MARLEY

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MANUAL

Class 500 Industrial
CROSS-FLOW COOLING TOWERS

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Operation and Maintenance Instructions

APRIL, 1980

OM-500G

5800 Foxridge Drive — P.O. Box 2912 — Mission, Kansas 66201

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INDUSTRIAL CROSS-FLOW COOLING TOWERS

Class 500 Towers

Operation and Maintenance Instructions

GENERAL

These instructions will assist in obtaining efficient, long life from Marley cooling equipment. Direct questions concerning tower operation and maintenance to your Marley sales office or representative. Always include your tower serial number when writing for information or ordering parts. Look for this number on the nameplate near the access door.

PRE-STARTING PROCEDURE

CLEANING. Remove any dirt and trash which has accumulated in the hot water distribution basins. Clean any nozzles that are clogged. Remove any sediment from the cold water basin, sump and screens. Use a water hose to flush cold water basins.

OPERATE WATER SYSTEM. Completely open all hot water flow control valves. Start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges or water hammer which could damage the distribution piping. Circulate water over the tower continuously for several days before starting the mechanical equipment and putting the tower into continuous operation.

INSPECTION. It is imperative that all operating assemblies be inspected before they are placed in operation. Following is a list of components to be checked before starting the tower:

1. Check drive shaft alignment. Realign if necessary. See Marley Drive Shaft Service Manual.
2. Check tightness of bolts that attach steel mechanical equipment support to the tower framing. Check tightness of bolts in fan cylinder joints and fan cylinder anchorage. Do not pull washers into the wood.
3. Check tightness of bolts at diagonals and columns, and at girts and columns in the area between fan and cold water basin.
4. Check tightness of the following bolted joints in the fan and drive assemblies:
   (a) Fan hub clamp bolts (see Marley Fan Service Manual for correct torque setting).
   (b) Fan hub cover bolts.
   (c) Geareducer and motor mounting bolts.
   (d) Drive shaft coupling and guard bolts.
5. Check Geareducer oil for water accumulation by draining off and testing a sample, as outlined in the Geareducer Service Manual. *Check Geareducer oil level at "oil level" mark on the side of the case. Add oil as required. The oil level placard must be adjusted so its "full" mark is at the same elevation as the "full" mark on the side of the Geareducer case. Check oil lines to be sure there are no leaks and all joints are tight.* See Geareducer Service Manual for oil filling procedure and list of recommended lubricants.
6. Rotate fan by hand to be sure of free rotation and ample tip clearance. See Fan Service Manual.
7. Check motor insulation with a "Megger". See Maintenance section of Marley Service Manual on Electric Motors.
8. *Lubricate the motor according to motor manufacturer's instructions.*
9. Test run each fan separately for a short time. Check for excessive vibration or unusual noise. If either is present, see Tower Trouble Tips on pages 8 and 9 of this manual. Fan must rotate clockwise when viewed from above. Recheck Geareducer oil level.
10. Check functioning of make-up water supply.
11. Make sure the blowdown or bleed-off will carry the proper amount of water.

STARTING PROCEDURE

FILLING THE WATER SYSTEM. Fill the cold water basin and circulating water system until the operating water level is reached; see Operation section, page 4.

Completely open all hot water flow control valves; then prime and start the circulating water pumps. Increase the flow of circulating water gradually to design water rate to avoid surges of water hammer which could damage the distribution piping. Adjust valves to equalize the hot water depth in the distribution basins. Lock valves in desired open position with valve locking bar.

On towers equipped with redwood stave distribution piping, some seepage at edge joints may occur during pre-start up and in the initial stages of operation. After the first two weeks of continuous operation, check tightness of nuts securing GRP pipe bands on the redwood stave pipe. Nuts should be snug. Do not over-tighten.

Clean the sump screens several times during the first weeks of operation. After this, clean sump screens as required.

STARTING THE FAN. Start the fan. After 30 minutes operation time to permit Geareducer oil to come up to operating temperature check motor load with watt meter, or take operating volt and ampere readings and calculate

motor HP. Refer to Marley Fan Service Manual for instructions. Pitch fans to pull correct contract horsepower when circulating design water rate at design hot water temperature.

OPERATION

TOWER PERFORMANCE. Keep the tower clean and the water distribution uniform to obtain continued maximum cooling capacity. Do not allow excessive deposits of scale or algae to build up on the filling or eliminators. Keep the metering orifices free of debris to assure correct distribution and cooling of water.

The capacity of a tower to cool water to a given cold water temperature varies with the wet-bulb temperature* and the heat load on the tower. As the wet-bulb temperature drops, the cold water temperature also drops. However, the cold water temperature does not drop as much as the wet-bulb temperature.

A tower does not control the heat load. The quantity of water circulated determines the cooling range** for a given heat load. The hot and cold water temperature increases with higher heat loads.

COLD WATER COLLECTING BASIN. The normal water depth in a wood basin is 5 inches, while in a concrete basin the normal water level is 8 to 13 inches below the curb. Adjust the make-up water supply to maintain this water level. Low operating depths of the water require air baffles under the fill to prevent air bypass. Maintain sufficient water depth to prevent cavitation.

HOT WATER DISTRIBUTION SYSTEM. Keep metering orifices clean and in place in distribution basins. Adjust water flow to give the same depth in the distribution basins of all cells. Design water depth varies from 3" to 5" depending upon design circulating water rate. If a major change in the quantity of water to be circulated over the tower is to be made, replace the removable metering orifices with ones of the new correct orifice size to provide adequate water break-up and maintain the proper water level.

If an Amertap condenser tube cleaning system is part of plant equipment, care should be taken during operation to back-wash the strainer section only after the sponge rubber cleaning balls are removed from the system by trapping them in the collector. If the balls are allowed to enter the cooling tower supply piping, they can clog the plastic metering orifices. Clogged orifices will cause unequal water distribution over the fill which will affect thermal performance. Extensive clogging can lead to overflowing the distribution basins and possible ice damage to towers installed in freezing climates. The basins should be frequently checked for orifice clogging until such time as the operation sequence of the Amertap system assures that no balls enter the cooling tower piping.

FAN DRIVE. If a two-speed motor is used, *allow a time delay of a minimum of 20 seconds after de-energizing the high speed winding and before energizing the low speed winding.* Tremendous strains are placed on driven machinery and motor unless the motor is allowed to slow to low speed rpm or less before the low speed winding is energized.

When changing fan direction of rotation, allow a minimum of two minutes time delay before energizing the fan motor.

WINTER OPERATION. During periods of low temperature operation, 35° to 40°F or below, ice will form on the relatively dry parts of the tower that are in contact with the incoming air. Primarily, this includes the louvers and adjacent structural framing.

Ice forming characteristics on any given tower will vary, depending on velocity and direction of wind, circulating water rate and heat load. Excessive ice formation may be controlled by regulating air and water flow through the tower by one or more of the following procedures:

1. Shut the fan down. This reduces the cooling rate to a minimum and increases the quantity of warm water on the louvers to a maximum. Except for extreme cold conditions or extended freezing conditions, this procedure will normally control ice formation. For automatic operation, a timer switch can be provided to shut the fan down for a few minutes each hour.
2. If the tower has two-speed motors, operate the fan at half speed forward. This reduces the cooling rate (heat transfer) and increases the quantity of warm water on the louvers.
3. Under extended extreme cold conditions, it may be necessary to operate the fan in reverse. This forces warm air out through the louvers, melting any accumulated ice. Reversal may be at either full or half speed, however, full speed is recommended if adequate heat load is available. Reverse operation of the fan should only be used to control ice, not prevent it. *Reverse fan operation should not exceed 15 to 20 minutes.* Usually much less time than this is required to melt accumulated ice.
4. With no heat load on the circulating water, icing can not be controlled effectively by air control during freezing weather. Towers must not be operated with reduced water rate and/or no heat load during freezing weather. If a by-pass directly into the cold water basin is used, all water must be by-passed. Design of a by-pass arrangement must include consideration of water impact effect on tower components.

CAUTION: Severely Cold Weather – Below 20°F. Ambient Dry Bulb – Reverse operation of fans for prolonged periods during sub-freezing weather can cause severe damage to fans and fan cylinders. Ice can accumulate inside fan cylinders at fan blade plane of rotation and fan blade tips will event-

*Wet-bulb temperature – the temperature indicated by the wet-bulb thermometer of a sling or mechanically aspirated psychrometer.

**Cooling range – the temperature difference between the hot water coming into the cooling tower and the cold water leaving the tower.

ually strike this ring of ice, damaging the fan blades or cylinder. Ice can also accumulate on fan blades and be thrown off, damaging fan cylinder or blades. Reverse operation of fans with adjacent fans not operating increases probability of icing. The low discharge velocity of moist air from fan cylinders in which fans are not in operation can result in moisture ladened air being pulled into the adjacent cylinder in which the fan is operating in reverse, increasing this ice build-up. Therefore, fans each side of the one operating in reverse must be operated in forward rotation at full or half speed, or all fans must be operated in reverse. Allow a minimum of 10 minute delay between reverse operation and forward operation during sub-freezing weather to permit ice to dissipate from fan blades and fan cylinders.

See "Fan Drive" for fan speed change and reversing precautions.

UNIT MAINTENANCE

Well maintained equipment gives the best operating results and the least maintenance cost. Marley recommends setting up a regular inspection schedule to insure effective safe operation of the cooling tower. Use the schedule in Table I to obtain continuously good performance with least tower maintenance. See Cooling Tower Inspection Check List in this manual. Keep a continuous lubrication and maintenance record for each cooling tower. Regular inspection and repair of personnel safety items, indicated by an asterisk in Table I, and a record of same is especially important. "SAFETY FIRST". For a supply of check list forms, contact your Marley sales office or representative.

HOT WATER DISTRIBUTION BASINS. Metering orifices in the floor of the hot water basin may be cleaned without shutting down any part of the tower. Remove dirt, algae, leaves, etc., which might get in these basins or orifices. The metering orifices must be kept in place to assure proper

TABLE I

INSPECTION & MAINTENANCE SCHEDULE

General Recommendations

(More frequent inspection and maintenance may be desirable)

	FAN & FAN GUARD	MOTOR	DRIVESHAFT & GUARDS	GEAREDUCER	ELIMINATOR	FILL	COLD WATER BASIN	FLOAT VALVE	SUCTION SCREEN	HOT WATER BASIN	CONTROL VALVES	STRUCTURAL MEMBERS	CASING	FAN CYLINDER	STAIRS, LADDERS, WALKWAYS, DOORS, HANDRAILS*	DAVITS, DERRICKS, HOISTS*
1. Inspect for clogging					M	M			W	W						
2. Check for unusual noise or vibration	D	D	D	D												
3. Inspect keys, keyways and set screws	S	S	S	S												
4. Make sure vents are open				S												
5. Lubricate (grease)		R									S					
6. Check oil seals				M												
7. Check operating oil level				D												
8. Check static oil level				M												
9. Check oil for water and sludge				M												
10. Change oil, at least				S												
11. Check fan blade tip clearance	S															
12. Check water level							D			D						
13. Check for leakage				W			S	S		S						
14. Inspect general condition	S	S	S	S	Y	S	Y	Y	S	S	S	S	Y	S	S	S
15. Tighten loose bolts	S	S	S	S								Y	R	S		
16. Clean	R	R	R	R	R	R	S	R	R	R	R					
17. Repaint	R	R	R	R												
18. Rebalance	R		R													
19. Completely open and close											S					
*20. Inspect/repair for safe use	Y		Y												Y	
*21. Inspect and repair before each use																R

D - daily; W - weekly; M - monthly; Q - quarterly; S - semi-annually; Y - yearly; R - as required

water distribution. Completely open and close flow control valves at least semi-annually to remove any scale on the threads. Grease the stainless steel stem to prevent scale forming. Lubricate the valves at least semi-annually with a lithium base NLGI No. 2 consistency grease. More frequent relubrication of valves and valve stems may be dictated by circulating water conditions.

COLD WATER COLLECTING BASIN. Inspect collecting basin occasionally for leaks and repair if necessary. Minor leaks may appear in redwood basins when starting with a dry basin but these generally disappear after the wood becomes soaked. Keep cold water outlets clean and free of debris. Make-up and circulating water controls must operate freely and maintain the desired water quantity in the system.

TOWER FRAMEWORK. Keep framework bolts tight. Pay particular attention to bolts in the mechanical equipment supports. Do not pull washers into the wood.

DRIVE SHAFT. Check drive shaft alignment and condition of couplings every six months. See the Drive Shaft Service Manual for correcting misalignment, balancing or replacing parts.

ELECTRIC MOTOR. Lubricate and maintain each electric motor in accordance with the manufacturer's instructions. If repair work is necessary, contact the nearest representative of the motor manufacturer. See Warranty Section of Marley Service Manual on Electric Motors.

FAN. Inspect fan blade surfaces every six months. For detailed maintenance information, refer to Marley Fan Service Manual.

GEAREDUCER. Make weekly and monthly oil checks. Inspect internal parts during seasonal oil change. Refer to the Geareducer Service Manual for detailed maintenance instructions.

PAINTING. Periodically clean and, if necessary, recoat all metal parts subject to corrosion.

COOLING TOWER WOOD DETERIORATION. Untreated wood in cooling towers can be damaged by decay anytime after the first year or two of service. If decay is discovered and treated in its early stages, serious wood damage can be prevented. Routine inspections should be made to assure that decay is discovered before it is heavily advanced.

Decay is commonly of two very general types, soft rot and pocket rot. Soft rot is easier to detect because it is almost always on the surface of wood members. It makes the surface soft and weak and in its more advanced stages the decayed wood can be easily removed. This type of rot occurs primarily in the flooded areas of the tower. Pocket rot, as the name implies, occurs in pockets inside of the wood members. For this reason it is more difficult to detect than is soft rot. Pocket rot is most commonly found in the heavier members in the plenum areas of the tower. One of the best methods of inspection for pocket rot is "sounding" with hammer blows. Members which have pocket rot sound "dead" while non-rotted members have a "ring" or "live" sound. Areas which sound "dead" can be probed with a screwdriver or other pointed tool to verify the presence of pocket rot.

Marley maintains a laboratory for detailed wood inspections and has personnel on its staff experienced in all aspects of wood deterioration and preservative treatment. In addition, several Marley publications are available which give detailed information on the subject of wood deterioration and treatment. Contact the nearest sales office or representative for more information about wood inspection services and for copies of the publications.

WATER TREATMENT

BLOWDOWN. Blowdown, or bleed-off, is the continuous removal of a portion of the water from the circulating 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 upon the cooling range (the difference between the hot and cold water temperatures) and the composition of the make-up water (water added to the system to compensate for losses by blowdown, evaporation and drift). The following table shows the amount of blowdown required to maintain different concentrations with various cooling ranges:

BLOWDOWN – % OF CIRCULATING RATE

COOLING	CONCENTRATIONS						
RANGE °F	1.5X	2.0X	2.5X	3.0X	4.0X	5.0X	6.0X
5	.78	.38	.25	.18	.11	.08	.06
10	1.58	.78	.51	.38	.25	.18	.14
15	2.38	1.18	.78	.58	.38	.28	.22
20	3.18	1.58	1.05	.78	.51	.38	.30
25	3.98	1.98	1.32	.98	.64	.48	.38

EXAMPLE: 7000 GPM circulating rate, 15° cooling range. To maintain 4 concentrations, the required blowdown is .38% or .0038 times 7000 GPM which is 26.6 GPM.

If tower is operated at 4 concentrations, circulating water will contain four times as much dissolved solid as the makeup water, providing none of the solids form scale or are otherwise removed from the system.

CHEMICAL TREATMENT. In some cases chemical treatment of the circulating water is not required if adequate blowdown is maintained. In most cases, however, chemical treatment is required to prevent scale formation and corrosion. Sulfuric acid or one of the polyphosphates is most generally used to control calcium carbonate scale. Various proprietary materials containing chromates, phosphates or other compounds are available for corrosion control. When water treatment chemicals are required, the services of reliable water treating companies should be obtained.

Slime, a gelatinous organic growth, and algae, a green moss, may grow in the cooling tower or heat exchangers. Their presence can interfere with cooling efficiencies. Proprietary

compounds are available from water treating companies for the control of slime and/or algae, however, compounds which contain copper must be used with care. Copper can accelerate corrosion of steel, iron, aluminum and galvanizing and should not be used in systems containing any of those materials. Chlorine and chlorine containing compounds are effective algaecides and slimicides but excess chlorine can damage wood and other organic materials of construction. If used, chlorine should be added as intermittent (or shock) treatment only as frequently as needed to control the slime and algae, and free residual levels should not exceed one part per million parts water (1 ppm). Chlorine or chlorine containing compounds should be added carefully since very high levels of chlorine may occur at or near the point of entry into the circulating water system.

FOAMING. Heavy foaming sometimes occurs when a new tower is put into operation. This type of foaming generally subsides after a relatively short period of operation. Persistent foaming can be caused by the concentrations of certain combinations of dissolved solids or by contamination of the circulating water with foam-causing compounds. This type of foaming can sometimes be minimized by increasing the blowdown, but in some cases foam depressant chemicals must be added to the system. Foam depressants are available from a number of chemical companies.

WATER DISCOLORATION. Woods contain some water soluble substances and these commonly discolor the circulating water on a new tower. This discoloration is not harmful to any of the components in the system and can be ignored. However, a combination of foaming and discolored water can result in staining of adjacent structures if foam is picked up by air being pulled through the tower and discharged out the fan cylinders. Avoid operation of fans until the foaming is controlled.

SPARE PARTS

Marley maintains a stock of replacement parts for mechanical equipment. Shipment of these parts is normally made within ten days after an order is received. If emergency service is necessary, contact the local Marley sales office or representative for assistance.

To prevent prolonged shutdown periods in case of damage to the mechanical equipment, it is suggested that the following spare parts be carried in the owner's stock:

1. One fan assembly.
2. One Geareducer assembly.
3. One drive shaft assembly.

Be sure to furnish the tower serial number when ordering any parts.

SEASONAL SHUTDOWN INSTRUCTIONS

BASIN AND FRAME

Drain the tower basins and all exposed piping. Leave the cold water basin drain open. Water may be left in wood cold water basin if tower is located in a non-freezing area.

During shutdown, clean the tower and make any necessary repairs. Apply protective coating as required to all metal parts. Particular attention should be given to mechanical equipment supports, drive shafts and drive shaft guards. Inspect visually for wood deterioration and test members for soft spots.

Protect wood towers against fire. If tower is wetted for fire protection, wet it down continuously; alternate wetting and drying is destructive to wood. CAUTION: If ambient temperature is 32 degrees or below, do not put cold water on tower.

MECHANICAL EQUIPMENT

Flow Control Valve

Grease valve threads at zerk fitting using rust inhibiting lithium base grease of NLGI No. 2 consistency and then open valve. Coat exposed valve stem with grease.

Geareducers (3 Months or Less Shutdown)

1. Each month, drain water condensate from the lowest point of the Geareducer and its oil system. Check oil level and add oil if necessary. Operate to re-coat all interior surfaces with oil.
2. At start-up, drain water condensate and check oil level. Add oil if necessary.

Refer to Geareducer service manual for maintenance and lubrication instructions.

3 Months or More Shutdown

If motors have space heaters, operate mechanical equipment one hour each month. If motors do not have space heaters, operate mechanical equipment one hour each week. At start-up, operate mechanical equipment one hour or until oil is warm, then shut the equipment down. Drain the oil and refill with new oil. Refer to Geareducer Manual for instructions on changing oil.

Electric Motors

Do not start motor without determining that there will be no interference with free rotation of the fan drive.

Refer to motor manufacturer's recommendations for lubrication and maintenance instructions.

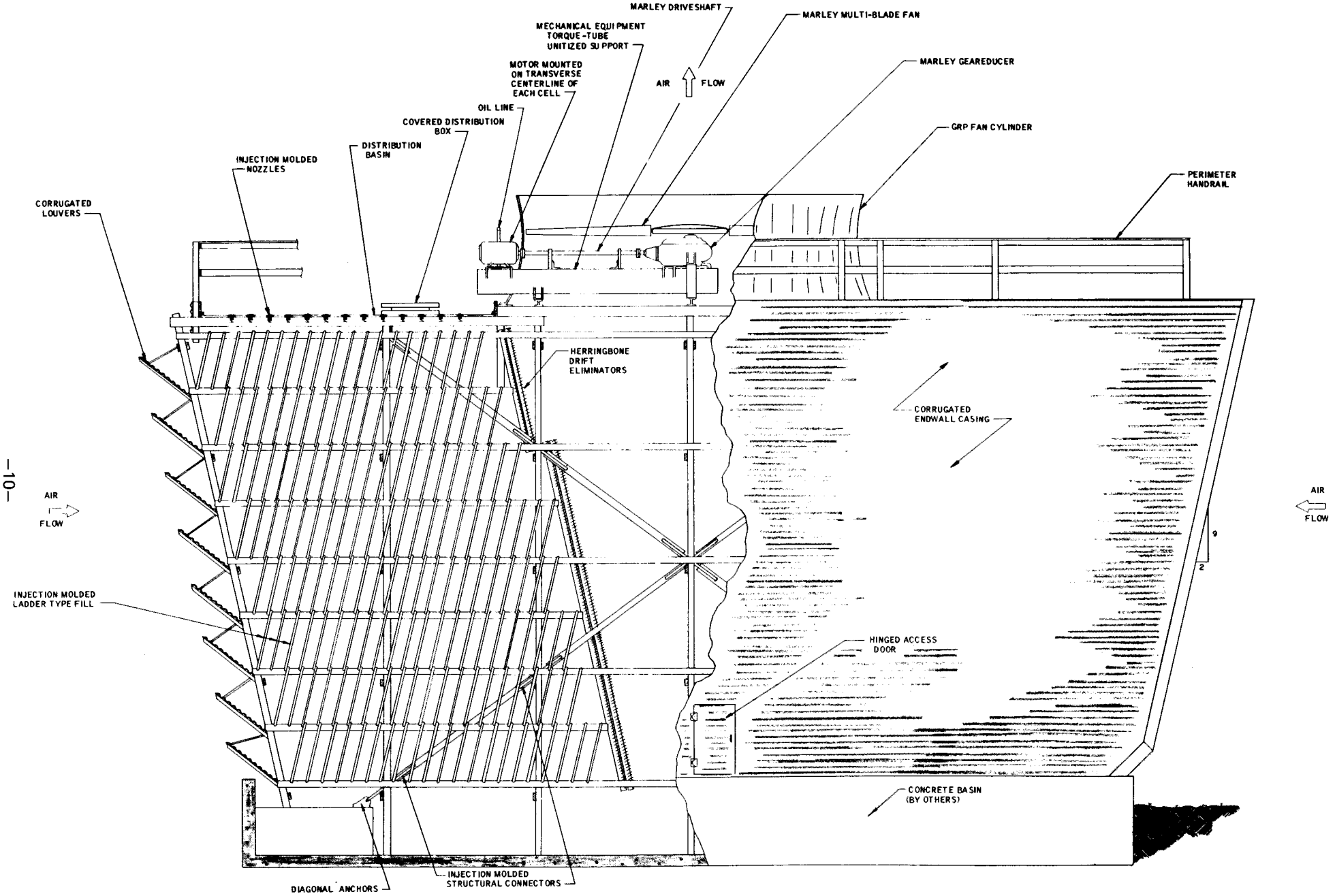
If shutdown period is longer than seasonal, contact your Marley sales office or representative for additional information.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Will Not Start	Power not available at motor terminals	1. Check power at starter. Correct any bad connections between the control apparatus and the motor. 2. Check starter contacts and control circuit. Reset overloads, close contacts, reset tripped switches or replace failed control switches. 3. If power is not on all leads at starter make sure overload and short circuit devices are in proper condition.
	Wrong connections	Check motor and control connections against wiring diagrams.
	Low voltage	Check nameplate voltage against power supply. Check voltage at motor terminals.
	Open circuit in motor winding	Check stator windings for open circuits.
	Motor or fan drive stuck	Disconnect motor from load and check motor and Geareducer for cause of problem.
	Rotor defective	Look for broken bars or rings.
Unusual Motor Noise	Motor running single-phase	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Motor leads connected incorrectly	Check motor connections against wiring diagram on motor.
	Ball bearings	Check lubrication. Replace bad bearings.
	Electrical unbalance	Check voltages and currents of all three lines. Correct if required.
	Air gap not uniform	Check and correct bracket fits or bearing.
	Rotor unbalance	Rebalance.
	Cooling fan hitting guard	Reinstall or replace fan.
Motor Runs Hot	Wrong voltage or unbalanced voltage	Check voltage and current of all three lines against nameplate values.
	Overload	Check fan blade pitch. See Fan Service Manual. Check for drag in fan drive train as from damaged bearings.
	Wrong motor rpm	Check nameplate against power supply. Check rpm of motor and gear ratio.
	Bearings overgreased	Remove grease reliefs. Run motor up to speed to purge excessive grease.
	Rotor rubs stator bore	If not poor machining, replace worn bearing.
	Wrong lubricant in bearings	Change to proper lubricant. See motor manufacturer's instructions.
	One phase open	Stop motor and attempt to start it. Motor will not start if single-phased. Check wiring, controls and motor.
	Poor ventilation	Clean motor and check ventilation openings. Allow ample ventilation around motor.
	Winding fault	Check with Ohmmeter.

TOWER TROUBLE TIPS

TROUBLE	CAUSE	REMEDY
Motor Runs Hot (continued)	Bent motor shaft	Straighten or replace shaft.
	Insufficient grease	Remove plugs and regrease bearings.
	Deterioration of or foreign material in grease	Flush bearings and relubricate.
	Bearings damaged	Replace bearings.
	Incorrect fan blade pitch	See Fan Service Manual for blade pitching instructions.
Motor Does Not Come Up To Speed	Voltage too low at motor terminals because of line drop	Check transformer and setting of taps. Use higher voltage on transformer terminals or reduce loads. Increase wire size or reduce inertia.
	Broken rotor bars	Look for cracks near the rings. A new rotor may be required. Have motor service man check motor.
Wrong Rotation (Motor)	Wrong sequence of phases	Change any two of the three motor leads.
Geareducer Noise	Geareducer bearings	If new, see if noise disappears after one week of operation. Drain, flush and refill Geareducer. See Geareducer Service Manual. If still noisy, replace.
	Gears	Correct tooth engagement. Replace badly worn gears. Replace gears with imperfect tooth spacing or form.
Unusual Fan Drive Vibration	Loose bolts and cap screws	Tighten all bolts and cap screws on all mechanical equipment and supports.
	Unbalanced drive shaft or worn couplings	Make sure motor and Geareducer shafts are in proper alignment and "match marks" properly matched. Repair or replace worn couplings. Rebalance drive shaft by adding or removing weights from balancing cap screws. See Drive Shaft Service Manual.
	Fan	Be sure blades are properly positioned in correct sockets. Check match numbers. Make certain all blades are as far from center of fan as safety devices permit. All blades must be pitched the same. See Fan Service Manual. Clean off deposit build-up on blades.
	Worn Geareducer bearings	Check fan and pinion shaft endplay. Replace bearings as necessary.
	Unbalanced motor	Disconnect load and operate motor. If motor still vibrates, rebalance rotor.
	Bent Geareducer shaft	Check fan and pinion shafts with dial indicator. Replace if necessary.
Fan Noise	Loose fan hub cover	Tighten hub cover fasteners.
	Blade rubbing inside of fan cylinder	Adjust cylinder to provide blade tip clearance.
	Loose bolts in blade clamps	Check and tighten if necessary.



TRANSVERSE CROSS SECTION

COOLING TOWER INSPECTION CHECK LIST

Route to:

Owner _____ Date Inspected _____

Plant _____ Inspected By _____

Location _____ Tower Manufacturer _____

Owner Designation _____ Installed _____ 19____

Water Treatment Used _____ Model No. _____

Design _____ GPM _____ HW _____ CW _____ WB

Condition: 1-Good; 2-Repair; 3-Replace	*1*	*2*	*3*
EXTERIOR STRUCTURE:			
1. Endwall Casing & Access Doors			
2. Louvers ( )			
3. Drain Boards			
*4. Stairway			
5. Fan Deck			
6. Fan Deck Supports			
*7. Handrails			
*8. Ladders & Walkways			
9. Distribution System			
Headers (Type)			
Distribution Basin			
Water Level			
Flow Control Valves (Size)			
Nozzles (Size)			
Water Distribution			
10. Spray System & Spray Nozzles			
11. Fan Cylinders (Type)			
INTERIOR STRUCTURE:			
12. Fill (Type)			
13. Columns			
14. Girts			
15. Diagonals			
16. Partitions & Doors			
17. Eliminators (Type)			
*18. Walkway			
19. Cold Water Basin (Type)			
Water Depth			
20. Mech. Equip. Support (Type			
HANDLING EQUIPMENT			
*21. Davits, Derricks & Hoists			
*22. Fan Cylinder & Deck Access Doors			

Condition: 1-Good; 2-Repair; 3-Replace	*1*	*2*	*3*
MECHANICAL EQUIPMENT			
23. Drive Shafts (Type)			
24. Speed Reducer			
Series Ratio			
Oil Level			
Oil Seals			
Vent			
Back Lash			
Pinion Shaft Play			
Fan Shaft End Play			
Last Oil Change (Date)			
Oil Used			
25. Fans			
Dia. Type			
Hub			
Blades			
Hub Cover			
Tip Clearance			
No Vibration Vibration			
Additional Components (If installed on tower)			
Fan Guards			
Oil Gauge & Drain Lines			
Vibration Limit Switches			
Other:			
26. Motor: Mfr.			
Name Plate HP RPM			
Phase Cycle Volts			
Amperes Frame			

REPLACEMENT PARTS REQUIRED:

QUAN.	DESCRIPTION	ORDER FROM	DATE REQ'D

MAINTENANCE WORK REQUIRED:

DESCRIPTION	REQ'D COMPLETION

*Personnel safety item — inspect semi-annually, repair as required for safe use

(Use back of this sheet for additional requirements or notes.)

SERVICE information

THE MARLEY COOLING TOWER COMPANY

Health Alert

Among other sources, outbreaks of Legionnaires' Disease have reportedly been traced to cooling towers. Maintenance procedures that prevent amplification and dissemination of Legionella and other airborne bacteria should be formulated and implemented BEFORE systems are operated and continued regularly thereafter to avoid the risk of sickness or death. The following is recommended:

- ❑ Do NOT attempt any service unless the fan motor is locked out.
- ❑ New cooling towers should be cleaned and treated with biocides by a water treatment expert before startup. See your Cooling Tower User Manual for more detailed instructions on biocidal treatment.
- ❑ At a minimum, cooling towers should be cleaned and disinfected with biocides twice a year. Systems with biofouling or positive cultures of legionella may require additional cleaning.
- ❑ Units should be inspected weekly for bacterial growth and general operating conditions. Bacterial growth should be reported to your water treatment expert for immediate attention.
- ❑ Drift eliminators should be inspected monthly. Any debris or scale should be cleaned off the eliminators when noted. Replace any damaged or worn out components.
- ❑ Workers cleaning units should use protective clothing and equipment during decontamination.
- ❑ Although using these practices will not guarantee that a system or individual component will not be contaminated by legionella, they should reduce the chance of colonization.

  For additional copies of the tower User Manual or other literature pertaining to this unit, please contact your Marley sales representative.