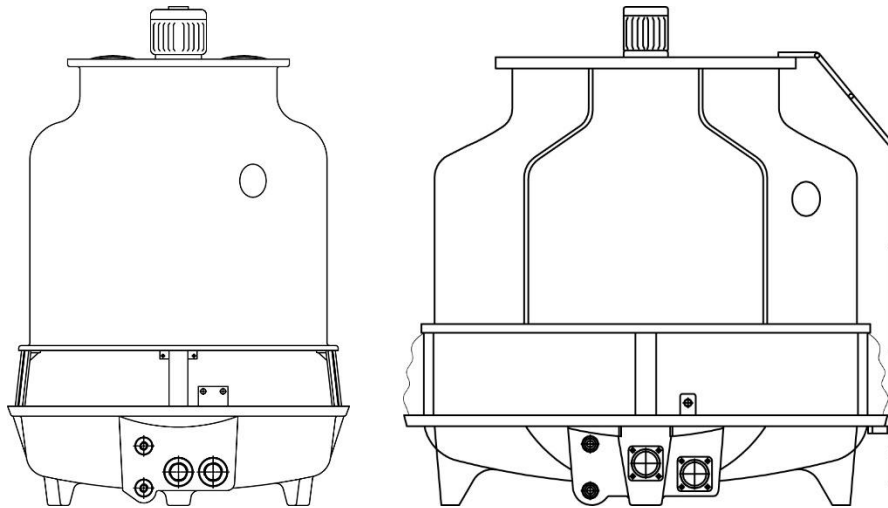


**OPERATIONS AND MAINTENANCE
INSTRUCTIONS
ST SERIES COOLING TOWERS**



AMCOT COOLING TOWER CORPORATION

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AMCOT ST SERIES FIBERGLASS COOLING TOWER

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AMCOT ST SERIES FIBERGLASS COOLING TOWER

INTRODUCTION

We would like to first say thank you for your business and purchase of an Amcot ST Series, open loop, counter flow, water cooling tower. Amcot strives to provide all of our clients with the highest level of customer service and quality products. Amcot's ST series cooling towers when operated and maintained properly will provide your facility with years of reliable service.

This operations and maintenance manual is designed to provide a wide range of recommendations and instructions on how to properly operate and maintain your cooling tower. It is important to remember that ALL cooling towers, regardless of manufacturer, face very harsh environments and it is imperative that proper maintenance is performed regularly in order to ensure a long service life.

Don't forget about your cooling tower!

Most cooling towers are located in a remote area of your facility, either on a roof, or outside and away from most other equipment. It is easy for maintenance staff and personnel to forget about them or not perform regular maintenance as a result. Unfortunately if this occurs, what could have been a relatively quick and inexpensive repair, could become a major ordeal for your facility. It is important to remember that your cooling tower is just one component in an overall system, but is a very critical as it helps maintain optimal operating temperatures for all of the other equipment.

This manual will cover basic operation of your tower, general recommendations for water quality, shutdown/startup checklists, and more!

If at any time you have questions, please contact your distributor, installing contractor or Amcot representative for immediate assistance. It is always helpful to have your model number and serial number which can be located on the unit's equipment tag. A duplicate tag for your tower was included in your shipment. This extra label can be placed below for quick reference.

YOUR TOWER WILL SHIP WITH ONE (1) EXTRA EQUIPMENT TAG.

PLACE THE EXTRA TAG HERE FOR QUICK REFERENCE.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

SAFETY PRECAUTIONS

It is important that only qualified technicians, licensed contractors, or licensed electricians perform installation related services of your cooling tower in order to make sure the unit is properly installed and in compliance with local building codes. Amcot is not responsible for any failures or damages to the cooling tower or it's components in the event the unit is not properly installed.

Also, to prevent personal injury or property damage it is important that the cooling tower is operated in a proper manner with all safety guards in place at all times.

WARNING: Cooling Towers should be installed with proper disconnect switches which are located within visible sight of the unit and have lock out capabilities. They must be properly sized if those disconnects are fused or include breakers. All electrical components must be installed in strict accordance to your local building codes.

WARNING: All electrical equipment should be disconnected and locked out prior to disassembling, entering, or working on the cooling tower.

WARNING: Most cooling towers utilize chemical treatment systems designed to help against the accumulation of scale, biological growth, along with bacteria and Legionella, all of which can be harmful if inhaled or ingested. While in most circumstances the air exhaust will not pose harm to individuals, it is strongly recommended that workers wear proper PPE equipment when working on or near the cooling tower.

WARNING: The cooling tower must always be operated with fan guard(s), louvers, and casing panels in place and secured. Failure to do so may cause personal injury, property damage, or both.

WARNING: Some vibration during operation is normal for most cooling towers. Preassembled towers are quality checked for loose fasteners and proper fan pitch, however during transit it is possible that fasteners may become loose. In the event you experience significant vibration occurring, immediately shut off the unit and check all fasteners and verify pitch and blade angle per the instructions in this manual before turning back on. If vibrations persist, contact your installing contractor, representative, or Amcot directly. Running the tower with excessive vibration can lead to significant equipment damage and even possibly cause personal injury or property damage.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

INSPECT YOUR SHIPMENT

Amcot makes every attempt to ensure your tower was properly packaged and secured for transit to your location. Unfortunately shipping damage can occur. It is the receiving party's responsibility to INSPECT the tower BEFORE you sign the bill of lading. IF damage is noticed, you should reject the delivery, take pictures, and immediately contact your contractor, representative or Amcot.

PLEASE NOTE IF YOU SIGN THE BILL OF LADING FROM THE CARRIER AND DO NOT INDICATE DAMAGES, AMCOT WILL BE UNABLE TO FILE ANY FREIGHT CLAIMS ON YOUR BEHALF. YOU, THE RECEIVER, WILL BE REQUIRED TO FILE SUCH CLAIMS. SEE AMCOT TERMS AND CONDITIONS FOR ADDITIONAL INFORMATION.

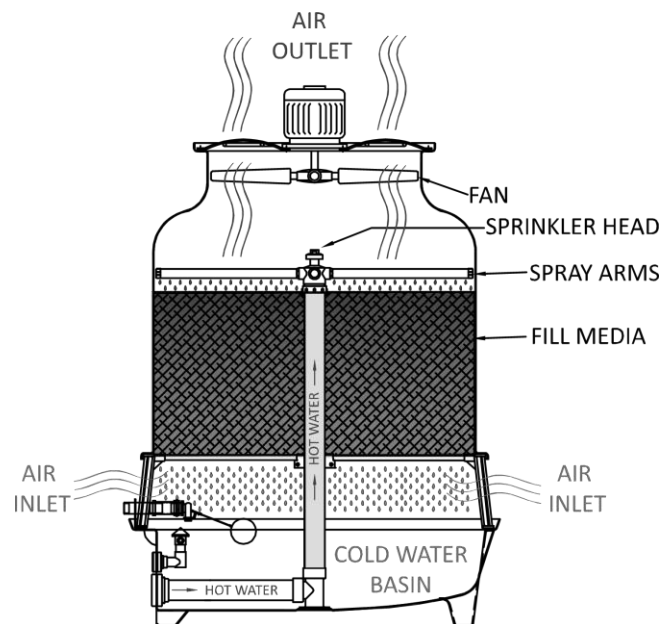
GENERAL OVERVIEW

PRINCIPLE OF OPERATION

The Amcot ST Series cooling tower is an open loop counter flow type of unit designed to remove excess heat from a water cooled system or application so that the equipment generating this heat can continuously operate within a specific temperature range.

Cooling towers are designed to remove system generated heat through evaporation. This evaporation occurs as a result of hot water being pumped into the tower, up a center standpipe to a rotating sprinkler system which distributes the water across a heat transfer media (fill media). At the same time, the fan pulls outside air into the unit through the air inlet louvers located around the bottom of the tower. The heat is transferred from the water to the incoming air as the two come into contact within the heat transfer media. The cold water which results from the heat transfer process is collected in the cooling tower's cold water basin and then is pumped by an external water pump (sold separately) back to your system where the process is repeated. The warm humid air exits the tower into the atmosphere. The diagram to the right illustrates the heat transfer process that occurs during normal operation.

While this illustration is for a general understanding of how your tower works, there are many details not shown. This brief explanation is a simplified method of how your cooling tower functions. Each installation and project is different. Amcot can provide support for your cooling tower and the components supplied with the tower. For overall system design questions you should contact the contractor or engineer who did the initial design.



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL OVERVIEW

TOWER CONSTRUCTION

Casing and Cold Water Basin

The Amcot ST Series Cooling Tower is constructed of heavy duty UV resistant fiber reinforced polyester, also known as fiberglass or FRP. The FRP exterior includes the upper casing panels and the cold water basin. Fiberglass is a mixture of polyester resin material and fiber matting formed by layering the fiber cloth and resin to create a finished product that is very strong, durable, resistant to cracking, non-corrosive, and provides superior protection against chemical attack. The polyester resin incorporates a UV inhibitor additive which protects against decay or deterioration from ultraviolet light which is a natural occurrence.

The Amcot ST Series cold water basin utilizes a sloped basin designed to facilitate proper water flow to the outlet pipe connection and promote positive head pressure for your circulating pump. The sloped basin also allows for complete water drainage to occur during maintenance, cleaning, or seasonal shutdown. The cold water basins incorporate your inlet/outlet connections which are the main supply and return lines, a float valve assembly for water makeup, a drain connection for removing water from the system, and an overflow connection to prevent the basin from overflowing should the float valve not be properly installed or becomes inoperable. Your outlet connection is supplied with a removable suction strainer which helps prevent large debris from entering your piping system.

The FRP Components are coated in a UV resistant gel coat so the tower will have a glossy sheen to the exterior surfaces. Over time it is normal for this sheen to dull as the tower ages

Structural Framework

On Amcot models ST-H-3 to ST-175 the mounting legs of the tower are integrated into the cold water basin to help simplify installation and construction.

For Amcot models ST-200 and greater the mounting framework of the tower is designed from Hot Dipped Galvanized Steel (HDGS) or Stainless Steel 304 (Optional) framing which provides reinforcement and support for the larger overall structure of these models.

WARNING: Your cooling tower MUST be supported in accordance with our recommended support drawings and also comply with local building code requirements. Failure to properly support the cooling tower can result on property damage, equipment failure, or personal injury. If your tower is not properly supported, your warranty will be void in accordance with Amcot Terms and Conditions.

Your tower must be properly supported by anchoring it to a concrete pad, piers, or columns or to a steel I-beam frame (not supplied by Amcot) that is designed to handle the operating weight and load of the tower.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL OVERVIEW

TOWER CONSTRUCTION

Motor Support Frame and Fan Guards

The Amcot ST Series cooling towers are provided with Hot Dipped Galvanized Steel (HDGS) or Stainless Steel 304 (Optional) OSHA compliant removable fan guards and heavy duty welded motor support frames which are designed to properly support and distribute the weight and forces being generated by the mechanical assembly.

NEVER OPERATE YOUR COOLING TOWER WITHOUT FAN GUARDS INSTALLED!

Air inlet Louvers

The air inlet louvers of the ST Series cooling tower is a PVC mesh screen which is designed to prevent debris and wildlife from entering the cooling tower. The air inlet louvers are designed so that they can be removed for cleaning or replacing. Removing the louver sections also permits access to the inside of the cold water basin.

Heat Transfer Media (Fill Media)

The ST Series cooling tower utilizes a heat transfer media known as "Fill Media". Fill media is an embossed PVC sheet material which is glued together to form a series of channels known as flutes. These flutes help spread out the water as it flows across the material. By spreading out the water, the fill media increases the water surface area that becomes exposed to the air flow. This in turn increases the amount of heat that can be removed from the system.

Your fill media is capable of withstanding continuous operating hot water temperatures of 115°F and is impervious to rot, decay, rust, and biological attack. The fill media is installed in preassembled packs or blocks.

It is important that proper water treatment be maintained by utilizing a local water treatment specialist in your area. Failure to maintain proper water treatment can cause the fill media to become clogged or fouled up over time, which will decrease your unit's overall capacity and ultimately result in an increase to your cold water temperature. If using a chemical water treatment system you should incorporate a biocide as a component of that treatment program to eliminate biological growth.

Water Distribution System

Your cooling tower is designed with a rotating spray system that is driven by incoming water pressure. Water enters the tower from the inlet pipe connection (located on the cold water basin side wall) and is pumped through a center stand pipe to the sprinkler head which directs water to a series of spray arms. The spray arms have a series of holes that allow the incoming hot water to be distributed onto the fill media. This assembly rotates in a clockwise fashion ensuring that water is evenly distributed to all areas of the fill media.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL OVERVIEW

TOWER CONSTRUCTION

Fan Blade Assembly

For ST Series models ST-3 thru ST-30 the fan assemblies are fixed pitch type, constructed from nylon. The pitch angles are preset by the factory to ensure proper operation and maximum allowable air flow is being generated while maintaining proper motor amp draw.

For models ST-40 and ST-50 the fan assemblies remain fixed pitch, but the fan blades are constructed from aluminum alloy while the hub is nylon.

For ST-60 through ST-1500 fans are adjustable pitch type and constructed from light weight corrosion resistant aluminum alloy. Blades are secured to the fan hub through a series of stainless steel U-bolts. Adjustable pitch fans do allow for some minor adjustment on the customer's part when it comes to air flow through the unit, however it is not recommended that you make these adjustments unless you are a licensed professional.

WARNING: Failure to properly balance fan assemblies can cause equipment failure, excessive vibrations, and personal injury in the event of a failure. It is critical that fans be balanced prior to startup by the installing technician even on towers that shipped preassembled!

Fan Motors & Reducers

Amcot ST Series models ST-H-5 thru ST-200 are supplied with direct drive motors which means that the mechanical assembly simply consists of a motor and fan assembly. For these units, there are no bearings to grease or belts to adjust.

On models ST-225 thru ST-1500 the mechanical assembly incorporates a housed belt reducer which regulates the output speed on the fan assembly to ensure proper air flow is maintained while minimizing sound generation. The reducer assembly is fully housed in an epoxy coated steel case with removable side walls for accessing the internal components and for adjusting belt tension. For adjustment and maintenance please see the appropriate section of this manual for more information.

Motors on the Amcot towers are designed to meet NEMA energy requirements and are UL/CSA approved and are IP55 compliant. On models ST-30 thru ST-1500 the motors can be operated on variable frequency drives (supplied separately) in order to maximize energy savings. In addition, all motors can be operated on standard on/off type of temperature controllers (sold separately).

Models ST-H-5 thru ST-H-20 utilize single phase 110/220v dual voltage motors which can accommodate either service power. ST-H-20 also has the ability to be supplied with a three phase 208-230/460v multi-voltage motor. ST-30 thru ST-1500 are supplied in 3 phase 208-230/460v motors as a standard. For special motor voltage requirements, Amcot can provide such motors which would be special order and have extended lead times.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL OVERVIEW

GENERAL OPERATING PRECAUTIONS

PERFORMANCE

Since the volume of water has a direct impact on cooling tower performance, be sure that the water flow rate is constantly maintained during operation. Fluctuations in water flow will directly impact cooling tower performance. Low flow rates can cause excessive scale and algae growth. Scale and algae accumulation can be minimized by incorporating a water treatment program (chemical or non-chemical types). It is best to contact the installing contractor or local representative for further assistance in these matters.

WATER LEVEL

Proper water level in the cold water basin should be maintained at all times. The recommended water level is 2-3 inches below the overflow. If the water level in the basin becomes too low this can allow air to enter your piping and cause pump cavitation. Closely monitor your float valve assembly or electronic level controller and ensure a proper water level is maintained.

NOISE/VIBRATION

Pay close attention to general operating conditions of your tower such as noise, vibrations, water temperature, and motor voltage. Sudden changes in any of these items can be an indicator that a problem has begun to develop and ultimately failure if you do not address the problem in a timely manner. Sudden increases in vibration can mean a fan assembly is cracked or out of balance or structural brackets may be compromised. Sudden shifts in voltages or amp draws can mean that reducer belts need to be adjusted or motor bearings could be failing or something is wrong with the power supply connected to the motor.

REPLACEMENT PARTS

Amcot stocks most parts for ST Series cooling towers in our Ontario, California facility. Amcot replacement parts are available through major HVAC wholesalers and distributors along with other authorized equipment distributors.

Only the use of original Amcot components is recommended. Using third party components that are not original factory parts will void your tower's warranty and could have significant impact on the towers rated capacity or performance.

If you are unsure of who your local supplier is, please call Amcot at 1-800-444-8693 and we will be more than happy to assist you with finding an authorized dealer.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

STARTUP INSPECTION

Once your cooling tower has been properly installed by licensed professionals, proper startup of the unit should occur. Below is a checklist of items to verify prior to performing initial startup of your unit and after seasonal shutdowns.

GENERAL PROCEDURES

REMEMBER TO ALWAYS SHUT DOWN AND PERFORM LOCKOUT/TAG-OUT PROCEDURES PRIOR TO SERVICING OR ACCESSING YOUR EQUIPMENT!

- ❖ Unit should be installed level and on proper footings or foundations made from concrete or steel.
 - Uneven foundations can impact equipment service life and void your warranty.
- ❖ Units should be secured and fastened according to the unit's foundation drawing.
 - Failure to properly secure the unit can cause equipment damage and void your warranty.
- ❖ Circulating water pump suction connection must be below the outlet connection to the cooling tower.
 - Failure to properly install your pump will cause damage to not only the pump's components but also can impact your overall system design.
- ❖ All piping should be properly supported. The cooling tower is not designed to be or act as a pipe support.
 - Failure to properly secure piping can cause physical damage to the cooling tower and void your warranty.
- ❖ Inlet and Outlet connections should incorporate flex connections at the point of connection to help isolate vibration from the tower or the pump.
- ❖ All piping connections should have operable valves for proper water balancing and tower isolation and servicing.
- ❖ Ensure your disconnect switch is properly installed and working.
- ❖ Any safety interlocks should be tested.
- ❖ When operating ST Series towers on inverter drives or Variable Frequency Drives, make sure the minimum speed requirements have been programmed.
 - Standard Fan Motors on the ST Series can be operated on variable frequency drives with an operating range of 20-60 hertz.
- ❖ Verify all valves, sensors, gauges, or other accessories are working properly.
- ❖ Amcot recommends a local water treatment specialist provide you with a water treatment program that is suitable for your local conditions.
 - Failure to implement and maintain a water treatment plan may void your tower warranty as this is the responsibility of the owner to maintain such plans.
- ❖ Make sure all electrical connections are secure.
- ❖ Check inside your tower and remove any debris.
- ❖ Check under or around your tower for any signs of water leaks.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

STARTUP PROCEDURES

GENERAL STARTUP GUIDELINES

- Inspect all exterior surfaces of the cooling tower.
- Inspect and check all fasteners.
- Remove any debris such as dirt, leaves, rocks, or other foreign items that do not belong.
- With motor disconnected and locked out, rotate the fan manually to ensure it is not coming into contact with casing panels or any other objects.
- Inspect the fan blades for any cracks or damage.
- Inspect motor junction box and electrical connections making sure all connections are secure.
- On the side of the cooling tower casing panel there is an inspection port and cover. Remove the cover, visually inspect the water distribution system and manually rotate to ensure it spins freely. Reinstall the cover.
- Flush the cold water basin to remove any dirt or debris. This can be done by using a simple hose and opening your drain connection.
- Inspect the water outlet strainer (located in the cold water basin) to make sure it is installed. If there is debris on the strainer, remove, clean, and reinstall.
- For tower models ST-225 and greater, inspect the gear reducer assembly. Check belt tension, belt condition, and grease the gear reducer using the fittings located on the reducer assembly. Make sure the side access panels to the gear reducer is secured prior to operation.
- Once everything has been inspected and cleaned, fill the cold water basin up to the overflow.
- You may now energize the unit
- You will need to do a series of starts and stops with your circulating pump in order to fill your water loop piping. Piping layout should be designed properly to minimize backflow when pump is not operating.
- It is recommended that you turn on the pump for approximately 20-30 seconds and then shut off. Allow the cold water basin to refill with water from your make-up source. Repeat this process until your piping is completely filled with water. Depending on your piping you may need to purge the system of any air pockets that could develop.
- Bump fan motor to make sure fan is rotating properly.
- Perform variable frequency drive (VFD) Startup in accordance with manufacturer's recommendations (if necessary).
- Check motor voltage and amperage, making sure the amperage is at or below nameplate for the specific voltage using.
- Establish bleed rate for water based on water chemical treatment plan in place.
- At this point the unit should be operational and ready for continuous running.
- Check and adjust float valve assembly as necessary. Water level should be 1-2 inches below the overflow during normal operation. It may be necessary to monitor this for several days.
- For ST-225 and greater, after the initial 40 operational hours you should shut down the unit, lockout the motor, and adjust belt tension.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

PREVENTATIVE MAINTENANCE

GENERAL OVERVIEW

The following is a series of recommended preventative maintenance procedures that should be performed on your cooling tower to help provide the maximum service life of your unit and ensure it provides years of reliable performance.

PREVENTATIVE MAINTENANCE

MONTHLY PROCEDURES

MONTHLY PROCEDURES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Check FRP casing and basin for cracks or damage												
Remove & clean basin strainer												
Check water level in basin; adjust float valve assembly as needed.												
Check water distribution system for debris, blockages												
Check water distribution system for rotation speed; adjust if needed.												
Check & clean fan screens, inlet louvers.												
Visually inspect motor for damage or changes in noise												
Check fan assembly for cracks, scale buildup. Clean if necessary.												
Check belt tension on reducer (ST-225 to ST-1500)												

AMCOT ST SERIES FIBERGLASS COOLING TOWER

PREVENTATIVE MAINTENANCE

QUARTERLY PROCEDURES

QUARTERLY PROCEDURES	1 st QTR	2 nd QTR	3 rd QTR	4 th QTR
Perform Monthly Checklist				
Cold Water Basin – Drain, Clean, Refill				
Basin Heaters – Check heater thermostat, clean probes, and inspect the heating element. (when applicable)				
Make-up Valve – check for operation and adjust. <i>Electronic Make-up valves – check solenoid valve and stilling chamber. (if applicable)</i> <i>External Float assemblies – clean interior of stilling chamber to ensure float is free and clear of side walls. (if applicable)</i>				

SEMI-ANNUAL PROCEDURES

Semi-Annual Procedures	Spring	Fall
Perform Monthly Checklist		
Sand Filters / Separators – Check condition of media or strainers, check sweeper piping and pumps. (when applicable)		

AMCOT ST SERIES FIBERGLASS COOLING TOWER

PREVENTATIVE MAINTENANCE

ANNUAL PROCEDURES

ANNUAL PROCEDURES	DATE
Perform Monthly Checklist	
Vibration Switches – Test and adjust sensitivity as needed. (when applicable)	
Inspect all seams for leaks	
Perform annual cooling tower cleanings by a licensed professional	
Inspect fill media for debris and condition.	
Remove and Clean Sprinkler Arms	
Check fill media supports	

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER PIPE ASSEMBLIES

General Overview

Your ST Series water distribution assembly rotates based on the water returning to the tower. The force of this water fills the overall system and as the water exits through holes located on the sprinkler arms, this propels the assembly causing it to rotate.

For accessing your water distribution system, it will be necessary to remove a section of the tower's casing panel, or to enter the tower through the fan guard on larger units.

WARNING: Do NOT attempt to repair or replace water distribution system components without first shutting down your cooling tower and performing lockout/tagout procedures.

Sprinkler pipes and their water diverter should never come into contact with the fill media or casing walls. If this occurs, the assembly will fail to rotate properly and impact tower capacity. Sprinkler pipes must also be regularly inspected to ensure that the orifices have not become blocked due to debris or particulate matter.

Sprinkler Pipe Assemblies (ST-H-5 thru ST-30)

Sprinkler pipes on ST-H-5 thru ST-30 are attached to the center sprinkler head by a threaded end connection and a lock nut which is designed to prevent the arms from becoming loose.

Disassembly:

1. Shutdown your cooling tower and remove casing panel to gain access.
2. Loosen the lock nut on the sprinkler arm.
3. Unthread the arm from the sprinkler head.

Cleaning:

1. Flush the arm using a spray hose and insert a screwdriver into the orifices to free or loosen any debris.
2. Gently tap the threaded end on the ground to expel any debris.

Installing: (after cleaning or for new sprinkler arms)

1. Screw the sprinkler arm back onto the sprinkler head taking care not to cross thread them.
2. The orifices should be pointing straight down.
3. Retighten the locking nut.
4. Adjust the arm a final time by turning it counter-clockwise so that the orifices are at a slight angle.
5. Reinstall casing panel and bring unit online.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER PIPE ASSEMBLIES

Sprinkler Pipe Assemblies (ST-40 to ST-60)

Sprinkler pipes on ST-40 to ST-60 are attached to the center sprinkler head by a threaded end connection and a lock nut which is designed to prevent the arms from becoming loose. In addition, these arms use a tension wire assembly to help prevent deflection when filled with water.

Disassembly:

1. Shutdown your cooling tower and remove casing panel to gain access.
2. Loosen lock nut on the sprinkler arm.
3. Unthread the arm from the sprinkler head.

Cleaning:

Flush the arm using a spray hose and insert a screwdriver into the orifices to free or loosen any debris. Gently tap the threaded end on the ground to expel any debris.

Installing: (after cleaning or for new sprinkler arms)

1. Screw the sprinkler arm back onto the sprinkler head taking care not to cross thread them.
2. The orifices should be pointing straight down.
3. Retighten the locking nut.
4. Adjust the arm a final time by turning it counter-clockwise so that the orifices are at a slight angle.
5. Reinstall the tension wire make sure that it is very taut.
6. Spin the spray system by hand to make sure that no spray arms or the water deflectors come into contact with the fill media.
7. Reinstall casing panel and bring unit online.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER PIPE ASSEMBLIES

Sprinkler Pipe Assemblies (ST-70 to ST-1500)

Sprinkler pipes on ST-70 to ST-1500 are attached to the center sprinkler head by a slip fit connection with set screws located on the sprinkler head point of connection. The assembly also uses a tension wire and turnbuckle assembly which extends from the center of the sprinkler head to the end of each sprinkler arm to help prevent deflection when filled with water.

Disassembly:

1. Shutdown your cooling tower and remove casing panel to gain access. (ST-70 – ST-125)
 - a. For ST-150 to ST-1500 it is recommended that you enter the tower by way of the fan guard located on top of the unit.
 - b. You should use a thin sheet of plywood and place this on top of the fill media so as to not stand directly on the fill. The fill is designed to support the weight of a maintenance worker, but you should avoid standing directly on the fill.
2. Remove tension wire from the end of the sprinkler arm, you do not need to remove it from the turnbuckle or center post.
3. Loosen set screws on the sprinkler head.
4. Remove the sprinkler arm by pulling it straight out.

Cleaning:

1. Flush the arm using a spray hose and insert a screwdriver into the orifices to free or loosen any debris.
2. Gently tap the end on the ground to expel any debris.

Installing: (after cleaning or for new sprinkler arms)

1. Insert the sprinkler arm into the sprinkler head with the orifices pointing straight down.
2. Turn the sprinkler arm slightly counter-clockwise so that the orifices are at a slight angle.
3. Tighten set screws on the sprinkler head.
4. Reinstall the tension wire making sure that it is very taut.
5. You can adjust tension wire further by adjusting the turnbuckles as necessary.
6. Spin the spray system by hand to make sure that no spray arms are the water deflectors come into contact with the fill media.

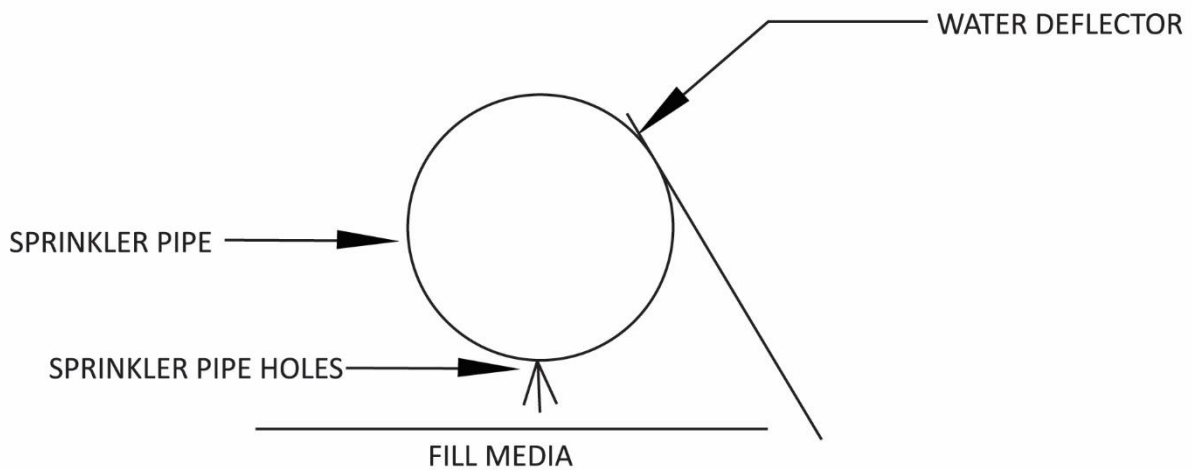
AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

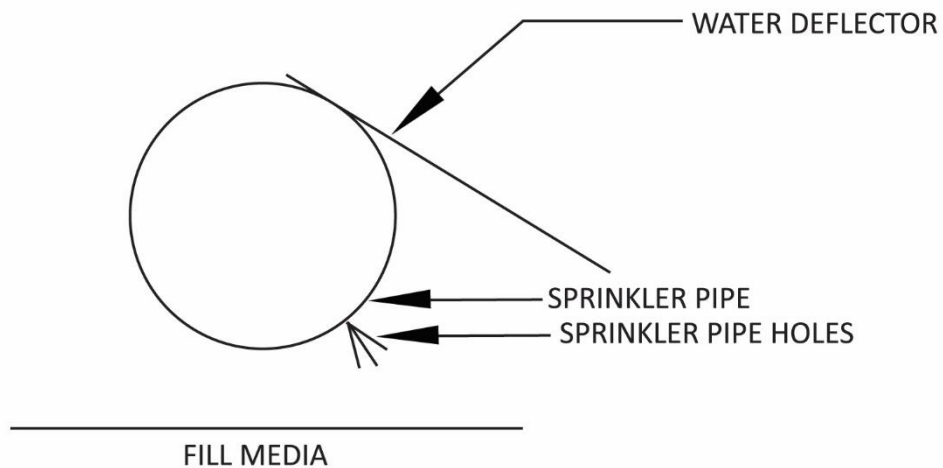
WATER DISTRIBUTION SYSTEM – SPRINKLER PIPE ASSEMBLIES

SPRINKLER ARM HOLE POSITIONING

INCORRECT POSITION - SPRINKLER ARM HOLES POINTING STRAIGHT DOWN, 6 O'CLOCK POSITION. WATER DEFLECTOR ALSO MAY HIT THE FILL MEDIA IN THIS POSITION.



CORRECT POSITION - SPRINKLER ARM HOLES SHOULD BE SET BETWEEN A 4-5 O'CLOCK POSITION WHERE STRAIGHT DOWN IS A 6 O'CLOCK POSITION.



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER HEAD ASSEMBLIES

Sprinkler Head

If your sprinkler head fails to rotate smoothly during normal operation or if you see a lot of water coming out at the base of the sprinkler head, this is an indicator that the sprinkler head's water seal is compromised.

In the event the sprinkler head becomes compromised, it may be possible to disassemble and repair. However if attempts are made to do these repairs and failure continues to occur, then it is recommended that the sprinkler head be replaced.

Sprinkler Head (ST-H-5 thru ST-60)

Sprinkler heads on smaller models, ST-H-5 to ST-60 are constructed from nylon. Sprinkler heads are secured to center riser pipe by a threaded connection.

Removing the entire assembly:

1. Shutdown your cooling tower and remove casing panel to gain access.
2. Disassemble the spray arms according to the instructions found on Pages 15-16.
3. Remove the sprinkler head from the standpipe by turning the base counter-clockwise.

WARNING: Take caution when loosening the sprinkler head from the standpipe. Applying too much force can crack the standpipe which will then require replacing.

Disassembly of Sprinkler Head:

1. Remove cap cover on top of sprinkler head.
2. Loosen the nut and washer until both top and bottom sections of sprinkler head are apart.
3. Clean the sprinkler head parts with fresh water and a brush.
4. Inspect parts for any wear or damage.
5. If parts are damaged or worn, replace the parts or contact your local representative/distributor/contractor.
6. If the parts appear to be OK after cleaning reassemble the sprinkler head.

Installing the assembly: (after cleaning or for new parts)

1. Gently clean threads on both the sprinkler head and stand pipe.
2. Thread sprinkler head onto standpipe taking care not to cross thread.
3. To tighten sprinkler head, turn the base clockwise.
4. Continue to tighten by hand until you cannot tighten any further.
5. Using wrench, turn sprinkler head ¼ turn more. DO NOT OVER TIGHTEN.
6. Reinstall sprinkler arms accordingly (refer to Page 15-16).
7. Reinstall casing panel and bring unit online.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER HEAD ASSEMBLIES

Sprinkler Head (ST-70 thru ST-1500)

Sprinkler heads on models, ST-70 to ST-1500 are constructed from aluminum or stainless steel. Sprinkler heads are secured to center riser pipe by a threaded connection.

Removing the entire assembly:

1. Disassemble the spray arms according to the instructions found on Page 17.
2. Remove the sprinkler head from the standpipe by turning the base counter-clockwise.

WARNING: Take caution when loosening the sprinkler head from the standpipe. Applying too much force can crack the standpipe which will then require replacing.

Disassembly of Sprinkler Head:

1. Shutdown your cooling tower and remove casing panel to gain access. (ST-70 – ST-125)
 - a. For ST-150 to ST-1500 it is recommended that you enter the tower by way of the fan guard located on top of the unit.
 - b. You should use a thin sheet of plywood and place this on top of the fill media so as to not stand directly on the fill. The fill is designed to support the weight of a maintenance worker, but you should avoid standing directly on the fill.
2. Remove cap cover on top of sprinkler head.
3. Remove the circlip.
4. Pull the top section of the sprinkler head from the base.
5. Clean sprinkler head with fresh water and a brush.
6. Inspect parts for any wear or damage.
7. If parts are damaged or worn, replace the parts or contact your local representative/distributor/contractor.
8. It may be possible to replace the bearings.
9. See the table on page 19 for more information.
10. If the parts appear to be OK after cleaning reassemble the sprinkler head.
11. Reassemble the sprinkler head.

Installing the assembly: (after cleaning or for new parts)

1. Gently clean threads on both the sprinkler head and stand pipe.
2. Thread sprinkler head onto standpipe taking care not to cross thread.
3. To tighten sprinkler head, turn the base clockwise.
4. Continue to tighten by hand until you cannot tighten any further.
5. Using wrench, turn sprinkler head $\frac{1}{4}$ turn more. DO NOT OVER TIGHTEN.
6. Reinstall sprinkler arms accordingly (refer to Page 17).
7. Reinstall casing panel and bring unit online.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – SPRINKLER HEAD ASSEMBLIES

Sprinkler Head Assembly Details

If your sprinkler head fails to rotate smoothly this can often be a sign of damage to the internal seal/bearing or a result of hard water scale buildup occurring between the lower and upper sections of the sprinkler head assembly itself. In some cases it may be possible to disassemble the two sections from one another, clean them with a wire brush to remove scale and reassemble. In other cases unfortunately it just may be necessary to replace the sprinkler head assembly completely.

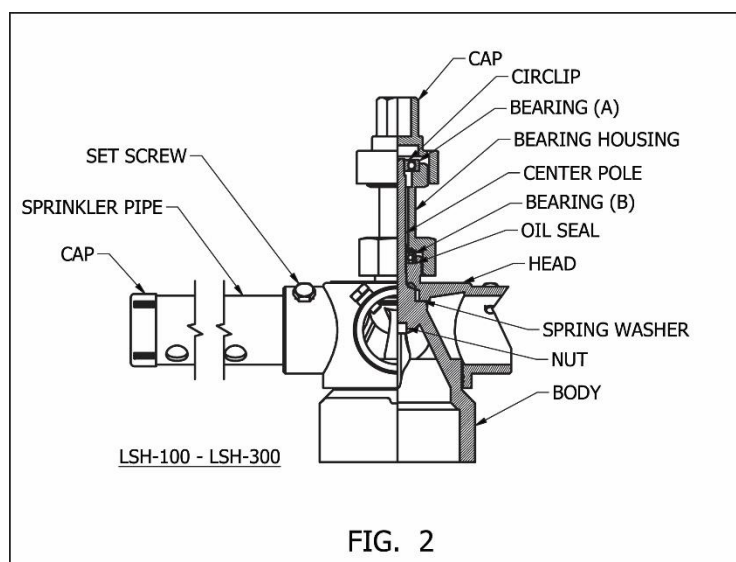
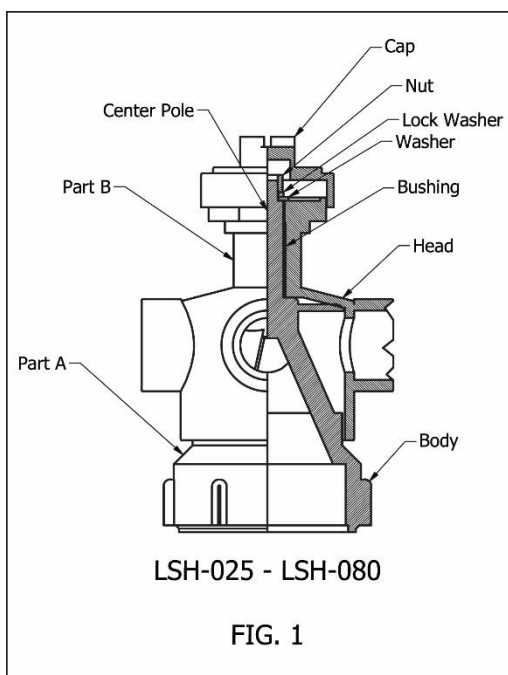
To disassemble and clean the sprinkler head assembly:

ST-H-5 to ST-60 (See Figure 1)

- Remove set screw cap on top of sprinkler head.
- Loosen nut and washer, then remove sprinkler head.
- Clean sprinkler head with fresh water and a brush. Check parts to see if they are worn or bad.
- If everything appears to be ok, reinstall sprinkler head. If problem persists it may be necessary to replace with a new head.

ST-70 - 1500 (See Figure 2)

- Remove the cap and take circlip off.
- Pull the rotary part (head) off of the fixed part (body).
- Clean in same manner as above and reinstall.
- It may be necessary to replace bearings or entire sprinkler head depending on extent of damages.



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

WATER DISTRIBUTION SYSTEM – GENERAL DATA

Sprinkler Head Identification

When attempting to identify sprinkler heads on towers that have been in service for a long time, each sprinkler head has a factory marking, “LSH” model number, on the top of the sprinkler head. To help with identifying your sprinkler head or potential tower model number you can refer to the table below.

SPRINKLER HEAD REFERENCE NUMBERS										
ST MODEL	5-10	15-20	25-40	50-60	70-100	125-175	200-250	300-400	500-700	800-1500
SPRINKLER HEAD LSH MODEL	-040	-050	-065	-080	-100	-125	-150	-200	-250	-300

Sprinkler Head Bearings (ST-70 thru ST-1500)

For these sprinkler heads, as noted on Page 20, in some cases it may be possible for the customer or contractor to replace the bearings which could allow you to return your unit to service faster. These bearings can be sourced through local bearing shops and the numbers in the table below are universal and can cross multiple manufacturers/brands of bearings.

ITEM NUMBER	SPRINKLER HEAD BEARINGS					
	LSH-100	LSH-125	LSH-150	LSH-200	LSH-250	LSH-300
BEARING A	6301z	6302z	6302z	6303z	6304z	6305z
BEARING B	6302z	6303z	6303z	6304z	6305z	6306z

Distribution System Rotation Speed

The speed at which the assembly rotates is based on the angle at which the sprinkler arm holes are set at along with the water inlet pressure and the condition of the sprinkler head.

RECOMMENDED ROTATION SPEED FOR WATER DISTRIBUTION SYSTEM							
ST MODEL	5 - 30	40 - 60	70 - 250	300 - 350	400 - 700	800 - 1000	1250 - 1500
RPM	7 - 10	5 - 8	5 - 7	3.5 - 5	2.5 - 4	2 - 3	1.5 - 2.5

If your rotation is too fast, you can slow the assembly down by rotating sprinkler arms in a clockwise direction so that the openings where the water comes out turns slightly more towards the fill. However if you turn them to where the openings are facing straight down, then your water distribution will fail to rotate which is not recommended. Always test rotation speed with the fan motor running as the air flow through the tower can cause the rotation speed to slow.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

FILL MEDIA

Your Amcot ST Type tower is supplied with fill media constructed from PVC embossed sheets which are glued together to form packs or sections which are then installed in layers. The fill media is the core location where the heat transfer takes place within the unit.

There is little to no maintenance required to the fill media, however to extend the life of the media it is highly recommended that customers incorporate both water treatment (chemical or non-chemical) and a solids filtration system whether this be an inline strainer or solids filtration system. Fill media deterioration over time occurs ultimately from the material becoming fouled by scale or debris over time which creates blockages within the media and prevents the air and water from mixing efficiently.

For water treatment guidelines, refer to page 43 for more information.

For solids filters it is recommended that at a minimum, your system should incorporate a basket strainer type of filter which will capture debris that is small enough to pass through the cooling tower's suction strainer. There are multiple forms of solid filtration available including but not limited to sand filters or vortex separators.

Attempting to clean the fill media with a pressure washer or by other forceful means can damage the fill media and actually cause additional loss of performance or capacity. It is not recommended that pressure washers or mechanical cleaning of the fill media be performed.

There are also chemical products sold and marketed in the industry that will "clean" the fill media by temporarily introducing the chemicals into the circulating water system. These chemicals have documented history of working, but there are also many customers whom claim they do not work. Therefore, the use of any product of this nature should be handled by a water treatment specialist or trained professional who is familiar with the product. Incorrect use of such chemicals could actually cause more damage to your tower or system overall as many of these chemical solutions can be very aggressive to aluminum and galvanized steel. Caution should be taken if you attempt to clean the fill with such chemicals. Amcot does not support the use of these chemicals and any damage that they may cause is not covered under our warranty.

WATER BASIN

The water basin on the Amcot ST Series is constructed of FRP similar to the casing of the tower. Overtime the basin will collect dirt and debris from the environment. Therefore it is recommended that the tower is always operated with the suction strainer in place which should be inspected and cleaned regularly. Also the tower should be drained and cleaned 1-2 times per year at a minimum to remove sediment that has collected in the basin. Your water basin incorporates a drain connection for this purpose.

If a crack develops on your water basin, it can be repaired by cleaning the area and applying polyester fiberglass resin and matting to the damaged area. These FRP repair kits can be found at most home improvement in the paint section or a local marine parts store.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

AIR INLET LOUVERS

The PVC air inlet louvers are designed to allow maximum air flow to enter the unit while preventing large debris from entering the tower which could cause water flow problems. The louvers are secured to a louver support system which uses knob pins or wing bolts with plastic washers to hold them in position. The louvers can be removed for cleaning or to provide access to the cold water basin of the tower.

Louvers should remain in place at all times especially during operation and should not be modified. Modification of the air inlet louvers will change the air flow dynamics of the cooling tower and can impact performance, capacity, or cause the motor amperage draw to increase which ultimately will lead to a mechanical failure. Modifying inlet louvers without written approval by Amcot will void tower warranty.

Amcot only recommends using the standard louver or the optional Anti-Splash Louver (ASL) option on the ST Series cooling tower. The ASL louver is an optional accessory that replaces the standard louver screen and is designed to prevent water splash out from occurring and minimize sunlight exposure to the basin which helps minimize biological growth.

ANTI-SPLASH LOUVERS (OPTIONAL)

Anti-splash Louvers (ASL) are an optional inlet louver design which can be used as a substitute to the standard inlet louvers. ASL louvers are specially designed to prevent water splash out from occurring while allowing the required air flow to pass through the unit without increasing amp draw or impacting performance of the tower.

ASL is installed in sections and secured to the tower with stainless steel fasteners. The fasteners can be removed so that the ASL sections can also be removed whether for cleaning, maintenance or access to the basin.

Modification of the ASL louvers will change the air flow dynamics of the cooling tower and can impact performance, capacity, or cause the motor amperage draw to increase which ultimately will lead to a mechanical failure. Modifying ASL type louvers without written approval by Amcot will void tower warranty.

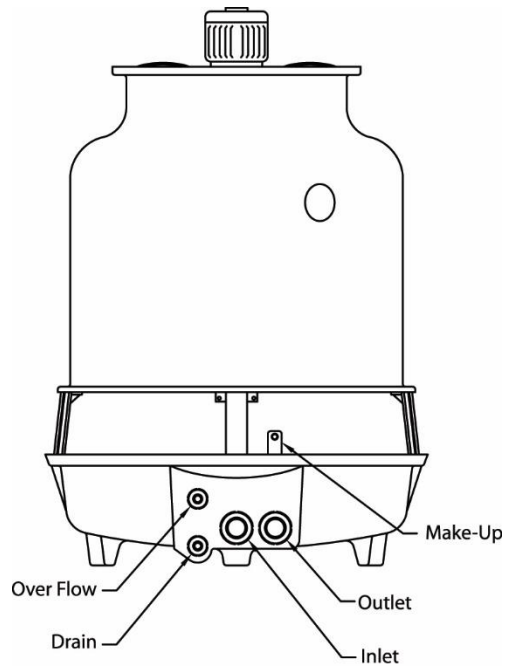
AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

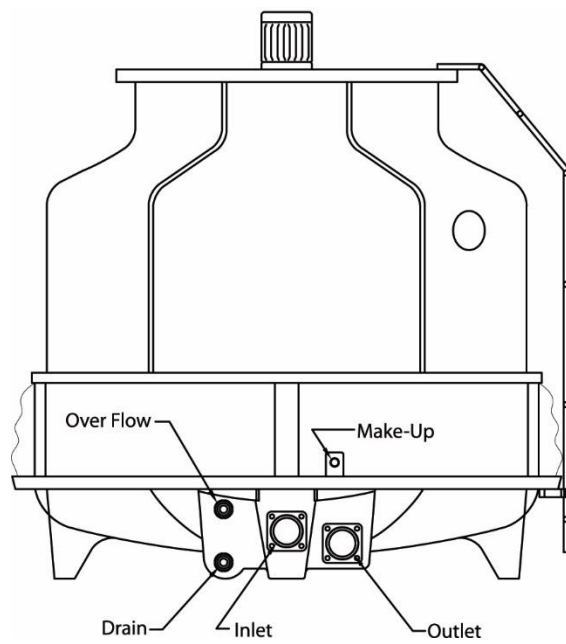
PIPE CONNECTIONS

Your cooling tower is supplied with several points of connection for piping. The standard connections include the inlet, outlet, make-up, overflow, drain, and on larger units an automatic filler (Quick Fill) connection.

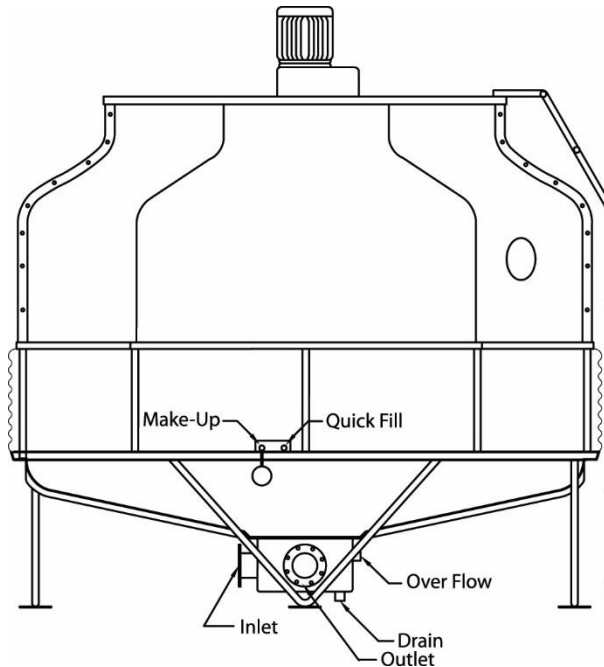
Models ST-H-3 to ST-60



Models ST-70 to ST-200



Models ST-225 to ST-1500



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

PIPE CONNECTIONS

Inlet/Outlet Connections

For Models ST-H-3 to ST-60, inlet/outlet connections are furnished in Female Pipe Thread (FPT) connection type. For models ST-70 and greater the towers are furnished with flanged pipe connections rated at 125 pounds.

It is recommended that shutoff valves be incorporated into your pipe plan near the inlet and outlet of the tower to assist with flow control and to isolate the tower when in seasonal shutdown or during maintenance.

We also recommend the use of flex connections before transitioning to hard pipe (Steel or PVC). The flex connectors are designed to minimize vibration from traveling along the piping whether it is originating at the tower or from the pumps. Flex connections are available at your local plumbing supply stores.

Make-Up Connection & Float Valve Assembly

The make-up connection on your cooling tower should be connected to a city water supply line. It is typical that this line connection be copper type and outfitted with a shutoff valve prior to connection at the cooling tower. This connection will be a Male Pipe Thread (MPT) type. This connection allows water level in your system to be maintained as you will be losing water from the evaporation process.

Amcot ST towers are supplied with mechanical float valve assemblies that are attached to the make-up connection. Mechanical float valve assemblies consists of a plastic or brass valve, rod, and plastic float. The rod that connects to the valve itself is adjustable by loosening the thumb screw that connects the valve and rod together.

If you wish to increase the water level in your basin you would loosen the thumb screw and raise the rod to lessen the angle at which it is positioned. To lower the water level in your basin, you will lower the rod or increase the angle. There is no defined set point for the angle, but we recommend starting at about a 30 degree angle and adjusting from there.

Amcot recommends a proper water level of two (2) inches below the overflow. During your routine maintenance you will want to adjust the float valve as needed to ensure that the proper water level is maintained.

If the water level is too low, this could cause pump cavitation and damage your pump. If the water level is too high, water will flow out through the overflow fitting on the tower and you will simply lose this water and any chemical treatment solution from your system.

The recommended maximum inlet water pressure on the ST Series float valve assemblies should not exceed 60 psi. If your city water pressure exceeds this amount you will need to install a pressure regulator on the supply line. Failure to do so will cause the valve to not operate properly.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Pipe Connections

Overflow Connection

Your tower is fitted with an overflow connection (FPT) and overflow assembly. The overflow is designed to ensure that water level does not exceed a predetermined level which could cause structural damage to the basin or cause water to overflow out of the basin and flood the immediate area. The tower should never be operated without the overflow in place. Failure to operate the tower without a proper overflow connection can cause damage to the cooling tower or surrounding equipment/property.

Drain Connection

Each tower is also supplied with a drain connection (FPT). This connection is typically used when removing water from the system for either cleaning, maintenance, or replacement of the circulating water. The drain connection should be piped to a facility drain which delivers this water to your local municipality. This drain connection is often used as a bleed connection for siphoning small volumes of water out of the system to prevent the buildup of dissolved solids within your system. Bleed or blow down is critical to the overall quality of your circulating water. For more information on this, please see the water treatment section of our manual on page 47.

Automatic Filler Connection

On models ST-200 to ST-1500 towers, there is an additional quick fill connection (MPT) adjacent to your standard make-up connection where the mechanical float valve is attached. The quick fill connection is optional and allows for an additional make-up connection that can be utilized when either filling the system with water initially or following maintenance to speed up the process. This connection should only be used in those cases and is not intended for use during normal operation.

WARNING: YOUR PIPING MUST BE PROPERLY SUPPORTED IN ACCORDANCE WITH GOVERNING CODES REQUIRED BY YOUR LOCAL, COUNTY, OR STATE REGULATIONS. IN ADDITION, THE COOLING TOWER IS NOT DESIGNED NOR CONSIDERED A PIPE SUPPORT. THEREFORE ALL PIPE CONNECTIONS MUST BE PROPERLY SUPPORTED WITHIN 12 INCHES OF THE POINT OF CONNECTION. FAILURE TO PROVIDE PROPER PIPE SUPPORT COULD DAMAGE YOUR COOLING TOWER AND VOID YOUR WARRANTY.

The following page contains a chart of the pipe connections on the specific ST models and their respected sizes.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

Pipe Connection Chart:

MODEL	INLET	OUTLET	MAKEUP	QUICK FILL	OVERFLOW	DRAIN
ST-3	1 1/2"	1 1/2"	1/2"	-	1"	3/4"
ST-H-3	1 1/2"	1 1/2"	1/2"		1"	3/4"
ST-5	1 1/2"	1 1/2"	1/2"	-	1"	3/4"
ST-H-5	1 1/2"	1 1/2"	1/2"		1"	3/4"
ST-8	1 1/2"	1 1/2"	1/2"	-	1"	3/4"
ST-H-8	1 1/2"	1 1/2"	1/2"		1"	3/4"
ST-10	1 1/2"	1 1/2"	1/2"	-	1"	3/4"
ST-H-10	1 1/2"	1 1/2"	1/2"		1"	3/4"
ST-15	2"	2"	1/2"	-	1"	1"
ST-H-15	2"	2"	1/2"		1"	1"
ST-20-1	2"	2"	1/2"	-	1"	1"
ST-H-20-1	2"	2"	1/2"		1"	1"
ST-20-3	2"	2"	1/2"	-	1"	1"
ST-H-20-3	2"	2"	1/2"		1"	1"
ST-25	2 1/2"	2 1/2"	1/2"	-	1"	1"
ST-30	2 1/2"	2 1/2"	1/2"	-	1"	1"
ST-40	2 1/2"	2 1/2"	3/4"	-	1"	1"
ST-50	3"	3"	3/4"	-	1"	1"
ST-60	3"	3"	3/4"	-	1"	1"
ST-70	4"	4"	3/4"	-	1"	1"
ST-80	4"	4"	3/4"	-	1"	1"
ST-100	4"	4"	1"	-	1"	1"
ST-125	5"	5"	1"	-	2"	1"
ST-150	5"	5"	1"	-	2"	2"
ST-175	5"	5"	1"	-	2"	2"
ST-200	6"	6"	1 1/4"	1 1/4"	2"	2"
ST-225	6"	6"	1 1/4"	1 1/4"	2"	2"
ST-250	8"	8"	1 1/4"	1 1/4"	2"	2"
ST-300	8"	8"	1 1/4"	1 1/4"	2"	2"
ST-350	8"	8"	1 1/4"	1 1/4"	2"	2"
ST-400	8"	8"	2"	2"	4"	2"
ST-500	10"	10"	2"	2"	4"	2"
ST-600	10"	10"	2"	2"	4"	2"
ST-700	10"	10"	2"	2"	4"	2"
ST-800	12"	12"	2"	2"	4"	3"
ST-1000	12"	12"	2"	2"	4"	3"
ST-1250	12"	12"	2 1/2"	2 1/2"	4"	3"
ST-1500	14"	14"	2 1/2"	2 1/2"	4"	3"

- Inlet/Outlet Connections 3" and less are Female Pipe Thread.
- Inlet/Outlet Connections 4" and larger are 125 pound Flange Type.
- Make-up & Quick Fill connections are Male Pipe Thread.
- Overflow & Drain are Female Pipe Thread.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Inlet Water Pressure

Your Amcot ST Series tower will perform best when the proper pump selection is made. When selecting your circulating pump, it is critical to ensure that the tower pump head (or inlet PSI) is incorporated into your pump's total PSI or TDH (Total Dynamic Head) calculation.

Improper pump selection can result in flow problems through your system which can impact performance and capacity of the tower. Inlet water pressure to the tower is considered to be adequate when water is seen coming out of all orifices in the spray arms and when the spray arms are within the recommended rotation speed shown in the chart down below.

Recommended Pump Head/PSI:

MODEL	PUMP HEAD (FT)	INLET PSI	MODEL	PUMP HEAD (FT)	INLET PSI
ST-3	5	2.17	ST-70	6.6	2.86
ST-H-3	5	2.17	ST-80	6.6	2.86
ST-5	5	2.17	ST-100	8.2	3.55
ST-H-5	5	2.17	ST-125	10	4.34
ST-8	5	2.17	ST-150	10	4.34
ST-H-8	5	2.17	ST-175	11	4.77
ST-10	5	2.17	ST-200	11	4.77
ST-H-10	5	2.17	ST-225	11	4.77
ST-15	5.3	2.30	ST-250	12	5.20
ST-H-15	5.3	2.30	ST-300	12	5.20
ST-20-1	5.6	2.43	ST-350	13.2	5.72
ST-H-20-1	5.6	2.43	ST-400	13.2	5.72
ST-20-3	5.6	2.43	ST-500	13.2	5.72
ST-H-20-3	5.6	2.43	ST-600	16.4	7.11
ST-25	5.6	2.43	ST-700	18.2	7.89
ST-30	6	2.60	ST-800	20	8.67
ST-40	6.6	2.86	ST-1000	20	8.67
ST-50	6.6	2.86	ST-1250	21.3	9.23
ST-60	6.6	2.86	ST-1500	23	9.97

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Access Ladder

For Models ST-40 and greater, your cooling tower is furnished with a shipman's type of access ladder for accessing the mechanical section of the tower. The ladder is designed to provide support up to a maximum weight of 250 pounds. For alternate or optional ladders or access platforms, please refer to submittal drawings as these are specific to your project and are not a standard offering on the ST tower.

Fan Guards

The Amcot ST-H-3 thru ST-30 towers are supplied with a one piece combination fan guard and motor bracket. This assembly is attached to the FRP casing panel and can be removed from the tower by simply removing the fasteners.

On models ST-40 and greater, the towers are supplied with segmented or multi-piece fan guard assembly which can be removed to provide access to the inside of the cooling tower. The fan guards are designed in accordance to OSHA standards and you should never operate the tower or remove the fan guard without first shutting down the tower and performing a lockout/tagout procedure on the disconnect box for personal safety.

WARNING: The cooling tower must always be operated with fan guards secured and in place to prevent personal injury, property damage, or both.

Mechanical System – Fan Assembly

ST-H-3 to ST-30

For models ST-H-3 through ST-30 the fan is a preassembled, fixed pitched nylon assembly which is specifically designed for your model cooling tower. The fan is installed directly to the motor and held in place by a fastening nut and lock washer located on the motor shaft.

ST-40 to ST-50

For models ST-40 through ST-50 the fan is a preassembled, fixed pitched nylon hub with aluminum blade assembly which is specifically designed for your model cooling tower. The fan is installed directly to the motor and held in place by a fastening nut and lock washer located on the motor shaft.

ST-60 to ST-1500

For models ST-60 through ST-1500 the fan is an adjustable pitch aluminum assembly which is specifically designed for your model cooling tower. For models ST-70 to ST-200 the fan assembly is installed directly to the motor and held in place by a fastening nut and lock washer located on the motor shaft. For models ST-225 and greater the fan assembly is secured to a V-belt reducer assembly output shaft.

**FANS SHOULD BE INSTALLED SO YOU SEE THE ROTATION ARROWS ON THE BLADES WHEN
LOOKING DOWN THROUGH FAN GUARD.**

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical System – Fan Assembly

Fan Assembly & Balancing

For ST-60 to ST-1500 fan assemblies, since they are adjustable pitch type of fans, it is important that they be properly set and balanced at the job site prior to operating to prevent damage to your equipment.

To set the pitch of the fan blades, you will loosen the U-bolt fastener(s) which secure the blade to the hub. On each fan blade there is a single mark or indicator line cast into the fan blade which when attached to the hub, can be lined up with the proper marking on the hub which indicates proper pitch.

On the hub, you will identify a series of markings. There should be seven (7) total markings. The center marking is longer than the other six (6). This center mark is position “0”.

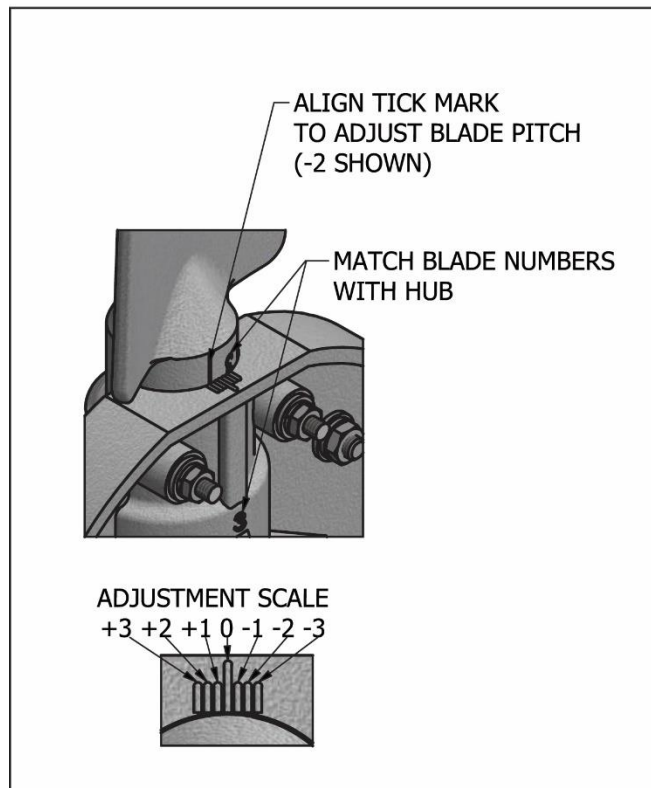
If you rotate the fan blade mark to the right when it is secured to the hub, this will represent the “minus” direction for pitch which increases the blade angle. Increasing blade angle will in turn increase airflow through the tower. It is important to note that increasing air flow will also mean adding additional load to the motor which will cause the amp draw to go up. Keep this in mind, because it is important that the motor amp draw during operation should not exceed the amp draw specified on the motor nameplate.

If you rotate the fan blade mark to the left when it is secured to the hub, this will represent the “plus” pitch which decreases blade angle and will in turn decrease air flow. This in turn lowers amp draw on the motor.

Once the fan blades are installed onto the hub, align the blade mark with the center marking on the hub. This represents a fan pitch of zero (0). A chart on page 32 provides the starting pitch for adjustable pitch fans. Once the blade is in the proper position, tighten the U-bolts to secure the fan blade to the hub. Do not overtighten the fasteners otherwise you will risk damaging the fan.

**Proper Torque on fan blade fasteners is Critical. Refer to the Fan Assembly Chart on page 34.
DO NOT OVERTIGHTEN!**

FAN PITCH MARKINGS



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical System – Fan Assembly

After the blades are in position and secured, this position represents the starting point for fan adjustment. This may or may not be the final position for operation!!

From here, you will need to use an Angle Meter and place on the blade to check blade angle. We recommend using the midpoint along the length of the blade to check this angle. Do this to all of the blades on your assembly. Make sure that the blades are within 1 degree of one another. In doing this, some blades may no longer be at the starting pitch location. That is ok. It is more important that blade angles are matching versus the indicators on the hub/fan assembly at this point. Failure to make sure the blade angles are matching will result in excessive vibration and mechanical failure.

Once this is completed, you will want to test the amp draw on the motor by using a digital clamp meter, or similar test tool. The amp draw reading should be at or below the amperage shown on the motor nameplate for the voltage being used.

Fan Adjustment

If the amp draw is too high (above the nameplate amperage), this means you need to decrease the pitch/angle of the fan blades. If the amp draw is too low (more than 10% below the nameplate amperage), then you need to increase the pitch/angle of the fan blades to increase air flow.

Repeat this process until the amperage is within the proper range and all blades are within 1 degree angle of one another.

Once the tower is in operation, slight motor and fan vibration is normal. However, if you see significant vibrations occurring after following the above steps, this could mean that there is physical damage to the fan assembly. Shutdown the motor, lockout the disconnect switch and visually inspect the fan assembly for damage. If you locate damage, please contact your distributor, representative, or Amcot immediately. It is not recommended that you operate the tower with a damaged fan installed.

If no damage is seen, check the mechanical support assembly for damage and verify all fasteners are tight and secure. If nothing is apparent when doing visual inspection and you have reconfirmed that blade angles are all correct, please contract Amcot immediately.

WARNING: Do not attempt to run your tower with excessive vibrations as this can cause major mechanical or structural failures to the tower and could even pose a risk to your personnel.

FANS SHOULD BE INSTALLED SO YOU SEE THE ROTATION ARROWS ON THE BLADES WHEN LOOKING DOWN THROUGH FAN GUARD.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

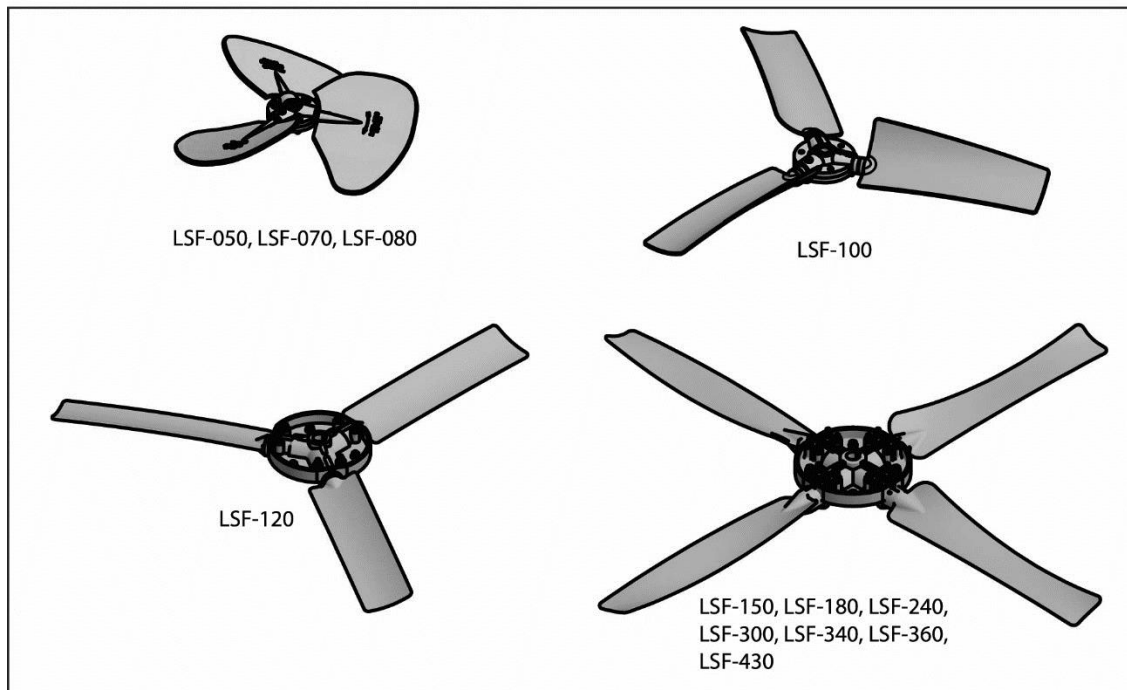
GENERAL MAINTENANCE

Mechanical System – Fan Assembly

The following is the pitch chart for the adjustable fans on models ST-60 to ST-1500.

FAN PITCH FOR ST-60 TO ST-1500			
MODELS	PITCH	MODEL	PITCH
ST-60	0	ST-300	+2
ST-70	0	ST-350	+2
ST-80	+1	ST-400	0
ST-100	+2	ST-500	0
ST-125	+2	ST-600	0
ST-150	-2	ST-700	0
ST-175	-2	ST-800	0
ST-200	-2	ST-1000	0
ST-225	+1	ST-1250	0
ST-250	+1	ST-1500	0

FAN MODELS FOR VISUAL IDENTIFICATION



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical System – Fan Assembly

Fan Assembly Data

MODEL	FAN BLADE REFERENCE NUMBER*	FAN DIAMETER (INCHES)	TORQUE (FT-LBS) RATING (Adjustable Fan Blades)
ST-3	LSF-050	19 1/2"	NA
ST-H-3	LSF-050	19 1/2"	NA
ST-5	LSF-050	19 1/2"	NA
ST-H-5	LSF-050	19 1/2"	NA
ST-8	LSF-050	19 1/2"	NA
ST-H-8	LSF-050	19 1/2"	NA
ST-10	LSF-070	26 3/8"	NA
ST-H-10	LSF-050	19 1/2"	NA
ST-15	LSF-070	26 3/8"	NA
ST-H-15	LSF-070	26 3/8"	NA
ST-20-1	LSF-080	30 1/4"	NA
ST-H-20-1	LSF-070	26 3/8"	NA
ST-20-3	LSF-080	30 1/4"	NA
ST-H-20-3	LSF-070	26 3/8"	NA
ST-25	LSF-080	30 1/4"	NA
ST-30	LSF-080	30 1/4"	NA
ST-40	LSF-100	38 1/4"	NA
ST-50	LSF-100	38 1/4"	NA
ST-60	LSF-120	46"	11
ST-70	LSF-120	46"	11
ST-80	LSF-120	46"	11
ST-100	LSF-150	57 7/8"	11
ST-125	LSF-150	57 7/8"	11
ST-150	LSF-180	68 7/8"	20
ST-175	LSF-180	68 7/8"	20
ST-200	LSF-180	68 7/8"	20
ST-225	LSF-240	94 1/2"	43
ST-250	LSF-240	94 1/2"	43
ST-300	LSF-240	94 1/2"	43
ST-350	LSF-240	94 1/2"	43
ST-400	LSF-300	118 3/8"	43
ST-500	LSF-300	118 3/8"	43
ST-600	LSF-340	133 7/8"	43
ST-700	LSF-340	133 7/8"	43
ST-800	LSF-360	141 3/4"	43
ST-1000	LSF-360	141 3/4"	43
ST-1250	LSF-360	141 3/4"	43
ST-1500	LSF-360	141 3/4"	43

*Fan Blade Reference number is the "LSF-XXX" markings found on the blades/hub.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical System – Motors

Motors – General Information

Amcot fan motors are designed specifically for use on the ST Series cooling tower. Most of the ST Model towers ST-3 to ST-200 are direct drive motors, meaning the fan is directly secured to the motor's output shaft. As a result, these motors use custom output shafts which are specific to Amcot towers/motors.

For ST Models ST-225 and greater, the motor uses a standard output shaft that corresponds with the NEMA frame for that motor HP. The mechanical assembly for these units utilize a housed belt reducer to regulate fan speed in relationship to motor RPM.

All of Amcot's ST Series motor are UL/CSA Recognized and have an IP55 Enclosure which means they are sealed and will not allow water or moisture to reach the internal components. These motors are designed specifically for harsh environments because of the moisture and chemicals that they may be exposed to when in operation.

Many towers are now operated on a variable frequency drive (VFD) or variable speed drive (VSD) control system to regulate motor speed based on cold water temperature. This offers owners the ability to minimize energy use by allowing the motor to run at speeds of less than 100%. Most motors are what is known as inverter duty rated which simply means they can be used in conjunction with such drives and the owners do not risk damaging the motor.

For Models ST-30 to ST-1500 the motors supplied are inverter duty rated which means they can be operated in conjunction with a VFD or VSD driver (sold separately). In doing so however the frequency range for the motor is 20-60 Hz. Frequencies below 20% must be locked out on the VFD/VSD, otherwise you will damage the motor and cause failure to occur.

For models ST-H-3 to ST-25, the fractional horsepower motors used on these units are not inverter duty rated. Therefore it is recommended that you do not use a VFD or VSD on these models.

For models ST-H-3 to ST-25, it is recommended that you would incorporate an alternate form of fan motor control such as a standard on/off temperature controller that monitors cold water basin temperature and cycles the motor on/off based on temperature settings programmed into the device.

Amcot motors are available in a wide range of electrical configurations. However for most markets we have standardized electrical specifications for our motors as follows:

ST-H-3 to ST-H-20-1	Single Phase, 110/220v, 60 Hertz
ST-H-20-3 to ST-1500	Three Phase, 208-230/460v, 60 Hertz

Motors should always be operated at or slightly below (within 10%) of the amp draw specified on the motor nameplate for the indicated voltage. Operation that exceeds nameplate voltage will permanently damage the motor. If Amp draw is too high, check for fill or air obstructions or decrease fan blade angles per fan adjustment instructions on pages 31-33.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MOTOR DATA

MODEL	Motor HP	Phase	Voltage	RPM	Poles	Frame Size	Amp Draw	Type
ST-3	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-H-3	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-5	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-H-5	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-8	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-H-8	1/6	1	110/220	1250	6	71M	2.8/1.4	TENV
ST-10	1/4	1	110/220	1140	6	71M	3.6/1.8	TENV
ST-H-10	1/4	1	110/220	1140	6	71M	3.6/1.8	TENV
ST-15	1/4	1	110/220	1140	6	71M	3.6/1.8	TENV
ST-H-15	1/4	1	110/220	1140	6	71M	3.6/1.8	TENV
ST-20-1	1/2	1	110/220	1110	6	80M	7.1/3.5	TENV
ST-H-20-1	1/2	1	110/220	1110	6	80M	7.1/3.5	TENV
ST-20-3	1/2	3	208-230/460	1170	6	145T	2.8-3.2/1.6	TENV
ST-H-20-3	1/2	3	208-230/460	1170	6	145T	2.8-3.2/1.6	TENV
ST-25	3/4	3	208-230/460	1130	6	145T	3.5-3.2/1.6	TENV
ST-30	1	3	208-230/460	1150	6	145T	4.0-3.6/1.8	TENV
ST-40	1 1/2	3	208-230/460	1130	6	182T	5.1-4.6/2.3	TENV
ST-50	1 1/2	3	208-230/460	1130	6	182T	5.1-4.6/2.3	TENV
ST-60	1 1/2	3	208-230/460	830	8	182T	5.3-5.8/2.9	TENV
ST-70	1 1/2	3	208-230/460	830	8	182T	5.3-5.8/2.9	TENV
ST-80	2	3	208-230/460	820	8	213T	7.3-8.0/4.0	TENV
ST-100	3	3	208-230/460	820	8	215T	11.5-12.8/6.3	TENV
ST-125	3	3	208-230/460	820	8	215T	11.5-12.8/6.3	TENV
ST-150	5	3	208-230/460	680	10	254T	18.0-20.0/10.0	TENV
ST-175	5	3	208-230/460	680	10	254T	18.0-20.0/10.0	TENV
ST-200	5	3	208-230/460	680	10	254T	18.0-20.0/10.0	TENV
ST-225	7 1/2	3	208-230/460	1750	4	213T	23.0-21.0/10.5	TEFC
ST-250	7 1/2	3	208-230/460	1750	4	213T	23.0-21.0/10.5	TEFC
ST-300	10	3	208-230/460	1755	4	215T	28.3-26.8/13.4	TEFC
ST-350	10	3	208-230/460	1755	4	215T	28.3-26.8/13.4	TEFC
ST-400	15	3	208-230/460	1765	4	254T	39.8-36.0/18.0	TEFC
ST-500	15	3	208-230/460	1765	4	254T	39.8-36.0/18.0	TEFC
ST-600	20	3	208-230/460	1765	4	256T	53.3-48.2/24.1	TEFC
ST-700	20	3	208-230/460	1765	4	256T	53.3-48.2/24.1	TEFC
ST-800	30	3	208-230/460	1765	4	180M	77.6-70.2/35.1	TEFC
ST-1000	30	3	208-230/460	1765	4	180M	77.6-70.2/35.1	TEFC
ST-1250	40	3	208-230/460	1775	4	180L	104-94.2/47.1	TEFC
ST-1500	50	3	208-230/460	1775	4	180L	131-118/59.2	TEFC

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical Systems

Motors – Wiring

WARNING: AMCOT RECOMMENDS THAT ALL MOTORS BE CONNECTED BY A LICENSED ELECTRICIAN TO ENSURE PROPER CONNECTION IS MADE TO PREVENT DAMAGE TO THE MOTOR ITSELF AND POSSIBLE INJURY TO THE INSTALLER.

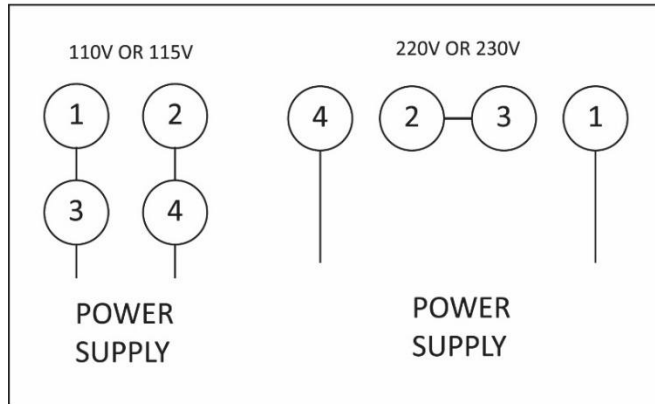
WARNING: DO NOT ATTEMPT TO CONNECT THE MOTOR TO LIVE WIRES. SERIOUS INJURY OR DEATH CAN OCCUR. POWER SHOULD BE TURNED OFF AT THE BREAKER BOX AND ELECTRICAL WIRING SHOULD BE TESTED PRIOR TO INSTALLING TO ENSURE THERE IS NO LIVE WIRES.

When connecting multi-voltage motors to your power supply, it is important to follow the wiring diagram located inside the junction box on the motor. This diagram is a metal sticker attached to the inside of the junction box cover and is visible when the cover is removed. DO NOT REMOVE THE LABEL.

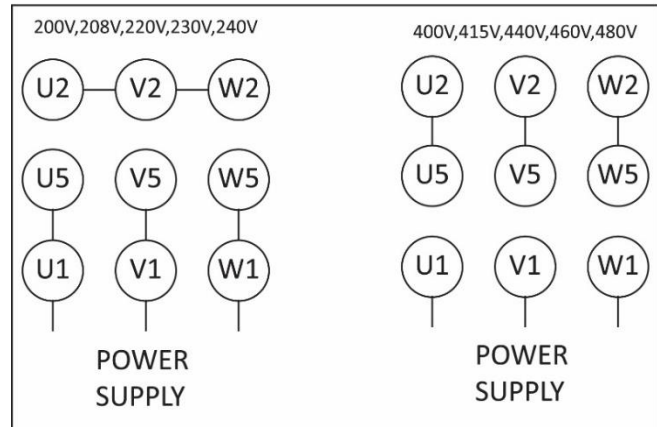
GENERAL MOTOR WIRING DIAGRAMS

(ALWAYS FOLLOW DIAGRAM LOCATED ON THE INSIDE OF THE JUNCTION BOX COVER!)

SINGLE PHASE MOTORS
ST-H-3 TO ST-H-20-1



THREE PHASE MOTORS
ST-H-20-3 TO ST-1500



AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical Systems

V-Belt Reducers

On Amcot ST Series Model towers ST-225 to ST-1500, your mechanical assembly incorporates a housed V-Belt reducer which is designed to provide a speed reduction between the output shaft of your motor and the fan shaft (output shaft of the reducer). This assembly is designed to ensure that the tower's fan speed is regulated so that proper air flow is maintained through the unit.

The drive assembly consists of several components. A diagram and list of those components can be located on Page 39.

The belts utilized in the reducer assembly are polyurethane with reinforcing polyester tension cords embedded in the belt. The belts are designed to operate for up to 10,000 hours. However, as these belts wear, they will stretch. It is important that proper tension is maintained, otherwise this could result in slippage, shortened life of the belts, or loss in power efficiency being transmitted to the fan and impact tower capacity.

Belt are sold as matched sets. If you need to replace a belt, it is ALWAYS recommended to replace all belts at the same time, otherwise you will not be able to achieve proper tension and belts will wear unevenly.

Prior to shipping the reducer with your unit at our facility, Amcot will inspect these components and in many cases we will attach the motor and reducer prior to shipping. When this occurs, Amcot will set the belt tension initially. HOWEVER, it is important to note that belt tension should always be verified at startup and within the first 48 hours of operation. Belts will begin to stretch immediately upon being placed into service. After this, it is recommended that you check belt tension at three (3) intervals of 100 operating ours and then monthly afterwards.

V-BELTS SHOULD BE CHECKED FOR PROPER TENSION:

- AT STARTUP

- AFTER 48 HOURS OF OPERATION

- 3 TIMES, 100 HOURS OF OPERATION INTERVALS

- MONTHLY

If you shut down your tower for longer periods (seasonal), it is recommended that you slacken the tension slightly on the belts to prevent additional stretching from occurring during non-operational periods.

The following pages provide adjustment guidelines for your belt reducer along with a diagram showing the various parts and components along with additional information about your reducer assembly.

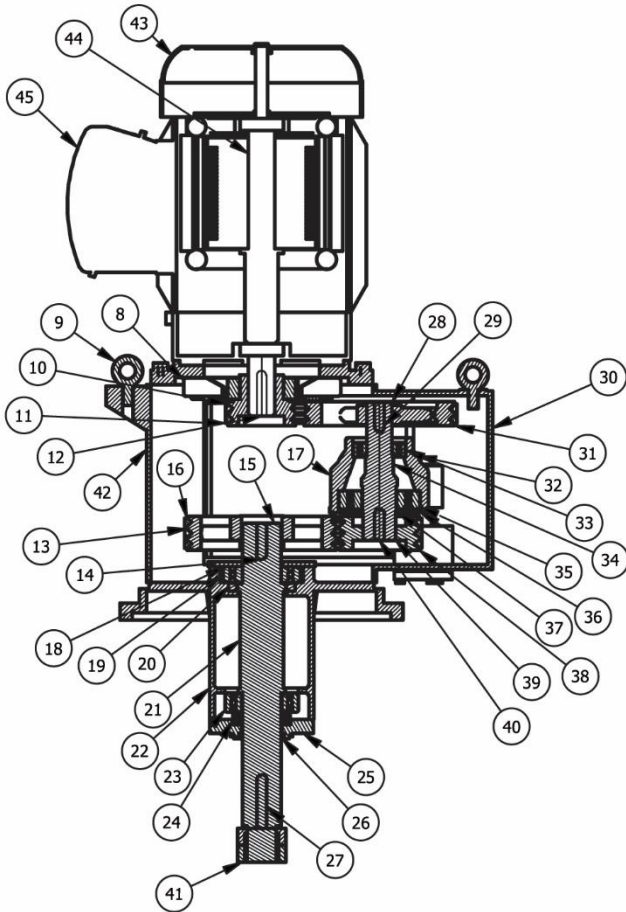
AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

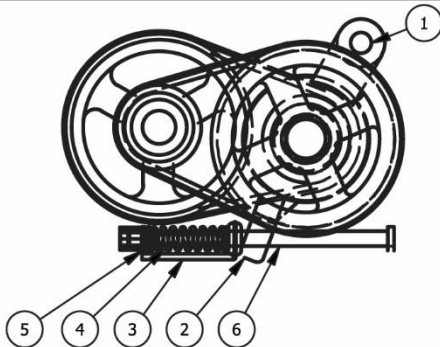
Mechanical Systems

V-BELT DIAGRAMS

MOTOR and V-BELT SPEED REDUCER



V-BELT SPEED REDUCER SECTION



Item No.	Description
1.	Support Pin
2.	Adjusting Lever
3.	Adjusting Gauge
4.	Adjusting Spring
5.	Washer
6.	Adjusting Bolt
7.	Sight Glass
8.	Cooling Fan
9.	Lifting Ring
10.	Pulley #1 (Motor Sheave)
11.	V-Belt (Upper)
12.	Key A
13.	Pulley #4 (Fan Sheave)
14.	Key D
15.	Circlip D
16.	V-Belt (Lower)
17.	Grease Nipple
18.	Housing Cover No. 1
19.	Bearing D
20.	Oil Seal D
21.	Fan Shaft
22.	Housing (Fan Shaft)
23.	Bearing E
24.	Bearing G
25.	Housing Cover #2
26.	Oil Seal E
27.	Key E
28.	Circlip B
29.	Key B
30.	Belt Cover
31.	Pulley #2
32.	Interim Shaft Housing
33.	Bearing B
34.	Intermediate Shaft
35.	Bearing C
36.	Interim Shaft Housing Cover
37.	Oil Seal C
38.	Pulley #3
39.	Circlip C
40.	Key C
41.	Fan Shaft Nut
42.	Belt Case
43.	Motor
44.	Motor Shaft
45.	Terminal Box

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

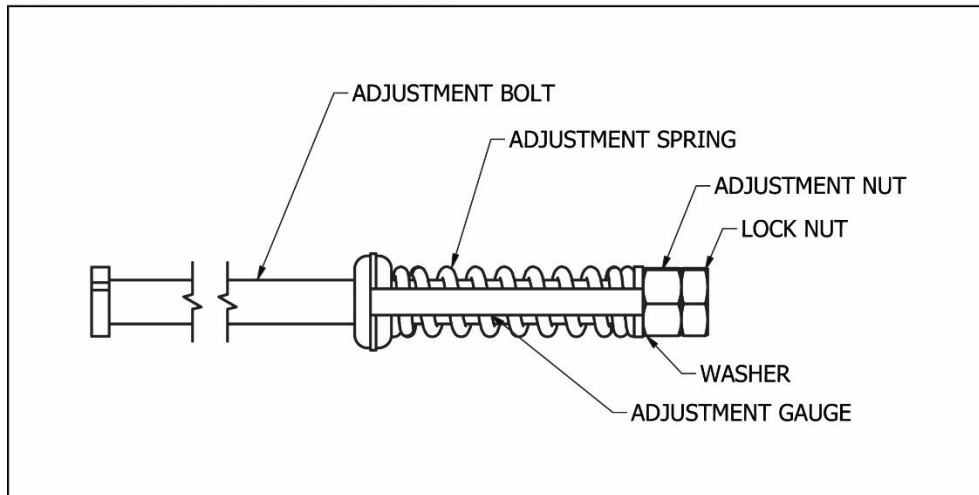
Mechanical Systems

V-Belt Reducers – Belt Tensioning

For belt adjustment, remove the outer cover to your reducer. This will reveal the internal components.

The adjustment assembly consists of an adjusting lever, gauge, spring, washer, and bolt. See below diagram.

V-BELT REDUCER BELT ADJUSTMENT ASSEMBLY



Turning the adjusting nut clockwise will compress the adjusting spring and move the adjusting washer closer to the adjusting gauge. Turning the adjusting nut counter-clockwise will loosen the assembly.

Proper belt tension is when the adjusting washer and end of the adjusting gauge are aligned with one another.

If there is a gap between the adjust washer location and the end of the adjusting gauge, this means that there is too much slack.

If the adjusting washer and end of the adjusting gauge overlap, then the belts are too tight.

The adjusting gauge itself is set by the factory and should never be altered or changed in anyway other than when replacing the entire adjustment assembly.

For seasonal shutdowns, it is recommended that you turn the adjusting nut $\frac{1}{4}$ to $\frac{1}{2}$ turn counterclockwise to slightly loosen the pressure being applied to the belts to prevent them from continuing to stretch during this extended shutdown period.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical Systems

Belt Replacement

Over time even with successful tensioning, your V-belts will require replacing. The following chart is the list of belts associated with the gear reducers for ST Series towers ST-225 to ST-1500.

- 1) Turn off unit and perform lockout/tag-out procedures
- 2) Remove the outer housing panel.
- 3) Loosen the adjusting nut and slide the intermediate shaft assembly towards the middle of the unit until the belts can be removed.
- 4) Clean and inspect the pulleys.
- 5) Install new belts.
- 6) Slide the intermediate shaft towards the outside.
- 7) Tighten the adjusting nut until the adjusting washer is aligned with the end of the adjusting gauge.

The following table provides the belt sizes and quantities for the various V-Belt reducers used on the Amcot ST Series cooling towers.

V-BELT SIZES AND QUANTITIES FOR LBM TYPE REDUCER						
TOWER MODEL	REDUCER MODEL	FAN SPEED	V-BELT SIZE	NUMBER OF BELTS (UPPER)	NUMBER OF BELTS (LOWER)	TOTAL BELTS PER SET
ST-225 & 250	LBM-055C	398	2-11Ms-800	1	-	2
			3-11Ms-800	-	1	
ST-300 & 350	LBM-075	398	2-11Ms-800	-	2	3
			3-11Ms-800	1	-	
ST-400 & 500	LBM-110	342	2-11Ms-1400	1	-	2
			3-11Ms-1400	-	1	
ST-600 & 700	LBM-150	282	2-11Ms-1400	1	1	3
			3-11Ms-1400	-	1	
ST-800 & 1000	LBM-220	265	2-11Ms-1550	-	2	4
			3-11Ms-1550	1	1	
ST-1250 & 1500	LBM-300	260	2-11Ms-1550	2	2	6
			3-11Ms-1550	-	2	

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Mechanical Systems

V-Belt Reducers – Startup

Once the adjusting washer and adjusting gauge are correctly, positioned, reinstall the cover plate to the reducer. Spin the fan assembly by hand a couple of times to ensure it is rotating smoothly.

Once you bring your tower online, check motor amp draw. The amp draw should be at or slightly below the amp stated on the motor's nameplate. If the amp draw is not, it is most likely associated with the fan pitch and we recommend revisiting the fan assembly adjustment procedures on pages 31-33.

Check belt tension after 48 hours of operation! Afterwards, perform 3 additional adjustments at 100 operational hour intervals, and then once per month.

V-Belt Reducers – Grease

There are two (2) grease nipples located on the reducer assembly. One is located inside of the gear reducer housing located on the intermediate shaft assembly. The other is located on the reducer's output shaft. It is recommended that 2-3 pumps of grease be administered to each fitting once per quarter or following seasonal shutdowns.

The recommended grease for Amcot ST Series LBM Reducers is SKF LGMT 3 General Purpose Industrial and Automotive Lubricant

BEARING REPLACEMENT

This procedure should only be performed by an experienced mechanical contractor or mechanic whom has experience in repair of gear drives, transmissions, or engines. The replacement of bearings can be quite extensive and time consuming. Please refer to the V-belt diagram for the location of the various bearings.

Below is a list of the Bearings found on the various Reducers and ST Series models ST-200 to ST-1500.

BEARING TABLE; ST V-BELT REDUCERS; LBM TYPE								
TOWER MODEL	REDUCER MODEL	BEARINGS						
		A	B	C	D	E	F	G
ST-225 & 250	LBM-055C	6308zz	6207z	6309z	6211z	6012z	6306zz	51112
ST-300 & 350	LBM-075	6308zz	6208z	6310z	6211z	6012z	6306zz	51112
ST-400 & 500	LBM-110	6309zz	6208z	6310z	6213z	6213z	6308zz	51113
ST-600 & 700	LBM-150	6309zz	6209z	6313z	NJ313	NJ215	6308zz	51115
ST-800 & 1000	LBM-220	6311zz	6213z	6317z	NJ317	NJ217	6309zz	51117
ST-1250 & 1500	LBM-300	6312zz	6213z	6317z	NJ317	NJ217	6312zz	51117

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Prolonged (Seasonal) Shutdowns

Some customers will not require their cooling towers to be operational during winter months of the year. In these cases, many owners will take their tower out of service for an extended period of time.

In doing so, you should take certain steps before entering these times of shutdown and additional steps when restarting your cooling tower after a prolonged shutdown period.

Prior to shutdown:

- Drain all water from the system
- Loosen the adjusting nut on the V-belt reducer (ST-225 to ST-1500) to provide slack to your V-Belts
- Tarp the top of the unit to prevent debris from entering and settling inside the unit which can be very hard to remove later.
- Ensure all valves are closed and disconnect power to your equipment.

Prior to Restarting:

- Open drain connection.
- Remove tarp if used.
- Wash down the entire unit with water to remove dust and debris
- Retighten V-belts on reducers (ST-225 to ST-1500) per belt tensioning steps on page 39.
- Grease Bearings on reducers (ST-225 to ST-1500) per instructions on Page 41.
- Inspect Float Valve Assembly
- Remove inspection port cover on side of unit and visually inspect the sprinkler assembly.
 - Rotate by hand to make sure it rotates freely.
- Inspect the mechanical assembly for any debris and clean accordingly.
- Inspect the fan assembly and clean to remove scale buildup and inspect for any cracks or damage.
- Fill cooling tower with water. Cycle your system and the flush. Refill system.
- Unit will now be ready to return to service.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE

Water Treatment

General Data

Water treatment is a major part of the general operation of a cooling tower. Operating a cooling tower with no water treatment will lead to scale/calcium accumulation in the cooling tower which can cause blockage to the fill media which in turn will lower performance. In addition, scale can build up and cause damage to your sprinkler head, sprinkler pipes, and other internal components.

Another concern in cooling towers is bacterial or microorganism growth. The cooling tower's internal environment when in operation is warm and very humid which is conducive to biological growth. It is important that this occurrence be minimized through the incorporation of a biocide within your water treatment program. Biological growth of most concern is the presence of Legionella. While Legionella is present in almost all water sources and normally does not pose a threat, there do exist harmful strains that when those harmful strains are breathed in, it can infect individuals with Legionnaire's disease which is a very serious and life threatening respiratory infection.

While Amcot cannot provide specific water treatment guidelines, we recommend that owners consult a local water treatment specialist whom can provide a water treatment program that is customized to your specific water conditions and concerns. Many factors are involved in the development of these programs and those specialists in your local region will be most familiar with the water quality in the area.

When establishing a water treatment program, it is recommended that a water test of your supply water be performed. Also, during operation, you should routinely take samples of both your supply water and the circulating water of the system and test them separately.

Amcot recommends that the following values of various water quality parameters:

WATER ANALYSIS PERMISSIBLE VALUES		
PARAMETER	MAKE-UP WATER	CIRCULATING WATER
pH LEVEL	6-8	6-8
CONDUCTIVITY ($\mu\text{v}/\text{cm}$)	>200 PPM	>500 PPM
TOTAL HARDNESS (CaCO_3)	>50 PPM	>200 PPM
ALKALINITY (CaCO_3)	>50 PPM	>100 PPM
CHLORINE (CL)	>50 PPM	>200 PPM
SULFURIC ACID ION (H_2SO_4)	>50 PPM	>200 PPM
SILICIC ACID (SiO^2)	>30 PPM	>50 PPM
FERRIC (Fe)	>0.3 PPM	>1.0 PPM

AMCOT ST SERIES FIBERGLASS COOLING TOWER

GENERAL MAINTENANCE & CONTROL

Water Treatment

Blowdown/Bleed

As a cooling tower is in operation, your system is constantly evaporating water at a rate of approximately 1% of the circulating water every minute. This is a natural occurrence in the heat removal process.

When this evaporation occurs, the water is removed from your system, but any solids (suspended or dissolved) in the circulating water system remain. As a result, these solids steadily increase in concentration and even with a water treatment program in place, these values will increase to the point that the dissolved solids will precipitate (meaning they will go from a dissolved state to a solid) and cause scale formation on the tower.

The only way to remove these solids from your system is to establish a bleed or blowdown value. Bleed/Blowdown is where you will remove a small volume of circulating water continuously from your system which will help lower the overall concentration to minimize precipitation. Your water treatment specialist will be able to evaluate your water analysis and establish what the proper rate should be when they set up your chemical system.

Non-Chemical Treatment

Non-Chemical water treatment systems have become increasingly popular and many have been successful when properly maintained and serviced. Non-Chemical systems can be used as a substitute over chemical feed systems. It is important to note however, that they are not maintenance free. So you will need to still have monthly servicing for these types of systems. You will also still need to establish and maintain a bleed/blowdown rate on your cooling tower. These systems typically will have a higher initial cost, but long term cost is expected to be greatly reduced because you do not require chemicals.

Solids Filtration

Chemical and Non-Chemical treatment programs help with dissolved or suspended solids and biological organisms (when biocide is added), however they cannot take care of actual particulates or debris such as dirt, silica, sand, or other solids that could enter your system. For these foreign particulates it is important that you never operate the tower without the suction strainer in place.

Solids filtration can be provided by incorporating basket strainers into your piping layout, or through the use of separators or sand filters.

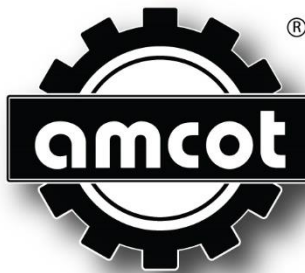
Amcot offers solids filtration systems and inline strainers should you seek to incorporate these into your system. For more information, contact Amcot or your manufacturer's representative, and we will be happy to assist you.

AMCOT ST SERIES FIBERGLASS COOLING TOWER

COOLING TOWER TROUBLESHOOTING GUIDE

SCENARIO	CAUSES	SOLUTIONS
RISE IN COLD WATER TEMPERATURE	1. EXCESS OR LACK OF WATER FLOW	1. CHECK PIPING VALVES AND MAKE SURE DESIGN WATER FLOW RATE IS MAINTAINED.
	2. IRREGULAR AIR FLOW	2. MAKE SURE EQUIPMENT AIR INTAKE IS NOT BEING BLOCKED. IMPROVE VENTILATION.
	3. RECIRCULATION OF AIR EXHAUST	3. TOP OF TOWER IS BELOW AN ADJACENT WALL OR ENCLOSURE WHICH COULD CAUSE WARM AIR TO RECIRCULATE. POTENTIALLY NEED TO ELEVATE TOWER.
	4. IRREGULAR OPERATION OF WATER DISTRIBUTION ASSEMBLY	4. CLEAN SPRINKLER ARMS, CHECK HOLE POSITION, MAKE SURE NO WATER IS COMING OUT OF BASE OF SPRINKLER HEAD.
	5. IMPROPER AIR FLOW	5. CHECK AMP DRAW AND ADJUST FAN PITCH ACCORDING TO MANUAL.
	6. FILL BLOCKAGE	6. REPLACE FILL MEDIA.
WATER DISTRIBUTION SYSTEM	1. SPRINKLER HEAD SEAL HAS FAILED RESULTING IN WATER COMING OUT AT BASE OF SPRINKLER HEAD.	1. CLEAN/REPLACE SPRINKLER HEAD.
	2. SPRAY ARMS NOT ROTATING WITHIN PROPER RANGE FOR UNIT.	2. CLEAN SPRINKLER ARMS, ADJUST SPRINKLER ARM HOLES TO ACHIEVE PROPER ROTATION.
	3. CHECK VALVES EXTERNAL TO TOWER.	3. MAKE SURE VALVES ARE SET PROPERLY.
	4. CHECK PUMP FOR IMPELLER/SEAL PROBLEMS OR IMPROPER SIZING.	4. PERFORM MAINTENANCE ON PUMP.
	5. CHECK STRAINERS/FILTERS	5. PERFORM MAINTENANCE/CLEANING OF BASKET STRAINERS OR FILTERS.
NOISE AND/OR VIBRATION	1. FAN BLADE TIPS IN CONTACT WITH CASING PANEL.	1. ADJUST FAN MOUNTING
	2. IMPROPER MOUNTING OF FAN BLADES	2. ADJUST PITCH ANGLE OF FAN BLADES PER MANUAL INSTRUCTIONS.
	3. LOOSE BOLTS	3. CHECK BOLTS/FASTENERS ON ALL PANELS AND MECHANICAL ASSEMBLY.
	4. V-BELT REDUCER NOISE	4. CHECK BELT TENSION/GREASE BEARINGS
	5. MOTOR NOISE	5. MOTOR BEARING FAILURE, WILL REQUIRE REPLACEMENT
	6. MECHANICAL ASSEMBLY CRACKS	6. CHECK MECHANICAL ASSEMBLY COMPONENTS FOR CRACKS OR RUST/CORROSION. CONTACT AMCOT ASAP.
EXCESS AMP DRAW ON MOTOR	1. FAN PITCH	1. CHECK FAN PITCH AND ADJUST SO AMP DRAW IS AT OR SLIGHTLY BELOW NAMEPLATE AMPERAGE.
	2. AIR RESTRICTIONS	2. POSSIBLE FILL BLOCKAGE WILL CAUSE INCREASE FAN LOADING AND INCREASE AMP DRAW. REPLACE FILL.
	3. LINE VOLTAGE FLUCTUATIONS.	3. CALL AN ELECTRICIAN TO TEST/MONITOR LINE VOLTAGE
	4. MOTOR BEARING FAILURE OCCURRING	4. REPLACE MOTOR.
EXCESS DRIFT LOSS	1. WATER DISTRIBUTION MALFUNCTION	1. CHECK SPRINKLER HEAD AND ARMS FOR PROPER WATER FLOW AND ROTATION SPEED.
	2. FILL BLOCKAGE	2. CHECK FILL MEDIA, CLEAN OR REPLACE.
	3. TOO MUCH CIRCULATING WATER	3. CHECK WATER FLOW TO TOWER AND ADJUST WITH EXTERNAL VALVES.
	4. TOO MUCH AIR FLOW THROUGH UNIT	4. CHECK FAN PITCH, LOWER BLADE ANGLE TO REDUCE AIR FLOW.

WHAT FIBERGLASS COOLING TOWERS ARE ALL ABOUT!



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LAST REVISED: 04/18
DOCUMENT: STOM0418