AMCOT COOLING TOWER CORPORATION

LRC-H & LRC-LNS

CROSS FLOW COOLING TOWER

OPERATIONS AND MAINTAINENCE MANUAL

1-800-444-8693

Operation and Maintenance Manual
For Amcot LRC-H Cooling Tower &
LRC-LNS Cooling Towers

1. **Preface**

The following information is intended to provide instruction, understanding, and includes manufacturer recommendations for maintaining and operating your new LRC-model cooling tower. Because it takes time to schedule maintenance and servicing after a tower has been damaged, there are steps that the customer can take, to prolong and prevent damage to both their tower and system as a whole. Please, read through this material and if at any time you have questions relating to our cooling tower, contact us at our corporate office. If proper maintenance is followed and you operate your tower within design parameters, Amcot's LRC-model tower can provide decades of solid operation and performance.

It is recommended that the servicing personnel should study the cooling tower in great detail. Become familiar with the cooling process and the miscellaneous parts within our cooling tower. You will be able to pinpoint problems and potentially solve a problem before it causes shutdown of your cooling tower, which is costly to your application.

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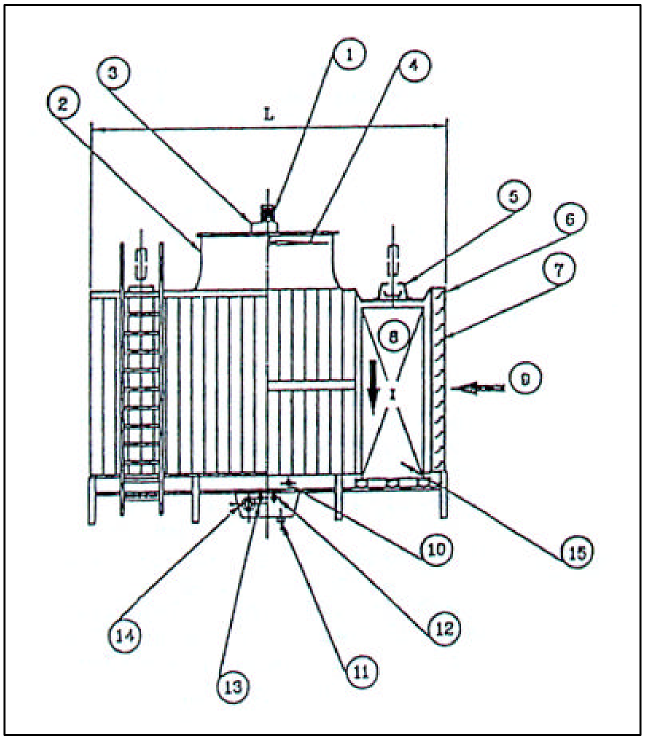

1.Motor	9. Air
2.Fan Stack	10. Overflow
3. Speed Reducer	11. Drain
4.Fan	12. Manual Make-Up
5.Distribution Pan	13. Automatic Make-Up
6.Distribution System	14. Outlet
7.Louver	15. Fill
8. Water	

2. STRUCTURE

2.1 FRAME

The frame of your LRC-model cooling tower is either constructed of Hot Dipped Galvanized steel or Stainless Steel, depending on what you specified at time of Purchase. Galvanized steel will provide protection from rusting and corrosion. When the steel is maintained, washed down and kept in good condition, your cooling tower's structure will remain stable and secure. Stainless-steel material also provides protection from rust and corrosion, and will outlast galvanized steel depending on environmental conditions around your area. You should consult the factory to determine which material will be sufficient in your application. F.R.P. (Fiberglass Reinforced Plastic) materials are used in the basin, casing and other sections of the tower. This material will not rust or corrode and has a high tolerance towards chemical exposure. Please consult factory on limitations for certain chemicals to ensure that you do not damage your fiberglass material. If used within the limitations, FRP material provides structural integrity identical to that of Steel and is lighter in weight.

2.2 HEIGHT

Amcot's LRC-model is smaller in height when compared to similar cooling towers. This is beneficial because pump head within the tower is decreased, horsepower is decreased yet

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identical air volume is achieved, resulting in lower operating costs with identical performance.

2.3 INTERNAL SPACE

The internal structure of your LRC tower is designed to provide maximum working space for repairs and maintenance. A sturdy platform, secured to the frame of the tower is provided for your maintenance team. **CAUTION**: *Due to slimes and algae that may build up the walkway can become slippery. Take Precautions and where proper work boots.*

2.4 Fan

The fan of your tower is designed to provide sufficient airflow at lower fan motor RPM and operate at a lower decibel level.

2.5 Fill Materials

Fill material is made of PVC stiff sheets, which are formed by vacuum molding, differing from standard materials used. This material has been tested both in laboratories and applications, to perfection, enabling maximum water surface exposure, allowing for maximum heat transfer.

2.6 Distribution System

LRC towers utilize gravity flow to distribute water evenly over fill material. Hot water entering the tower is dispersed into a distribution pan located on top of the cooling tower next to louvers. The hot water drops through the distribution pans that have predrilled and predetermined hole placement to ensure that water is covering the entire fill media. This form of distribution helps reduce pump size, friction loss, psi requirements, while providing even distribution. The distribution plate within the pan helps slow water flow so that the heat transfer can begin immediately.

3. INSTALLATION

3.1 CAUTIONS FOR INSTALLATIONS

A. Pick a location in which airflow is steady and free of structures, which may lower efficiency.
B. Location should be relatively free of dust, acids, and other material, which could build up in your tower and lower efficiency or damage the unit.
C. Keep the tower away from heat sources because these units raise the surrounding air temperature, which will affect your cooling tower's efficiency. (If this cannot be avoided, an atmosphere temperature should be taken and provided to the factory for recalculation).
D. Provide enough space for piping.
E. Be sure to keep the tower vertical when lifting or mounting to foundation. Once on foundation, anchor bolts and legs of tower should be fastened tightly.
F. The design of the cooling tower is to pull air through the air inlets (louver sides). Be sure that proper space is provided between the tower and an obstacle if structure free areas are not allowable. SEE TABLE BELOW

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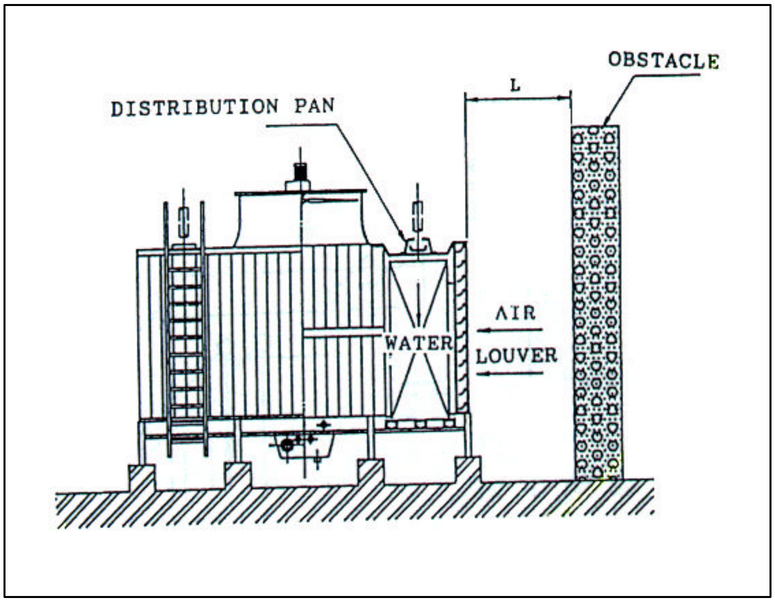

LRC MODEL	DISTANCE FROM STRUCTURES (i.e., Buildings, etc..)
80 ~ 125	**More Then 6.5 Feet**
150 ~ 200	**More Then 8 Feet**
225 ~ 350	**More then 9.5 Feet**
400 ~ 600	**More Then 10.5 Feet**
700 ~ 800	**More Then 13 Feet**
900 ~ 1250	**More Then 16.5 Feet**

3.2 **Pump and Piping**

A. Regarding the piping illustration for cooling tower, please refer to the following chart:

B. When doing the piping work, diameter and length of the inlet pipe rigged on the two sides of the hot water basin should be matched accordingly. Flow Control valves should be installed.

C. The pipe diameter should also match the water flow of tower design.

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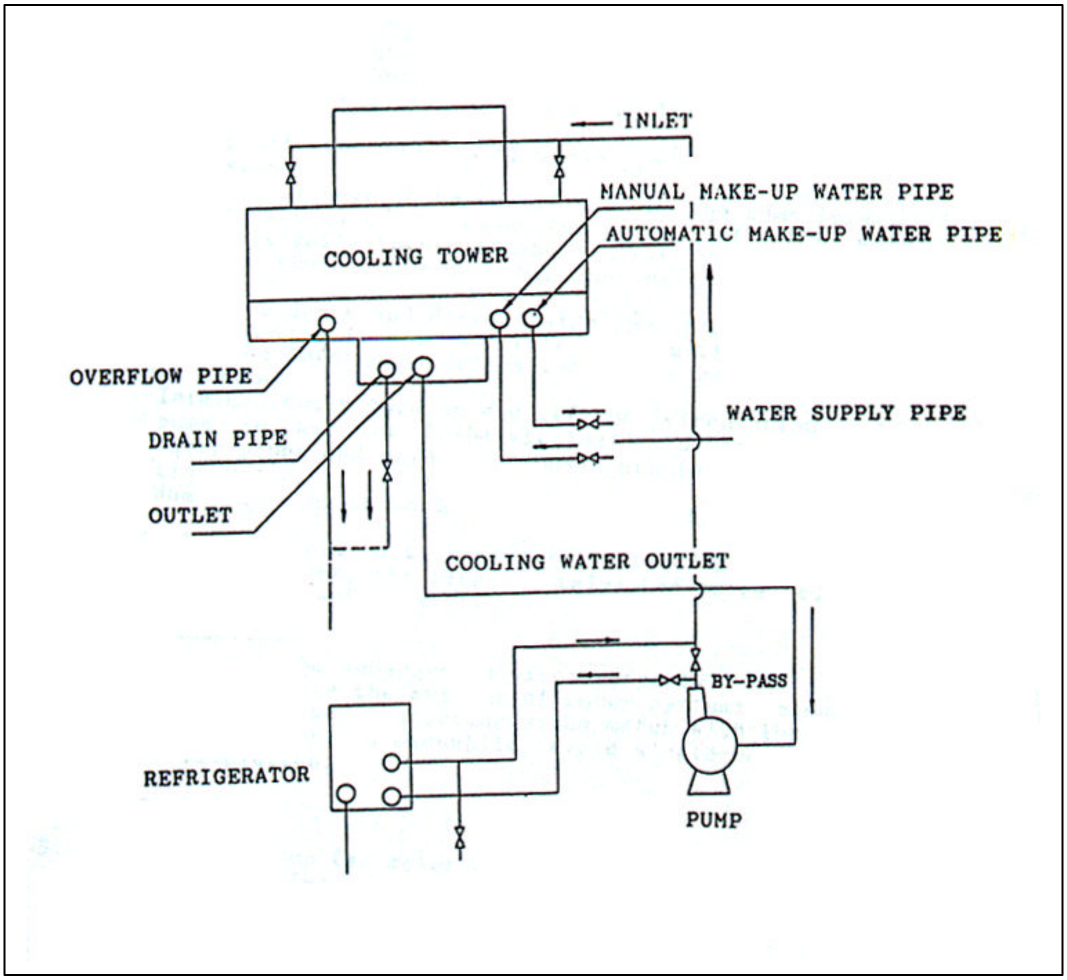

4. **Preparations Before Operations**

4.1 Irrelevant objects by the air inlet or surrounding the fan stack should be removed.

4.2 Be sure that Fan blade will not make contact with Fan stack so as to avoid damage to tower.

4.3 Check to see if the V-Belts of Speed Reducer are properly adjusted.

4.4 V-Belts have to be positioned on the same level.

4.5 After the above checks have been made, switch the fan motor on and off intermittently to see if the fan revolves correctly. At this time you can also check for any abstract noises or vibrations.

4.6 Clean dust and dirt from inside the cold water basin and then fill basin to the overflow level.

4.7 Remove all foreign objects and materials from the Hot water distribution pans on top of cooling tower.

4.8 Turn Centrifugal Pump on and off intermittently to remove air from pipes and allow water to fill the system.

4.9 When the pump is in normal operation water level will decrease depending on length of run and actually flow rates required. Float Valve should be adjusted at this point to ensure design

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cold water temperature is being met, flow rate is adequate and all pipe connection are safely submerged.

5. **Power System**

5.1 Connect the wires according to wire diagram.

5.2 Re-identify the switches for power system, check if the fuse and connecting wires match with the motor horsepower and avoid single-phase revolution.

6. **Starting**

6.1 Start and stop Fan motor, checking to see if motor revolves in the specified direction or if abnormal vibrations or noises begin. If so, shut down the unit and contact Amcot for recommendations.

6.2 Check if the Fan Motor is receiving correct voltage and is constant. It is recommended that a vibration switch be used to prevent excessive vibration as a result of fan imbalance or other problems which can generate vibration

6.3 Adjust the water flow with control valves to keep water level of hot water basin between 2~3 inches high.

6.4 Check to be sure desired water level in cold water basin remains constant.

7. **Cooling Tower Operation**.

7.1 After five to six days of operation, check V-Belts once more to be sure that they have not loosened. If they have, retighten these belts to avoid reduction in fan blade speed and to prevent damage to reducer.

7.2 The circulation water should be replaced at this time to rid system of dirt and debris and to prevent blockage of piping.

8. **Routine Maintenance**

Please consult a water treatment specialist to verify percentage of bleed that should be established on your system. This will be dependent upon the level of calcium, chlorine, and other minerals within your water supply. Be sure to check hot water and cold water basins on a regular basis and clean any debris that is found within these sections of the tower. This will increase the life of your cooling towers because water quality is one of the major reasons behind tower efficiency and structural integrity. Also make a habit of checking V-Belts, Dispersion holes and fill material to make sure no blockage is occurring. If so, these units can be cleaned using garden hose nozzles or which simple items like a screwdriver.

9. **Seasonal Shutdown**

9.1 Loosen the V-Belts located within the speed reducer and lubricate bearings.

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9.2 All circulating water should be drained and disposed of or placed within a holding tank to prevent damage to piping during winter months in which temperatures will drop below freezing.

9.3 Before restarting cooling tower, be sure that all parts are intact and that nothing is obstructing movable parts which could result in damage. If needed, contact Amcot our your local service representative to perform an inspection on the cooling tower.

10. Cooling Tower Performance

Flow rates and water level along with the wet bulb, hot water, and cold water temperatures are the major factors in cooling tower performance. If performance appears to have increased or decreased during life of tower, consult the chart below to find possible reasons. If these reasons are not applicable, contact Amcot for a consultation.

Causes of Increase	Cause of Decrease
1. The heat load has increased. 2. Circulating water has decreased. 3. The difference between inlet water temperature and wet-bulb has increased.	1. The heat load has decreased. 2. Circulating Water has Increased. 3. Difference between Inlet and Wet Bulb temperature has decreased. 4. Low inlet water Temperature when entering tower.

The addition or removal of equipment will affect heat loads. It is important to know what the capacity limitations of your cooling tower is to ensure that you do not adversely affect the performance of the
Cooling Tower. It is impossible to get a normal temperature reading at one particular instance because weather conditions throughout the day can affect tower cooling. A series of days in differing conditions should be used to determine an average that will constitute the best determination. In plain, on hot days cooling tower efficiency may decrease, on cold days, cooling tower performance will increase.

The addition or removal of equipment also affects flow rates. In addition, flow rates can be affected by pipe blockage or clogging. It is important to keep your pipelines free of debris and to obtain good water treatment that will limit algae, slimes and calcium build-ups. This will also increase the life of your equipment.

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Trouble-Shooting Table

Trouble	Causes	Solutions
Noises And Vibrations	1. Loose Bolts 2. Fan Blade tip making contact with fan stack 3. Fan Not Balanced. 4. Bearing Malfunction. 5. Motor Malfunction. 6. Speed Reducer	1. Retighten bolts 2. Shut Down, Adjust Motor Base to provide equal clearance between fan stack and fan. 3. Adjust pitches to equalize 4. Replace bearings. 5. Rewind or replace motor. 6. Check reducer, make sure well oiled/greased, check v-belts to be sure they are tight.
Power Overloads	1. Excessive drops in Voltage 2. Improper fan blade angle. 3. Motor malfunction	1. Check power supply. 2. Adjust pitches to recommended settings 3. Replace motor
Rise in water temperature	1. Decrease in water flow. 2. Drop in water level of basin or distribution pans. 3. Decrease in air flow 4. Blockage of inlet louvers	1. Check water pump and pipes for blockage. 2. Clean distribution pans and check float valve. 3. Check fill material for blockage, check reducer v-belts, check motor. 4. Remove debris, be sure louvers are equal distance apart.
Drop in Water Flow	1. Blockage of Strainer 2. Water basin level decreases 3. Inadequate water flow from pump	1. Remove and clean strainer. 2. Adjust float valve. 3. Check pump seals and connections.
Water carry-over	1. Excessive Water Flow 2. Unevenness of water volume in distribution basin. 3. Excessive air flow.	1. Adjust water flow rate through pumps or with flow valves. 2. Clean distribution pan. 3. Adjust fan blade pitches to reduce drift loss.

11.0 CALCULATION OF MAKE-UP WATER

The gradual loss of circulating water during operation is caused by the following factors:

A. During heat exchange, the contact of cold air and hot water will generate an evaporation loss due to moisture absorption into air flow. This is known as evaporation loss, which is how heat exchange is accomplished.

B. As air volume increases the driving force of this current overcomes the gravitational flow of water fall and causes a small amount of water to be carried out of the tower.

C. When the water is circulating for a long time, solids build up and as this concentration increases it becomes vital to "bleed" a certain amount of water from the tower which is known as a bleed loss. This will prevent buildup of contaminants which can affect tower structure.

11.1 Calculating Evaporation Loss

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$$E = Q/1000 = (T1-T2) / 1000 \times L$$

E= Evaporating Water	GPM
Q= Heat Load	BTU/Hr
1000 = Water Evaporation Heat	BTU/Hr
T1= Inlet Water Temperature	^oF
T2= Outlet Water Temperature	^oF
L= Circulating Water Flow	GPM

11.2 The Loss Of Carry-Over

The loss of Carry-over depends on the cooling tower design, and Air Velocity. Generally speaking, the loss is equal to 0.2% to 0.3% of total circulation water.

11.3 The Loss of Regular Blow-Down

To decrease the loss of blow-down, please follow the procedures below:

A. Open the drain on the hot water basin while the cooling tower is in operation.
B. Increase the operational water level to anticipate the water flowing out of the overflow outlet
C. Replace the water in the cold water basin and pipes annually.

The water quality and its concentration of solids will determine the loss of regular blow-down. Generally speaking, the loss is about 0.3% of total circulating water.

11.4 Make-up Water Calculation

The total make-up water of circulating water is equal to:

$$M = E + C + D$$

M = Make-up Water	E = Evaporation Loss
C = Carry-over	D = Regular Blow-down Loss

When the cooling tower is rigged to an air-conditioner, the cooling range is set at 10 ^oF. In this case, the make-up water needed for the cooling tower is about 2% of the circulation water.

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