lock-out tag-out safety procedures. A service switch directly ahead of the VFD shall be provided for voltage isolation during VFD maintenance. An integrated full voltage non-reversing bypass starter shall be furnished allowing fan motor operation if VFD has failed. The VFD system shall receive a speed refer-ence signal from the building manage-ment system monitoring the cooling tower cold-water temperature. As an option to receiving the speed reference signal from a building management system, the drive must have the capability to receive a 4-20 mA temperature signal from an RTD transmitter. When using an RTD for temperature monitoring and speed control the VFD shall have an internal PI regula-tor to modulate fan speed maintaining set point temperature. The drive's panel shall display the set-point temperature and cold-water temperature on two separate lines. The bypass shall include a complete electromechanical magnetic bypass cir-cuit with the capability to isolate the VFD when in the bypass mode. Transfer to the bypass mode shall be manual in the event of VFD failure. Once the motor is trans-ferred to the bypass circuit the fan motor

Specification Value

- Marley VFD drive systems are designed to combine absolute temperature control with ideal energy management. The cooling tower user selects a cold water temperature and the drive system will vary the fan speed to maintain that temperature. Precise temperature control is accomplished with far less stress to the mechanical equipment components. The improved energy management provides fast payback.

  Motors operated on a VFD shall carry a service factor of 1.0. When operating on a VFD, the drive parameters should be programmed to limit the current to motor nameplate hp. Adjust the Motor specification accordingly.

Specifications	Specification Value
will run at constant full speed. Operator controls shall be mounted on the front of the enclosure and shall consist of Start and Stop control, Bypass/VFD selection, Auto/Manual selections and manual speed control. To prevent heating problems in the fan motor the VFD system shall de energize the motor once 25% motor speed is reached and cooling is no longer required. The cooling tower manufacturer shall offer VFD start-up assistance to assure proper VFD programming for cooling tower operation.	
Miscellaneous Options	
Equalizer Flume Weir Gates:	
11.2 *Add the following paragraph under Cold Water Collection Basin:* The interconnecting flume between cells shall be equipped with a removable cover plate to permit the shutdown of one cell for maintenance purposes, or to permit independent cell operation.	■ Where it is your intention to be able to operate both cells of the tower while the flume cover plate is installed, separate outlet connections, float valves and overflows must be provided for each cell. Likewise, this would require separate sensors and controls for basin heater systems, if installed.
Fan Cylinder Extensions:	
9.1 *Insert the following before the last sentence:* Fan cylinder extensions shall be provided to elevate the fan discharge to a height of ___ mm above the fan deck level.	■ Extensions are available in nominal 30cm increments to a maximum height that varies by model. Such extensions may be considered necessary in order to elevate the discharge beyond the bounds of an enclosure. Discuss applicability with your local Marley sales representative.
Basin Sweeper Piping:	
11.2 *Add the following paragraph to the Cold Water Collection Basin section:* The cold water basin shall be equipped with factory installed corrosion resistant PVC sweeper piping with plastic nozzles. The sweeper piping system shall be designed to force dirt and debris towards a dedicated drain in the depressed section of the collection basin.	
Splash Attenuation:	
1.3 *Insert the following paragraph in the Base section:* The cooling tower shall be equipped with polypropylene splash attenuation media factory installed in the collection basin to reduce falling water noise.	

Specifications	Specification Value
Outlet Sound Attenuation:	
1.3 *Add the following paragraph to the Base section:* The cooling tower shall be equipped with outlet sound attenuation baffles positioned and spaced horizontally across the entire fan opening. The baffles shall be constructed of perforated sheet metal filled with sound absorbing material, and contained within a steel box that is self-supporting.	
Ultra Quiet Fan:	■ For more severe cases requiring the lowest possible fan sound levels the Marley "Ultra Quiet" fan option is now available on all MD models. Tower height may increase slightly–obtain current sales drawings from your Marley sales representative for accurate dimensions. If your requirement calls for outlet attenuation, you might consider the Ultra Quiet fan in lieu of attenuation. Outlet attenuators are not available with the Ultra Quiet Fan option.
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 51 m/s. Fan(s) shall be driven through a one-piece multi-groove, solid back V-type belt, sheaves (pulleys), and tapered roller bearings. Bearings shall be rated at an L_{10} life of 100,000 hours, or greater. Both motor and fan sheaves (pulleys) shall be all cast aluminum to prevent premature corrosion.	
6.1 (alternate) *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 51 m/s. Fan(s) shall be driven	

Marley "Ultra Quiet" fan

Specifications	Specification Value
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.	
FM Approval:	
Available only on multi-cell towers.	
5.3 *Add the following paragraph in the Construction section:* For applications of two or more cells, the tower shall be listed in the current FM Approval Guide (approvalguide.com) and conform to the FM Approval Standard for Cooling Towers, Class Number 4930 that is approved for use without sprinkler systems. The tower shall have successfully passed full scale fire testing, static and cyclic wind pressure testing, large missile impact testing (for Zone HM), and structural design evaluation as administered by FM Approvals. he tower shall be capable of +70/-140 psf for Zone H as defined by FM Global. A copy of the FM Approval Certificate of Compliance dated November 2013 or later shall be available upon request.	■ This could have a very beneficial effect upon your fire insurance premiums. Towers not able to meet FM requirements may require the inclusion of a fire protection sprinkler system to achieve a comparable level of insurance premium cost. Even if you are not insured by FM, this requirement ensures that each cell will contain any fire that may occur without losing the ability of limited operations and capacity.
Low-Clog Film Fill:	
7.1 *Replace paragraph 7.1 with the following:* Fill shall be vertical-fluted, counterflow film type, thermoformed PVC, with no greater than 15 sheets/ft of fill across the cross section of the tower. Fill shall be supported on channel sections connected to the tower structure and have a flame spread rating less than 25.	■ Low-clog fill provides a higher degree of clog resistance for dirty water applications. Allows substances to migrate through it, while maintaining thermal efficiency. Large orifice, low-clog nozzles develop uniform water distribution over a wide range of operating water pressures. The combination of PVC piping and polypropylene nozzles is very resistant to the build-up of scale and slime. Typical applications include: • Reclaimed or recycled water source • River or lake water source • Scaling well-water source • Elevated oil or grease • Poor control of biological growth or mineral scale • Moderate product contamination (non-fibrous) • Dusty, nutrient laden, agricultural, or mining environment
8.1 *Replace paragraph 8.1 with the following:* A pressured low-clog spray system shall distribute water evenly over the fill. The branch arms shall be corrosion resistant PVC with polypropylene spray nozzles attached to the branch arms with a threaded connection for ease of removal and cleaning. Branch arms are connected to a common internal header box using a grommet connection. Spray system shall provide uniform distribution within the nozzle operating pressure range.	

MD cooling tower

ENGINEERING DATA AND SPECIFICATIONS

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