MC fluid cooler

engineering data
and specifications

MARLEY®

AIR MOVEMENT PACKAGE

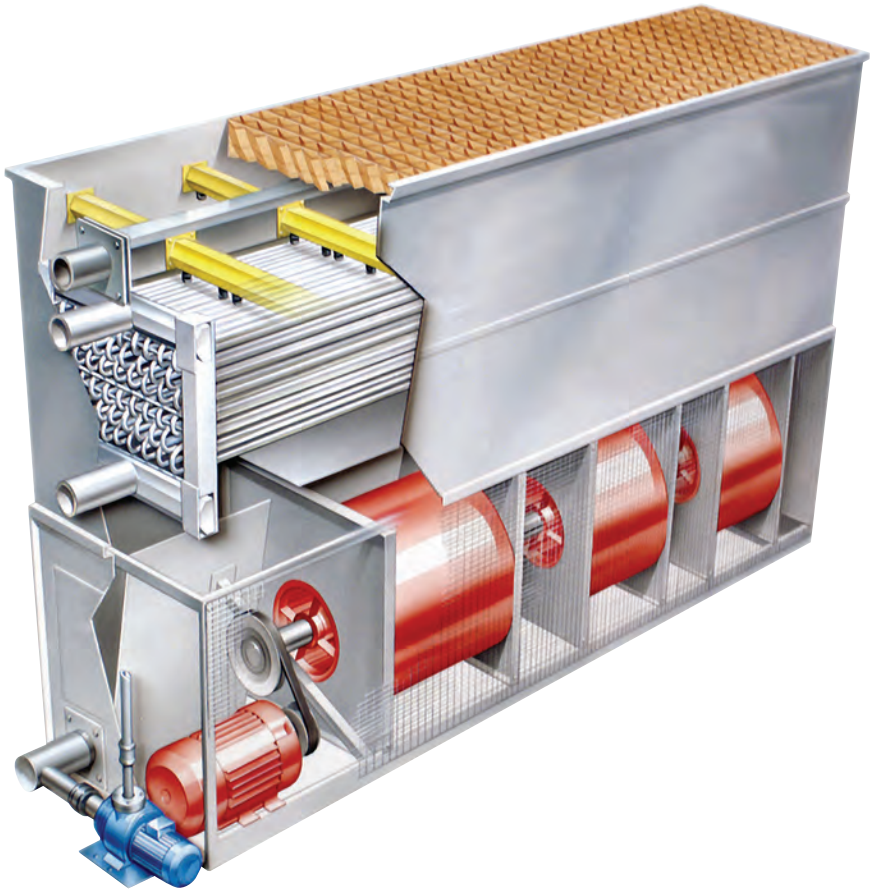
- Forward-curved centrifugal fans are dynamically balanced and mounted on tubular steel shafts.
- Fans are supported by roller-bearings mounted at both ends with heavy-guage steel supports.
- Spherical roller bearings are rated at an L_{10} life of 50,000 hours.
- Fan guard / Air-inlet screens are 16 gauge galvanized steel.
- TEFC Fan Motor—1.15 service factor, variable torque, and specially insulated for fluid cooler duty.
- The MC Fluid Cooler air movement package including the structural support—guaranteed against failure for a period of five full years. The motor is warranted separately by the motor manufacturer.

WATER DISTRIBUTION SYSTEM

- Pressurized spray system distributes water evenly over the fill. Header and branch arms are PVC.
- Low-clog polypropylene nozzles—delivers precise distribution of water over the coil area.
- Marley's hot-dipped galvanized coil is tested at 400 psi to ensure integrity and sloped to ensure total drainage at shutdown
- Marley XCEL drift eliminators—limit drift losses to no more than .005% of the design gpm flow rate.

STRUCTURE

- Forced-draft, counter-flow design requires considerably less plan area than crossflow fluid coolers typically use.
- Series 300 stainless steel or heavy mill galvanized steel construction.
- Factory assembled—ensures final field installation will be hassle-free.
- Centrifugal fans and a fully-enclosed falling water area create one of the quietest fluid cooler configurations on the market.



The Marley **MC Fluid Cooler** is particularly suited to the urban environment, reducing noise while increasing energy efficiency and performance. By keeping the process fluid in a clean, closed loop, and combining the function of a cooling tower and heat exchanger into one system, they provide superior operational and maintenance benefits.

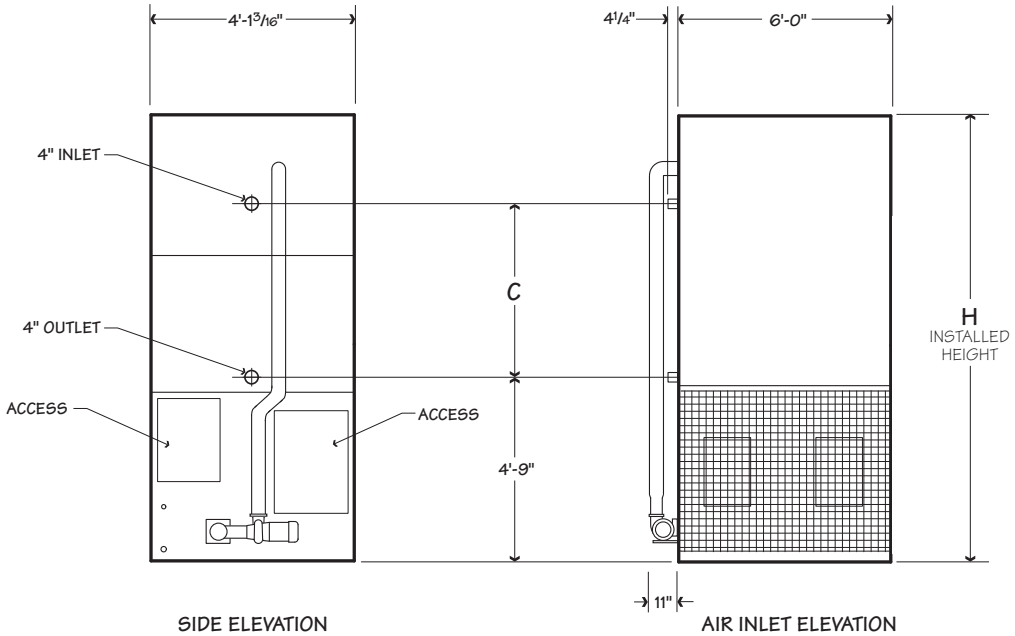
The specifications portion of this publication not only relates the language to use in describing an appropriate **MC Fluid Cooler**—but also defines why certain items and features are important enough to specify with the intention of insisting upon compliance by all bidders. The left-hand column of pages 17 thru 27 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 17 thru 20 indicate those paragraphs which will result in the purchase of a basic fluid cooler—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 fluid cooler is part. It will also incorporate those standard materials which testing and experience has proven to provide acceptable longevity in normal operating conditions.

Pages 21 thru 27 provide paragraphs intended to add those features, components and materials that will customize the fluid cooler to meet the user's requirements.

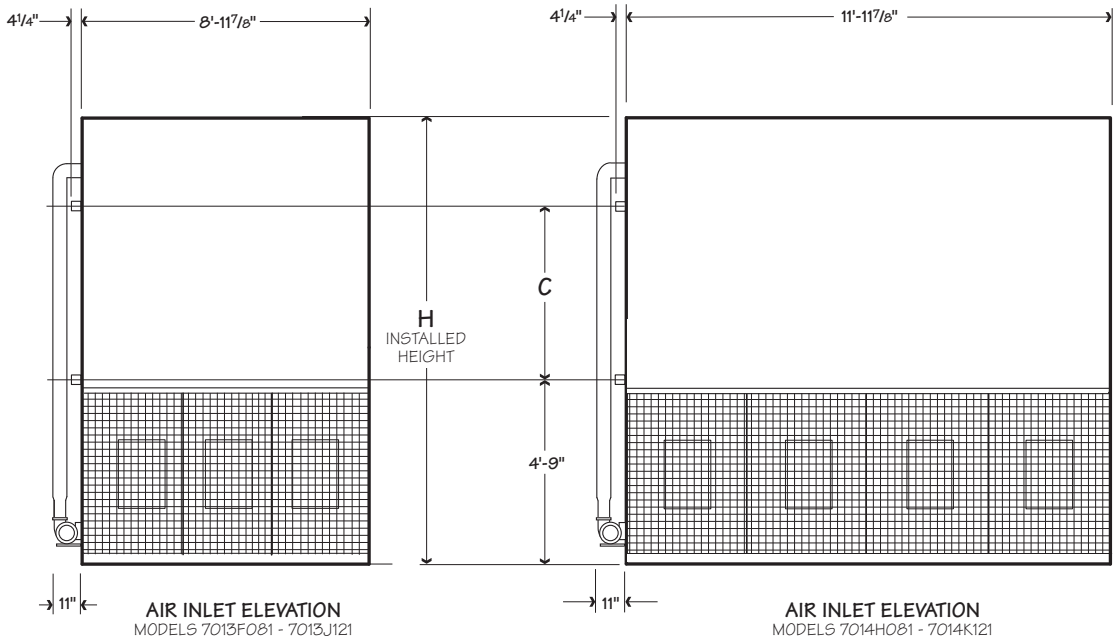
Use this data for preliminary layouts only. Obtain current drawing from your Marley sales representative.

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



SIDE ELEVATION
ALL MODELS

AIR INLET ELEVATION
MODELS 7012D081 - 7012H121



AIR INLET ELEVATION
MODELS 7013F081 - 7013J121

AIR INLET ELEVATION
MODELS 7014H081 - 7014K121

Model	Dimensions		Motor	Pump	Operating Weight	Shipping Weight lb	
	H	C	hp	hp	lb	Weight per Cell	Heaviest Section
7012D081	9'-3½"	2'-8"	3	.5	3589	3113	2154
7012F081	9'-3½"	2'-8"	5				
7012H081	9'-3½"	2'-8"	7.5				
7012D101	10'-0½"	3'-5"	3	.5	4087	3490	2531
7012F101	10'-0½"	3'-5"	5				
7012H101	10'-0½"	3'-5"	7.5				
7012D121	10'-9½"	4'-2"	3	.5	4491	3867	2910
7012F121	10'-9½"	4'-2"	5				
7012H121	10'-9½"	4'-2"	7.5				
7013F081	9'-3½"	2'-8"	5	.75	4866	4035	2817
7013H081	9'-3½"	2'-8"	7.5				
7013J081	9'-3½"	2'-8"	10				
7013F101	10'-0½"	3'-5"	5	.75	5397	4541	3327
7013H101	10'-0½"	3'-5"	7.5				
7013J101	10'-0½"	3'-5"	10				
7013F121	10'-9½"	4'-2"	5	.75	5943	5049	3834
7013H121	10'-9½"	4'-2"	7.5				
7013J121	10'-9½"	4'-2"	10				
7014H081	9'-3½"	2'-8"	7.5	1	6149	5068	3527
7014J081	9'-3½"	2'-8"	10				
7014K081	9'-3½"	2'-8"	15				
7014H101	10'-0½"	3'-5"	7.5	1	6830	5703	4160
7014J101	10'-0½"	3'-5"	10				
7014K101	10'-0½"	3'-5"	15				
7014H121	10'-9½"	4'-2"	7.5	1	7515	6338	4797
7014J121	10'-9½"	4'-2"	10				
7014K121	10'-9½"	4'-2"	15				

NOTE

1 **Use this bulletin for preliminary layouts only.** Obtain current drawings from your Marley sales representative. All table data is per cell.

2 Standard overflow is a 2" dia. F connection located on the side of the collection basin. Makeup water connection is a 1" dia. M connection located on the side of the collection basin. Drain is a 2"F connection located on the side of the collection basin.

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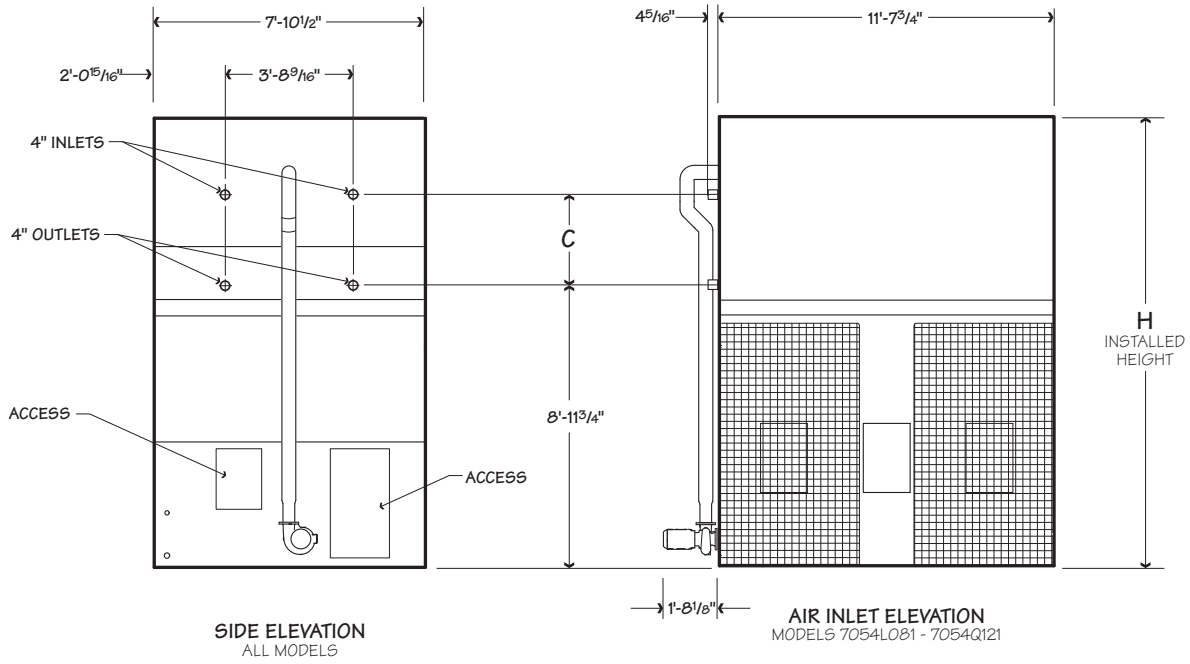
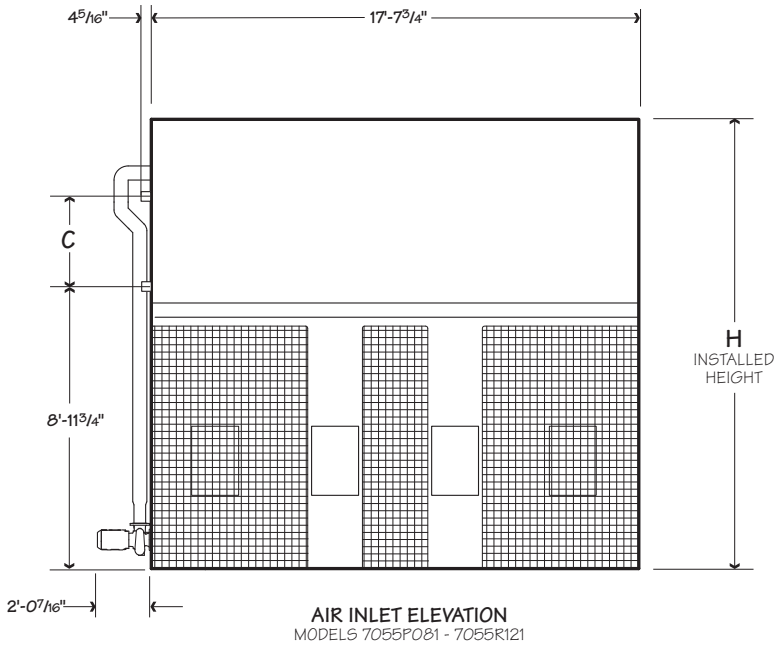


SIDE ELEVATION
ALL MODELS

AIR INLET ELEVATION
MODELS 7054L081 - 7054Q121



AIR INLET ELEVATION
MODELS 7055P081 - 7055R121

Model	Dimensions		Motor	Pump	Operating Weight	Shipping Weight lb	
	H	C	hp	hp	lb	Weight per Cell	Heaviest Section
7054L081	13'-8¼"	2'-8"	20	3	12674	9050	6437
7054M081	13'-8¼"	2'-8"	25				
7054N081	13'-8¼"	2'-8"	30				
7054P081	13'-8¼"	2'-8"	40				
7054Q081	13'-8¼"	2'-8"	50				
7054L101	14'-5¼"	3'-5"	20	3	14001	10269	7654
7054M101	14'-5¼"	3'-5"	25				
7054N101	14'-5¼"	3'-5"	30				
7054P101	14'-5¼"	3'-5"	40				
7054Q101	14'-5¼"	3'-5"	50				
7054L121	15'-2¼"	4'-2"	20	3	15141	11305	8691
7054M121	15'-2¼"	4'-2"	25				
7054N121	15'-2¼"	4'-2"	30				
7054P121	15'-2¼"	4'-2"	40				
7054Q121	15'-2¼"	4'-2"	50				
7055P081	13'-8¼"	2'-8"	20 x 2	5	17659	12253	8644
7055Q081	13'-8¼"	2'-8"	25 x 2				
7055R081	13'-8¼"	2'-8"	30 x 2				
7055P101	14'-5¼"	3'-5"	20 x 2	5	19504	13940	10328
7055Q101	14'-5¼"	3'-5"	25 x 2				
7055R101	14'-5¼"	3'-5"	30 x 2				
7055P121	15'-2¼"	4'-2"	20 x 2	5	21269	15626	12013
7055Q121	15'-2¼"	4'-2"	25 x 2				
7055R121	15'-2¼"	4'-2"	30 x 2				

NOTE

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2 Standard overflow is a 2" dia. F connection located on the side of the collection basin. Makeup water connection is a 1" dia. M connection located on the side of the collection basin. Drain is a 2"F connection located on the side of the collection basin.

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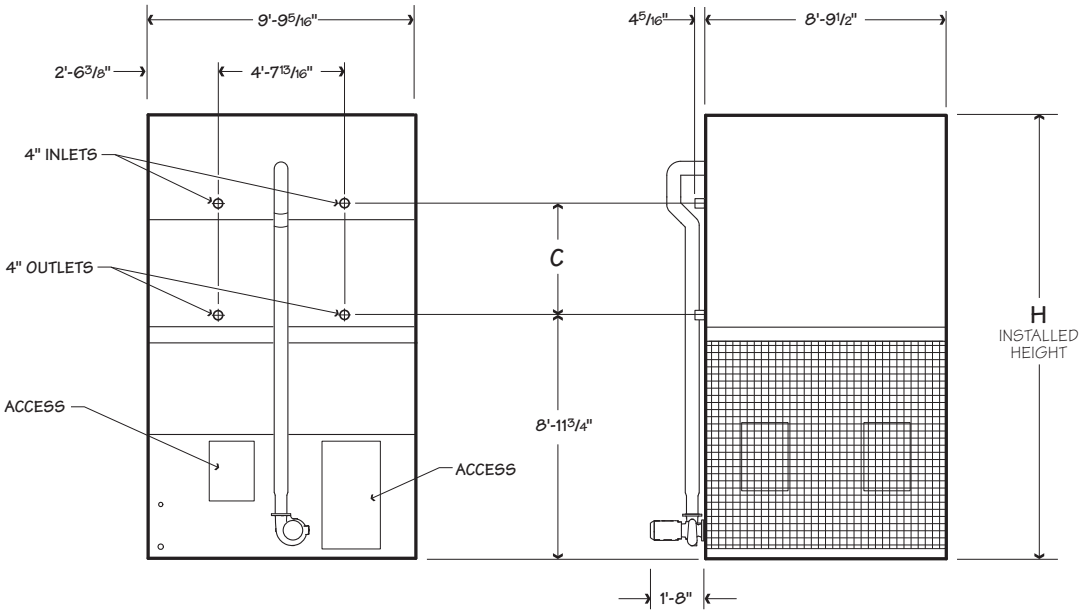
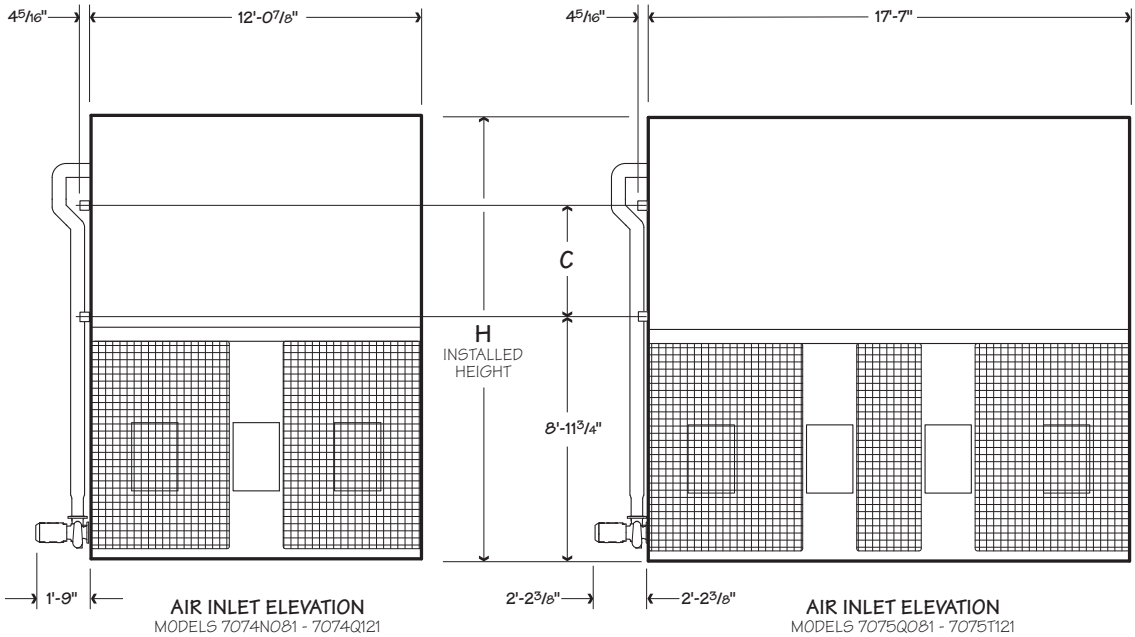


SIDE ELEVATION
ALL MODELS

AIR INLET ELEVATION
MODELS 7074Q081 - 7074T121



AIR INLET ELEVATION
MODELS 7074N081 - 7074Q121

AIR INLET ELEVATION
MODELS 7075Q081 - 7075T121

Model	Dimensions		Motor	Pump	Operating Weight	Shipping Weight lb	
	H	C	hp	hp	lb	Weight per Cell	Heaviest Section
7073M081	13'-8 5/16"	2'-8"	25	3	13646	10011	6459
7073N081	13'-8 5/16"	2'-8"	30				
7073P081	13'-8 5/16"	2'-8"	40				
7073M101	14'-5 5/16"	3'-5"	25	3	14923	11187	7636
7073N101	14'-5 5/16"	3'-5"	30				
7073P101	14'-5 5/16"	3'-5"	40				
7073M121	15'-2 5/16"	4'-2"	25	3	16206	12364	8812
7073N121	15'-2 5/16"	4'-2"	30				
7073P121	15'-2 5/16"	4'-2"	40				
7074N081	13'-8 5/16"	2'-8"	30	5	17317	12387	7824
7074P081	13'-8 5/16"	2'-8"	40				
7074Q081	13'-8 5/16"	2'-8"	50				
7074N101	14'-5 5/16"	3'-5"	30	5	18955	13886	9323
7074P101	14'-5 5/16"	3'-5"	40				
7074Q101	14'-5 5/16"	3'-5"	50				
7074N121	15'-2 5/16"	4'-2"	30	5	20584	15381	10818
7074P121	15'-2 5/16"	4'-2"	40				
7074Q121	15'-2 5/16"	4'-2"	50				
7075Q081	13'-8 5/16"	2'-8"	25 x 2	7.5	24220	16918	10514
7075R081	13'-8 5/16"	2'-8"	30 x 2				
7075T081	13'-8 5/16"	2'-8"	40 x 2				
7075Q101	14'-5 5/16"	3'-5"	25 x 2	7.5	26294	18993	12589
7075R101	14'-5 5/16"	3'-5"	30 x 2				
7075T101	14'-5 5/16"	3'-5"	40 x 2				
7075Q121	15'-2 5/16"	4'-2"	25 x 2	7.5	28334	20836	14432
7075R121	15'-2 5/16"	4'-2"	30 x 2				
7075T121	15'-2 5/16"	4'-2"	40 x 2				

NOTE

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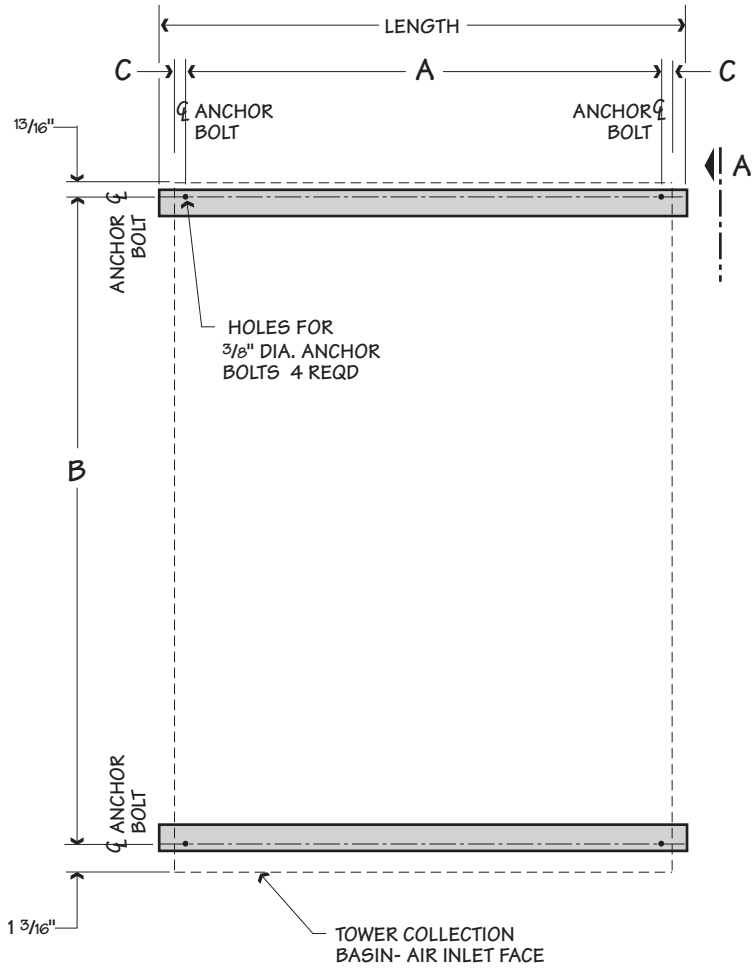
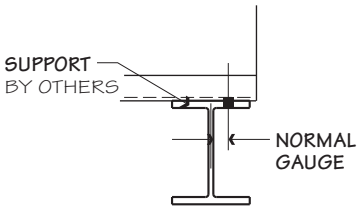
2 Standard overflow is a 1 1/2" dia. F connection located on the side of the collection basin. Makeup water connection is a 1 1/2" dia. M connection located on the side of the collection basin. Drain is a 2"F connection located on the side of the collection basin.



SUPPORTING STEEL
SINGLE CELL

Model	A	B	C
7012	4'-11 13/16"	3'-11 5/8"	6"
7013	7'-11 3/4"		
7014	10'-11 5/8"		
7054	11'-6 3/16"	7'-8 15/16"	15/16"
7055	17'-6 1/4"		
7073	8'-7 15/16"	9'-7 3/8"	13/16"
7074	11'-11 5/16"		
7075	17'-5 7/16"		



VIEW A

NOTE

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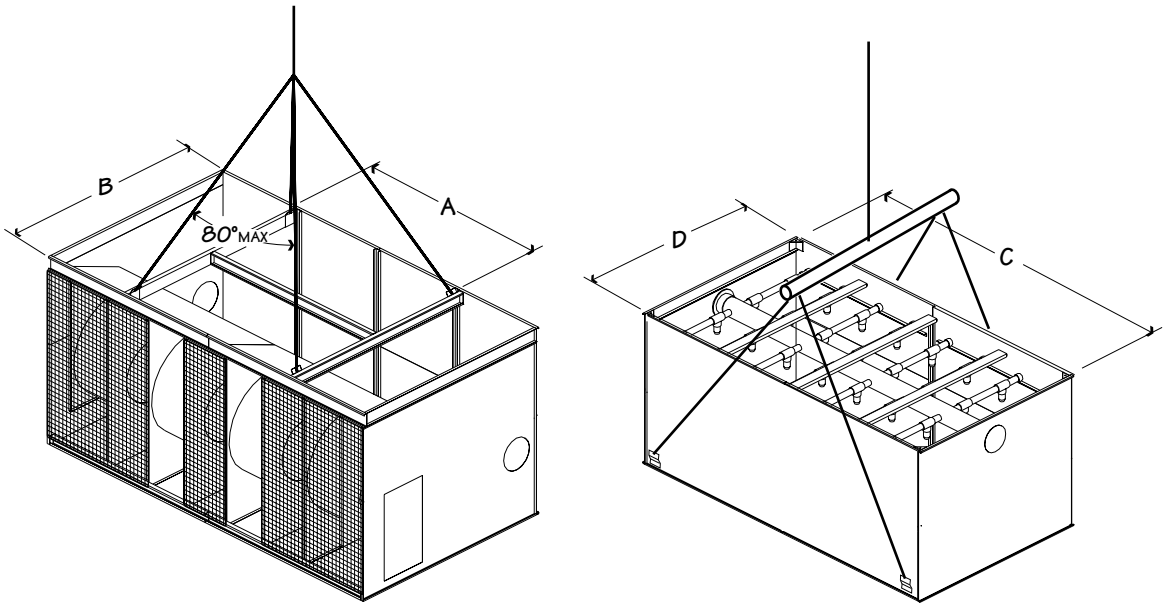
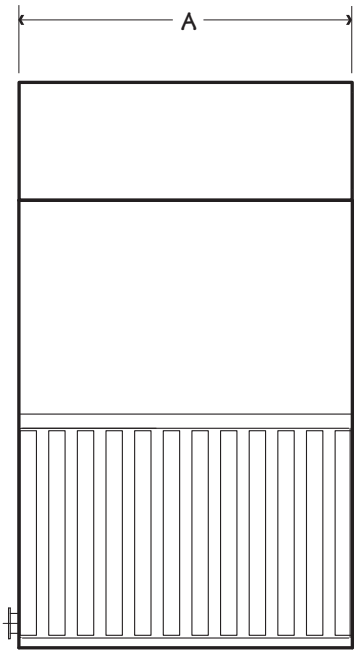
2 Purchaser to provide fluid cooler support complete with holes and anchor bolts. Do not use studs! Anchor points must be framed flush and level at top.
3 Continuous beam required for entire length.
4 Fluid cooler may be placed on a flat concrete slab.



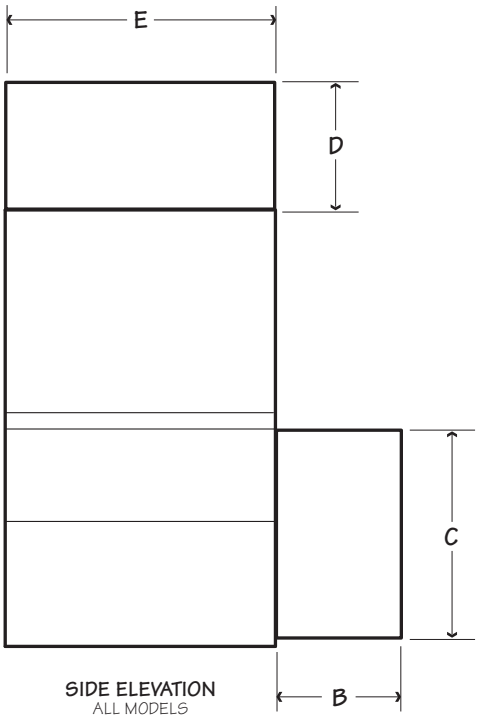
Model	Lower Module			Upper Module		
	A	B	Weight lb	C	D	Weight lb
7012	4'-8"	3'-9"	960	5'-3"	3'-9"	2910
7013	7'-8"	3'-9"	1210	8'-3"	3'-9"	3835
7014	10'-10"	3'-9"	1540	11'-3"	3'-9"	4795
7054	4'-1"	6'-9"	2615	10'-11"	8'-0"	8690
7055	10'-1"	6'-9"	3615	5'-9"	8'-0"	12015
7073	8'-3"	9'-2"	3550	8'-3"	9'-2"	8810
7074	4'-3"	8'-8"	4565	11'-7"	9'-2"	10820
7075	9'-0"	8'-8"	6405	17'-1"	9'-2"	14430

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 fluid cooler unit.



AIR INLET ELEVATION



SIDE ELEVATION
ALL MODELS

Model	Depth	Dimensions				
		A	B	C	D	E
7012	2'	5'-11 13/16"	3'-7 5/16"	3'-7 13/16"	3'-8 5/16"	4'-1 1/4"
	4'	5'-11 13/16"	5'-6 15/16"	3'-7 13/16"	5'-7 15/16"	4'-1 1/4"
7013	2'	8'-11 11/16"	3'-7 5/16"	3'-7 13/16"	3'-8 5/16"	4'-1 1/4"
	4'	8'-11 11/16"	5'-6 15/16"	3'-7 13/16"	5'-7 15/16"	4'-1 1/4"
7014	2'	11'-11 5/8"	3'-7 5/16"	3'-7 13/16"	3'-8 5/16"	4'-1 1/4"
	4'	11'-11 5/8"	5'-6 15/16"	3'-7 13/16"	5'-7 15/16"	4'-1 1/4"
7054	2'	11'-7 3/4"	3'-7 5/16"	6'-11 1/2"	3'-8 5/16"	7'-10 1/2"
	4'	11'-7 3/4"	5'-6 15/16"	6'-11 1/2"	5'-7 15/16"	7'-10 1/2"
7055	2'	17'-7 13/16"	3'-7 5/16"	6'-11 1/2"	3'-8 5/16"	7'-10 1/2"
	4'	17'-7 13/16"	5'-6 15/16"	6'-11 1/2"	5'-7 15/16"	7'-10 1/2"
7073	2'	8'-9 1/2"	3'-7 5/16"	6'-11 1/2"	3'-8 5/16"	9'-9 5/16"
	4'	8'-9 1/2"	5'-6 15/16"	6'-11 1/2"	5'-7 15/16"	9'-9 5/16"
7074	2'	12'-0 7/8"	3'-7 5/16"	6'-11 1/2"	3'-8 5/16"	9'-9 5/16"
	4'	12'-0 7/8"	5'-6 15/16"	6'-11 1/2"	5'-7 15/16"	9'-9 5/16"
7075	2'	17'-7"	3'-7 5/16"	6'-11 1/2"	3'-8 5/16"	9'-9 5/16"
	4'	17'-7"	5'-6 15/16"	6'-11 1/2"	5'-7 15/16"	9'-9 5/16"

NOTE

1 Attentuators will result in an additional external resistance therefore the fan will be unable to deliver the same airflow resulting in a small reduction in performance.

2 Critical noise applications **must** be referred to SPX Cooling Technologies engineering.

FLUID COOLER COIL

When the ambient temperature falls below 32°F, heat loss from the coil can be substantial even without recirculating water flowing over the coil. The process fluid, without an applied heat load, may be prone to freezing. There are various methods to protect against coil freezing.

Ethylene and propylene glycol solutions are the best means to protect against coil freezing and are recommended for most installations. The appropriate concentration of ethylene or propylene glycol should be determined based on the required protection from low ambient temperatures.

If the use of an industrial antifreeze solution is not compatible with the system, another accepted method of preventing coil freezing is to maintain a sufficient flow rate and heat load on the process fluid. The fluid exiting the coil must be maintained at or above 45°F at the full process flow rate. If the process load does not yield such a heat load, it may be necessary to apply a supplementary heat load to the process fluid.

Draining the coil is not considered to be an acceptable means of protection against freezing. Introducing air to the interior of the bundle will promote corrosion of the heat exchanger coil. In an emergency, this alternative can be used in the event that the process fluid drops below 45°F, the ambient temperature is below freezing and the coils are not protected with industrial antifreeze.

Cycling of the recirculating water pumps should not be used to control process flow temperatures. Coils may be used for seasonal dry operation followed by seasonal wet operation, but not for frequent cycling of the recirculating water pump. Such operation may lead to an excessive scale buildup resulting in a decrease in efficiency.

⚠ CAUTION

Freezing ambient conditions could cause significant damage to the heat exchanger coil of the MH Fluid Cooler. To avoid possible damage, it is imperative to provide for adequate freeze protection.

FLUID COOLING RECIRCULATING WATER

When the ambient air temperature falls below 32°F, the recirculating water within the fluid cooler can freeze. Marley Technical Report #H-003 *"Operating Cooling Towers in Freezing Weather"* describes how to prevent freezing during operation. Ask your Marley sales representative for a copy or download a copy at spxcooling.com.

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

ELECTRIC BASIN HEATERS

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

- Stainless steel electric immersion heater(s). Threaded couplings are provided in the side of the collection basin.
- NEMA 4 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

  The enclosure may be mounted on the side of the fluid cooler
- Control probe in the collection basin to monitor water temperature and level.
- Heat tracing for recirculating water pump.

The basin heater option is only for freeze protection of the recirculation water in collection basin. The basin heater option does not protect the coil during freezing weather.

Heater components are normally shipped separately for installation by others.

INDOOR STORAGE TANK

With this type of system, water flows from an indoor tank and back to the fluid cooler where it is cooled and recirculated. The water flows by gravity from the fluid cooler 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 fluid cooler size and gpm and on the volume of water contained in the piping system to and from the fluid cooler. 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.

The MC Fluid Cooler 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. The MC Fluid Cooler is equipped with a blowdown line with metering valve connected directly to the overflow. Specific blowdown adjustment instructions and additional blowdown information can be found in the *MC Fluid Cooler User Manual* .

⚠ CAUTION

The fluid cooler 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 fluid cooler is in compliance with applicable air pollution, fire and clean air codes.

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 fluid cooler—ideally the pH of the recirculating water should fall between 6.5 and 9.0. Batch feeding of the chemicals directly into the fluid cooler is not a good practice since localized damage to the fluid cooler is possible. Specific startup instructions and additional water quality recommendations can be found in the *MC Fluid Cooler User Manual* which accompanies the fluid cooler and also is available from your local Marley sales representative.

Specifications	Specification Value
1.0 **Base:**	
1.1 Furnish and install a forced-draft, counterflow-type, factory assembled, film fill, industrial duty, galvanized steel, closed circuit fluid cooler. Unit shall consist of _____ cell(s), as shown on plans. The limiting overall dimensions of the fluid cooler shall be _____ wide, _____ long, and _____ high. Total operating horsepower of all fans shall not exceed _____ hp, consisting of_____ @ _____ hp motor(s). Fluid cooler shall be similar and equal in all respects to Marley Model _____.	■ Your specification base establishes the type, configuration, base material and physical limitations of the fluid cooler to be quoted. During the planning and layout stages of your project, you will have focused your attention on a fluid cooler 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. The benefit of a forced-draft counterflow fluid cooler is that they are inherently easy to operate, access and maintain. Forced-draft counterflow fluid coolers have all mechanical equipment located at a low level for easy access, and the water distribution system is accessible by simply removing the lightweight drift eliminator panels
2.0 **Thermal Performance:**	
2.1 *Water as the heat transfer fluid.* The fluid cooler shall be capable of cooling _____ gpm of water from _____ °F to _____ °F at a design entering air wet-bulb temperature of _____ °F. Coil pressure drop shall not exceed _____ psi.	
2.1 *Aqueous glycol solution as the heat transfer fluid.* The fluid cooler shall be capable of cooling _____ gpm of water from _____ °F to _____ °F at a design entering air wet-bulb temperature of _____ °F. Coil pressure drop shall not exceed _____ psi.	
3.0 **Performance Warranty:**	
3.1 The fluid cooler manufacturer shall guarantee that the fluid cooler supplied will meet the specified performance conditions when the fluid cooler is installed according to plan. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the fluid cooler fails to perform within the limits of test tolerance; then the fluid cooler 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.	

Specifications	Specification Value

4.0 Coil:

4.1 Coil(s) shall consist of fully welded box headers with serpentine coils and hot-dip galvanized after fabrication. Coils shall be tested to 400 psi air pressure while immersed in water. Maximum operating design pressure shall be 225 psi. The coil shall be designed for free drainages of fluid at shutdown.

5.0 Design Loading:

5.1 The fluid cooler and its components shall be designed to withstand a wind load of 20 psf. The fluid cooler shall be designed to withstand shipping and hoisting loads of 2g horizontal or 3g vertical. Handrails, where specified shall be capable of withstanding a 200 lb concentrated live load in any direction and shall be designed in accordance with OSHA guidelines.

6.0 Construction:

6.1 Except where otherwise specified, all components of the fluid cooler shall be fabricated of heavy-gauge steel, protected against corrosion by G-235 galvanizing. After passivation of the galvanized steel (8 weeks at pH 7-8, and calcium hardness and alkalinity at 100-300 ppm each), the fluid cooler shall be capable of withstanding water having a pH of 6.5 to 9.0; a chloride content up to 500 ppm as NaCl (300 ppm as Cl-); a sulfate content (as SO_4) up to 250 ppm; a calcium content (as CaCO3) up to 500 ppm; silica (as SiO_2) up to 150 ppm; and design operating ranges up to 50°F. The circulating water shall contain no oil, grease, fatty acids, or organic solvents.

6.2 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 fluid cooler 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.

- The MC Fluid Cooler coil is suitable for cooling water, oils and other fluids compatible with carbon steel in a closed, pressurized system. Each coil is constructed of all-prime surface, continuous steel tubing, formed into a serpentine shape and welded into an assembly. The complete assembly is then hot-dip galvanized after fabrication. Design pressure is 225 psig, and each coil is tested to 400 psig air pressure under water. Tubes are sloped to provide free drainage when vented.

- The indicated design values are the minimum allowables under accepted design standards. They give you assurance that the fluid cooler can be shipped, handled, hoisted–and ultimately operated in a normal fluid cooler environment. Most MC Series 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.

- In the history of fluid coolers, no other coating for carbon steel has exhibited the success and longevity of galvanization in exposure to the normal fluid cooler 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 fluid cooler 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 21.

Specifications	Specification Value
7.0 **Mechanical Equipment**:	
7.1 Fan(s) shall be forward curved centrifugal-type, which are statically and dynamically balanced. The fan impeller is manufactured from galvanized steel, blades are riveted to the center plate and inlet rings and have stay rods to ensure maximum concentricity and rigidity. The stay rods are adjusted by the manufacturer during the balancing operation and require no field adjustment. Fan(s) shall be driven through one-piece, multi-groove, V-belt, pulleys, and spherical roller bearings. Bearings shall be rated at an L_{10} life of 50,000 hours, or greater. A hinged motor adjustment plate with threaded tensioning bolts shall be installed to allow correct belt tensioning.	■ The Marley drive system features all-aluminum sheaves (pulleys), power band belts, and long-life bearings for dependable service. To reduce cost, some manufacturers may use TEAO motors, whose only source of cooling is the flow of air produced by the fluid cooler fan. They are sometimes applied at horsepowers significantly beyond their nameplate rating. Unless otherwise specified, motor speed will be 1800 RPM, 60 Hertz on standard models. If you prefer the operating flexibility of two-speed operation, please specify two-speed, single-winding motors which offer full and half speeds for maximum energy savings. Incidentally, two speed motors are a far better choice than separate “pony” motors which simply double the problems indicated above. The value of a 5 year mechanical equipment warranty speaks for itself.
7.2 Motor(s) shall be ____ hp maximum, Totally Enclosed, 1.15 service factor, variable torque, and specially insulated for fluid cooler duty. Speed and electrical characteristics shall be _____ RPM, single-winding, 3 phase, 60 hertz, ____ volts. Motor shall operate in the shaft-horizontal position and nameplate horsepower shall not be exceeded at design operation	
7.3 The complete mechanical equipment assembly for each cell shall be supported by a rigid, galvanized 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 five (5) years following the date of fluid cooler shipment. This warranty is limited to the fan, fan shaft, bearings, sheaves and mechanical equipment support. The motor, motor components and belt(s) are warranted by their manufacturer.	
8.0 **Drift Eliminators:**	
8.1 Drift eliminators shall be 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 in standard configuration without premium cost. If a lower rate is required, please discuss with your Marley sales representative.

Specifications	Specification Value
9.0 **Hot Water Distribution System:**	
9.1 A pressured spray system shall distribute water evenly over the fill. Header and branch arms shall be PVC with polypropylene spray nozzles attached to the branch arms by an integral screw connection for ease of removal and cleaning. The spray system shall provide full coverage of the coil at a flow rate sufficient to ensure complete wetting of the coil at all times.	■ The combination of PVC piping and polypropylene nozzles is very resistant to the build-up of scale and slime.
10.0 **Casing:**	
10.1 The casing shall be heavy gauge G-235 galvanized steel and shall be capable of withstanding the loads described in paragraph 5.1.	
11.0 **Access:**	
11.1 A large galvanized, rectangular access door shall be located on both end panels for entry into the cold water basin. Rectangular panels are shall be provided for access to the fan plenum area to facilitate inspection and allow maintenance to the fan drive system	
12.0 **Cold Water Collection Basin**:	
12.1 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 fluid cooler. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate.	■ The MC fluid cooler design offers side-suction as standard. Bottom outlets may be supplied to accommodate a variety of piping schemes. Unless so specified, the fluid cooler 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.
13.0 **Warranty**:	
13.1 The MC Fluid Cooler shall be free from defects in materials and workmanship for a period of eighteen (18) months from the date of shipment.	

Specifications	Specification Value
Stainless Steel Options	
Stainless Steel Collection Basin:	
12.1: *Replace paragraph 12.1 with the following:* The collection basin shall be heavy-gauge Series 300 stainless steel. Suction connections shall be equipped with stainless steel 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 fluid cooler. The basin floor shall slope toward the drain to allow complete flush out of debris and silt which may accumulate. All steel items which project into the basin (anchor clips, etc.) shall also be made of stainless steel.	■ The cold water basin is the only part of the fluid cooler 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 fluid cooler to repair or replace. For these reasons, many customers–particularly those who are replacing older fluid coolers–choose to specify stainless steel cold water basins.
All Stainless Fluid cooler:	
6.1 *Replace paragraph 6.1 with the following:* Except where otherwise specified, all components of the fluid cooler shall be fabricated of heavy-gauge, series 300 stainless steel. The fluid cooler shall be capable of withstanding water having a chloride content (NaCl) up to 750 ppm; a sulfate content (SO_4) up to 1200 ppm; a calcium content ($CaCO_3$) up to 800 ppm; silica (SiO_2) up to 150 ppm; and design operating ranges up to 50°F. 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 stainless steel. No paints or electostatically-applied coatings, however exotic they may be, can match stainless steel's ability to withstand adverse operating conditions.
4.1 *Replace paragraph 4.1 with the following:* Coil(s) shall consist of fully welded box headers with serpentine coils. All coil components shall be assembled from series 300 stainless steel. Coils shall be tested to 400 psi air pressure while immersed in water. Maximum operating design pressure shall be 150 psi. The coil shall be designed for free drainages of fluid at shutdown.	■ For process fluids that are not compatible with the standard galvanized steel construction, stainless steel offers you the ultimate in corrosion resistance and long life. The thermal performance rating shall be based on the Cooling Technology Institute certified performance rating adjusted for the thermal properties of stainless steel.

Specifications	Specification Value

Control Options

Control System:

6.4 *Add the following paragraph in the Mechanical Equipment section:* The fluid cooler shall be equipped with a UL 508 control system in a NEMA 3R or 4X outdoor enclosure capable of controlling single-speed or two-speed motors as required, and designed specifically for fluid cooler applications. The panel shall include a main fused disconnect with an external operating handle, lockable in the off position for safety. Across-the-line magnetic starters as required shall be controlled with a solid state temperature controller. Door mounted selector switches shall be provided to enable automatic or manual control and wired for 120VAC control. Control circuit to be wired out to terminal blocks for field connection to remote vibration switches. The temperature controller shall be adjustable for the required process temperature. The temperature controller will display two temperatures, one for process temperature at the coil and the other for set point. Process temperature input shall be obtained using a thermal sensing device on the process coil and wired back to the solid state temperature controller in the control panel. Staging of multiple motors and speeds will be accomplished with an integral PLC.

■ If it is your opinion that the control system for the fluid cooler be part of the fluid cooler manufacturer's responsibility, we are in wholehearted agreement with you. Who better to determine the most efficient mode and manner of a fluid cooler's operation–and to apply a system most compatible with it–than the designer and manufacturer of the fluid cooler?

Marley variable speed drives are also available for the ultimate in temperature control, energy management and mechanical equipment longevity.

Vibration Limit Switch:

6.5 *Add the following paragraph in the Mechanical Equipment section:* A vibration limit switch in a NEMA 4X 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.

■ Unless specified otherwise, a Marley V6 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.

Specifications

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 fluid cooler 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 NEMA 4 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 40°F water temperature at an ambient air temperature of _____ °F.

Fan Motor Variable Speed Drive:

Marley All Weather ACH550 System

6.4 *Add the following paragraph in the Mechanical Equipment section when VFD is used with customers Building Management System:* A complete UL listed Variable Speed Drive system in a NEMA 1 indoor, NEMA 12 indoor or NEMA 3R outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching and integrated bypass design. VFD out put switching shall not cause mechanical issues with gearbox teeth or drive shafts. The VFD shall catch a fan spinning in the reverse direction without tripping. The panel shall include a main disconnect with short circuit protection and external operating handle, lockable in the off position for safety. The VFD system shall receive a speed reference signal from the Building Management System monitoring the tower fluid 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. The VFD shall have an internal PI regulator to modulate fan speed maintaining set point temperature. The drive's panel display shall be able to display the set-point

Specification Value

- 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.

- Marley VFD drive systems are designed to combine absolute temperature control with ideal energy management. The fluid cooler 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

temperature and cold-fluid temperature on two separate lines. The bypass shall include a complete magnetic bypass circuit and with 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 transferred to the by-pass circuit the fan motor will run at constant full speed. The bypass circuit will not modulate ON and OFF based on fluid temperature. The application must be able to handle very cold fluid temperatures while the VFD is in a by-pass mode. 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, manual speed control. To prevent heating problems in the fluid cooloer fan motor and to assure proper gear reducer lubrication the VFD system shall de energize the motor once 25% motor speed is reached and cooling is no longer required. The fluid cooler manufacturer shall supply VFD start-up assistance. Tower vibration testing throughout the speed range is required to identify and lockout any natural frequency vibration levels which may exceed CTI guidelines.

Marley Premium VFD System

6.4 *Add the following paragraph in the Mechanical Equipment section when VFD is used as a stand alone system:* A complete UL listed Variable Speed Drive system in a NEMA 12 indoor or NEMA 3R outdoor enclosure shall be provided. The VFD shall use PWM technology with IGBT switching and integrated bypass design. VFD output switching shall not cause mechanical issues with gearbox teeth or drive shafts. The VFD shall catch a fan spinning in the reverse direction without tripping. The panel shall include a main disconnect with short circuit protection and external operating handle, lockable in the off position for safety. The system shall include a solid state, PI temperature controller to adjust frequency output of the drive in response to the tower fluid temperature. The temperature of the fluid and set point shall be displayed on the door of the control panel. The bypass shall include a complete magnetic bypass circuit with capability to isolate the VFD when in the bypass mode. Transfer to the bypass mode shall be automatic in the event of VFD failure or for specific trip

Specifications	Specification Value
conditions allowing safe transfer of utility voltage to the motor. Automatic bypass with an earth ground condition is not allowed. The bypass contactor shall be cycled on and off while operating in bypass, to maintain the set-point temperature of the cold water. The drive design shall be operated as a stand-alone system without the need for a BMS system. Operator controls shall be mounted on the front of the enclosure and shall consist of start and stop control, bypass/VFD selector switch, Auto/Manual selector switch, manual speed control, and solid-state temperature controller. An emergency bypass selector switch internal to the panel allowing the fluid cooler fan motor to be run at full speed shall be furnished. To prevent heating problems in the fluid cooler fan motor and to assure proper gear box lubrication the VFD system shall de energize the motor once 25% motor speed is reached and cooling is no longer required. The VFD shall include de-icing logic with auto canceling and adjustable time. Speed in De-Ice mode shall not exceed 50% motor speed. The fluid cooler manufacturer shall supply VFD start-up assistance. Tower vibration testing throughout the speed range is required to identify and lockout any natural frequency vibration levels which may exceed CTI guidelines.	

Specifications	Specification Value
Miscellaneous Options	
Sound Control:	
1.2 *Add the following paragraph under Base:* The fluid cooler shall be quiet operation, and shall produce an overall level of sound not higher than _____ dB(A) measured at the critical location indicated on the plans.	■ Sound produced by a standard MC Fluid Cooler operating in an unobstructed environment will meet all but the most restrictive noise limitations–and will react favorably to natural attenuation. Where the fluid cooler has been sized to operate within an enclosure, the enclosure itself will have a damping effect on sound. Sound also declines with distance–by about 5 or 6 dB(A) each time the distance doubles. Where noise at a critical point is likely to exceed an acceptable limit, you have several options–listed below in ascending order of cost impact: • Where only a slight reduction in noise will satisfy–and the source of concern is in a particular direction–merely turning the fluid cooler may be the answer. Less sound emanates from the cased face of the fluid cooler than does from the air intake face. • In many cases, noise concerns are limited to night time, when ambient noise levels are lower and neighbors are trying to sleep. You can usually resolve these situations by using two speed motors in either full/half speed or full/ ⅔ speed configuration, and operating the fans at reduced speed without cycling “after hours”. (The natural night time reduction in wet-bulb temperature makes this a very feasible solution in most areas of the world, but the need to avoid cycling may cause the cold water temperature to vary significantly.) • Variable speed drives automatically minimize the fluid cooler's noise level during periods of reduced load and/or reduced ambient without sacrificing the system's ability to maintain a constant cold water temperature. This is a relatively inexpensive solution, and can pay for itself quickly in reduced energy costs. • Where noise is a concern at all times (for example, near a hospital), the best solution is to oversize the fluid cooler so it can operate continuously at reduced (⅔ or ½) motor speed even at the highest design wet-bulb temperature. Typical sound reductions are 7 dB(A) at ⅔ fan speed or 10 dB(A) at ½ fan speed, but larger reductions are often possible. • The most extreme cases may require inlet and discharge sound attenuator sections–however, the static pressure loss imposed by discharge attenuators may necessitate an increase in fluid cooler size. Two stages of inlet or discharge attenuators supported by the fluid cooler and designed and tested for the most stringent requirements are available as an option. See page 14. The advantage is yours. You now have the choices you need to balance your project’s performance, space and cost requirements with your sound level needs for a win-win solution to your cooling system design. Your Marley sales representative will be able to help you meet your sound requirements.

Specifications	Specification Value
Discharge Hood: 6.4 *Add the following paragraph to the Mechanical Equipment Section:* There shall be a galvanized steel tapered duct on the discharge side of the fluid cooler. Drift eliminators shall be repositioned into the lower section of the duct.	■ Where a tower is installed in a building well or there are high surrounding walls, it is possible that a proportion of the hot and humid discharge air will be drawn back into the fans thus increasing the inlet wet bulb temperature with detriment to the tower performance. The tapered discharge duct is intended to increase the exit velocity by up to 70% in order to reduce the effects of recirculation in some installations. Experience and sound judgement should be exercised to determine when and if a duct is required. If the surrounding walls are much higher than the tower discharge height, then extensions to the tapered duct may be installed.

MC fluid cooler

ENGINEERING DATA AND SPECIFICATIONS

SPX COOLING TECHNOLOGIES, INC.
7401 WEST 129 STREET
OVERLAND PARK, KS 66213 USA
913 664 7400 | spxcooling@spx.com
spxcooling.com

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