FXT Cooling Tower

OPERATION & MAINTENANCE MANUAL

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Operation & Maintenance Manual

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1. Recommended Maintenance Intervals

Inspect and clean as necessary [1]	Start-Up	Monthly	Quarterly	Annually	Shutdown
Inspect general condition of the unit [2] and check unit for unusual noise or vibration	✔	✔			
Inspect cold and hot-water basins/Spray nozzles	✔		✔		
Drain basins and piping			✔		✔
Inspect air inlet screens	✔	✔			
Check and adjust water level in basins	✔	✔			
Check operation of make-up valve	✔	✔			
Check and adjust bleed rate	✔	✔			
Inspect tower finish				✔	
Mechanical equipment system [1]	**Start-Up**	**Monthly**	**Quarterly**	**Annually**	**Shutdown**
Check belt condition	✔	✔			
Adjust belt tension [3]	✔		✔		
Lubricate fan shaft bearings [4]	✔		✔		✔
Lubricate motor base adjusting screw	✔		✔		✔
Check drive alignment	✔			✔	
Check motor voltage and current	✔		✔		
Clean fan motor exterior	✔		✔		
Check fan motor for proper rotation	✔				
Check general condition of the fans	✔		✔		
Check fan for uniform pitch			✔		
Check fan for rotation without obstruction	✔		✔		
Check and recoat steel shafts with Rust Veto®	✔		✔		✔
Check vibration cutout switch	✔			✔	

Table 1. Recommended Maintenance Intervals

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[1] Recommended service intervals are the minimum for typical installations. Harsh environmental conditions may dictate more frequent servicing.

[2] When operating in ambient temperatures below freezing, the unit should be inspected more frequently.

[3] Tension on new belts must be readjusted after the first 24 hours of operation and quarterly, thereafter.

[4] Lubricate fan shaft bearings quarterly or every 2,000 hours of operation, whichever occurs first.

2. Equipment Overview

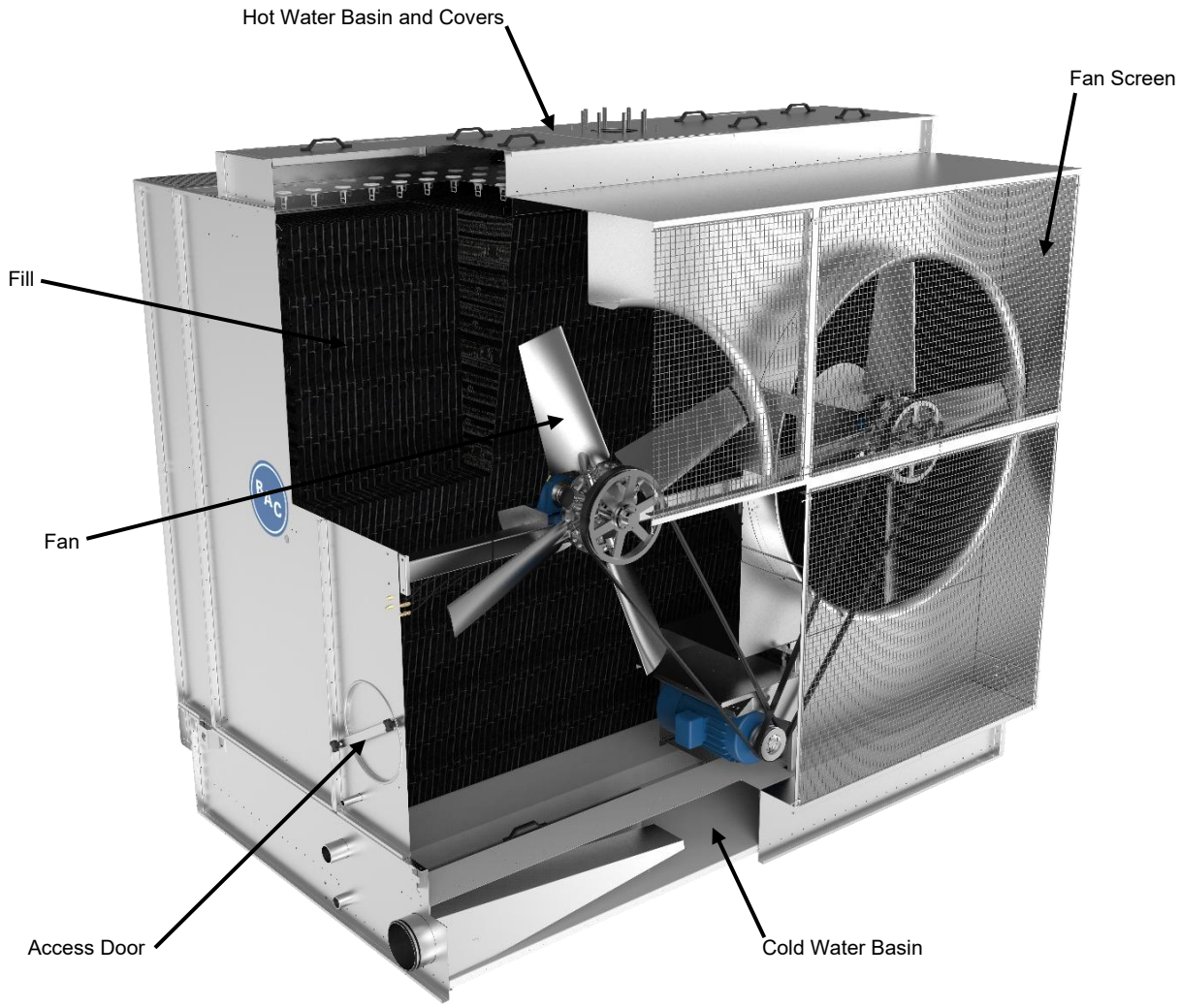

Figure 1. FXT Cooling Tower

3. Safety Warnings

⚠ DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

⚠ DANGER Performing work on an energized unit poses a risk of electrocution, which can cause severe personal injury, death, and/or property damage. Do not perform any service on or near the unit without first ensuring the unit is de-energized and all lockout / tagout procedures have been followed. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.

⚠ DANGER Do not perform any service on or near the fans, motors, or drives or inside the unit without first ensuring that the fans and pumps are disconnected, locked out, and tagged out.

⚠ WARNING Dangerous voltages are present in this equipment. Disconnect the electrical service of the source and tag the circuit out before servicing or replacing components.

⚠ WARNING When access to the top of the unit is desired, the purchaser/end-user is cautioned to wear proper equipment and use appropriate means to comply with applicable safety standards related to working on elevated surfaces.

⚠ WARNING Before performing an adjustment or inspection of the VCOS, make certain that all power has been disconnected and locked in the off position. Moisture inside the switch can lead to switch failure. Care must be taken when replacing the cover on the vibration switch to ensure that the proper watertight seal is obtained.

⚠ CAUTION Openings and/or submerged obstructions may exist in the bottom of the cold-water basin. Use caution when walking inside this equipment.

NOTICE Check to ensure the controls for the fan motor are set to allow a maximum of six on-off cycles per hour to prevent motor overload.

NOTICE When the belts are correctly tensioned, the fan motor should start without producing any chirping or squealing noises.

NOTICE Covering the unit with a clear plastic tarpaulin during storage can trap heat inside the unit and cause damage to the PVC components. If units must be covered during storage, an opaque, reflective tarp should be used.

NOTICE Do not use steam or high pressure water to clean PVC eliminators or materials other than steel.

NOTICE Never use chloride or chlorine based solvents such as bleach or muriatic (hydrochloric) acid to clean stainless steel. It is important to rinse the surface with warm water and wipe with a dry cloth after cleaning.

NOTICE The basin heater is not designed to prevent icing during unit operation.

NOTICE The heater control panel temperature/low level control can only be used with the supplied combination temperature/liquid level sensor probe. Please contact your local BAC representative for replacement parts.

NOTICE Do not operate the system unattended or for extended periods of time during test mode (resistor across terminals T1 and T2). Operation in water temperatures above 45°F (7.2°C) could damage the unit.

NOTICE Do not operate the system unattended or for extended periods of time with terminals G1-G2 jumpered. A low liquid level condition could occur, and the system will not shut off which could result in damage to the heater and unit.

4. General Information

The services required to maintain a piece of evaporative cooling equipment are primarily a function of the quality of the air and water in the locality of the installation:

a. **AIR:** The unit should be located such that unusual quantities of industrial smoke, chemical fumes, salt, or heavy dust do not enter the equipment. Such airborne impurities are carried into the equipment and absorbed by the recirculating water, which can form a corrosive solution.
b. **WATER:** As water evaporates from the equipment, dissolved solids are left behind, which were originally contained in the make-up water. These dissolved solids may be either alkaline or acidic and as they are concentrated in the circulating water, they can cause scaling or accelerated corrosion.

The extent of impurities in the air and water determines the frequency of most maintenance services and governs the extent of water treatment which can vary from a simple continuous bleed and biological control to a sophisticated treatment system. Refer to **“Water Treatment”** on page 28 and **“Biological Control”** on page 30 for more details.

4.1 Warranty

Please refer to the Terms and Conditions in the submittal package applicable to and in effect at the time of the sale/ purchase of these products.

5. Operation and Maintenance

5.1 Initial and Seasonal Start-up

⚠ DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

⚠ DANGER Performing work on an energized unit poses a risk of electrocution, which can cause severe personal injury, death, and/or property damage. Do not perform any service on or near the unit without first ensuring the unit is de-energized and all lockout / tagout procedures have been followed. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.

⚠ DANGER Do not perform any service on or near the fans, motors, or drives or inside the unit without first ensuring that the fans and pumps are disconnected, locked out, and tagged out.

NOTICE Check to ensure the controls for the fan motor are set to allow a maximum of six on-off cycles per hour to prevent motor overload.

The guidelines below are general recommendations. For more detailed information, refer to the appropriate sections of each component.

General

1. If the unit is mounted on vibration isolators or isolation rails (provided by others), refer to the vibration isolation manufacturer's guidelines before loading/unloading weight from the unit.
2. Verify fan and system pump motors are disconnected and locked out.

Cleaning

1. Drain the cold-water basin with the strainer in place.

2. Open the hot-water basin cover and remove any dirt or debris from the hot-water basin.
3. Clean and inspect the fan deck.
4. Remove all dirt and debris from the fan guard.
5. Inspect and clean all spray nozzles.
6. Clean all mechanical components, such as the fan and motor.
7. Flush the cold-water basin interior to remove any accumulated dirt and debris.
8. Remove, clean, and replace the strainer.

Inspection

1. Conduct external inspection of the equipment: check for leaks, corrosion and any structural damage.
2. Conduct internal inspection of the equipment: check for structural or mechanical component damage.
3. Inspect piping and connections.
4. Thoroughly inspect the fan(s) for any mechanical or physical damage.
5. Verify proper fan tip clearance. Refer to **3.a** in **Fan "Inspection & Maintenance"** section on page 19.
6. At seasonal start-up or after prolonged shutdown, check the motor insulation with an insulation tester prior to the motor start-up.
7. Prior to the seasonal start-up, check and adjust the belt tension. At the initial start-up, the belt tension may not require adjustment as drive will be properly tensioned at the factory prior to shipment.
8. Check that the float operated make-up valve is operating freely.

Start-up

1. Prior to seasonal start-up, lubricate the motor base adjusting screw as shown in **Figure 5**, **Figure 6**, **Figure 7** and the fan shaft bearings (refer lubrication details on **"Fan Shaft Bearing"** on page 23). At initial start-up, no bearing lubrication is required since the bearings are factory lubricated prior to shipment. However, if the unit has been idle for more than three months, re-lubricate the bearings as described in **"Prolonged Outdoor Storage"** section on page 14.
2. Apply Rust Veto® to steel shafts, and bushings.
3. Fill the cold-water basin with fresh water to the overflow level via the make-up valve.
4. Set the make-up valve float so water shuts off at the operating level as shown in **Table 2**.

5. Check that the float-operated make-up valve is operating freely. Closely monitor the water level and adjust as necessary during the first 24 hours of operation.
6. Start the system pump.
7. Adjust the system flow rate to the design rate listed on the submittal package. Open the supply valve slowly until the design flow is reached, based on the hot-water basin operating level. See **“Water Distribution System”** on page 25 for details.
8. For multicell arrangements, balance flow between the cells to obtain even water distribution.
9. Adjust the valve (supplied by others) in the tower bleed line to achieve the desired bleed rate by closing or opening the valve.
10. Inspect the nozzles and heat transfer section as described in **2.a** and **2.b** in **“Water Distribution System”** on page 26.
11. Execute one of the following biocide treatment programs while operating the circulating pump and prior to operating the unit fans:
    a. Resume treatment with the biocide that was used prior to shut down. Operate the pump only while maintaining the maximum recommended biocide residual for a sufficient duration (residual and time will vary with the biocide) as recommended by the water treatment supplier. Start the fan only after this treatment period is completed.
    b. Check the pH of the circulating water and, if necessary, adjust it to 7.0 - 7.6 pH. Then, running the pump only, treat the system with sodium hypochlorite to maintain a level of 4 to 5 mg/l (ppm) free chlorine (as Cl2) over a six-hour period. Test kits for measuring the free residual of chlorine are commercially available. Start the fan only after this treatment period is completed.
12. For initial start-up, briefly energize the fan motor(s) and direction of fan rotation. The fan should rotate in the direction of the arrow indicated on the fan cowl.
13. Run the fan in manual mode for several minutes to check for any unusual noise or vibrations.
14. For two-speed motors check that the starter incorporates a 15-second time delay when switching from high to low speed.
15. Once the cooling tower is operating, check the current and voltage of all three phases (legs) of the fan motor with a heat load on the tower under warm ambient conditions. Check the submittal package for the unit conditions. The current must not exceed the nameplate ratings.
16. Check the operation of the vibration cutout switch.

17. For units with the optional electric water level control, see on page 27.

After 24 hours of operation under thermal load, perform the following services:

18. Check the tower for any unusual noise or vibrations.
19. Check operating water level in the hot and cold-water basins.
20. Adjust make-up valve if necessary.
21. Check belt tension and readjust if necessary.
22. Inspect spray nozzles and heat transfer section.

5.2 Extended Shutdown

DANGER Do not perform any service on or near the fans, motors, or drives or inside the unit without first ensuring that the fans and pumps are disconnected, locked out, and tagged out.

Perform following services whenever cooling tower is shut down for more than three days:

1. If the unit is mounted on vibration isolators or isolation rails (by others), refer to the manufacturer's guidelines before loading/unloading weight from the unit.
2. Disconnect, lock-out, and tag-out all fans and pumps.
3. Close the shut-off valve in the make-up water line (supplied by others) and drain cold-water basin and all exposed water piping. Heat trace and insulate all exposed piping.
4. To minimize the risk of biological contamination during shutdown, it is recommended the entire system be drained.
5. Clean all debris, such as leaves and dirt, from the interior and exterior of the unit.
6. Clean and flush the hot and cold-water basins with the basin strainer in place.
7. Leave the cold-water basin drain open so rain and melting snow will drain from the unit.
8. Clean the basin strainer and re-install.
9. Cover the fan intake opening to keep out dirt and debris.
10. Lubricate the fan shaft bearings, motor base, and motor base adjusting screw.
11. Apply Rust Veto® to fan shafts and bushings.
12. Inspect the protective finish on the unit. Clean and refinish if there are signs of rust or finish damage. Refer to **"Corrosion Protection"** on page 28 for more details.
13. Lockout the fan motor starting device in the "OFF" position to ensure personal safety in case of future inspection or service.

5.3 Prolonged Outdoor Storage

DANGER Do not perform any service on or near the fans, motors, or drives or inside the unit without first ensuring that the fans and pumps are disconnected, locked out, and tagged out.

NOTICE Covering the unit with a clear plastic tarpaulin during storage can trap heat inside the unit and cause damage to the PVC components. If units must be covered during storage, an opaque, reflective tarp should be used.

Perform the following services whenever unit will be shut down and stored more than three months. Follow the procedure described in **"Extended Shutdown"** on page 13 if the unit is installed.

Storage Preparation

1. Ensure the cold-water basin is fully drained and the drain is open.
2. For storage prior to installation, all components and accessories that are shipped inside the tower and are not a permanent fixture in the basin, should be removed and stored indoors.
3. Remove and store fan belts (if supplied) at room temperature. Tag belts appropriately for future identification.
4. Apply weather-resistant lubricant or heavy grease such as Anti-Seize (**BAC p/n 160069**) to all exposed threaded or flanged connections and adjustable motor base threaded rods.
5. If the unit is equipped with a control panel, insert desiccant bags into the panel to absorb moisture. Seal the control panel for storage.
6. Spray coat electrical component housings (if supplied) with suitable protective coating, such as Cosmoline® Weathershed and individually cover them with plastic while taking care to leave openings for free air circulation.
7. Hot-water basins should be covered to keep out leaves, debris, etc.
8. Inspect the protective finish on the unit. Clean and refinish if there are signs of rust or finish damage. Refer to **"Corrosion Protection"** on page 28 for more details.

Motor Recommendations

BAC standard motors are designed for storage at ambient temperatures of -20ºF to 104ºF (-28.9ºC to 40ºC). Prolonged periods of exposure above or below these specified conditions could degrade components of the motor and cause malfunction or premature failure.

1. Motors should be removed and stored inside whenever possible. When indoor storage is not possible the motors must be covered with a tarpaulin. Do not use plastic or plastic film. This cover should extend below the motor and be secured; however, it should not tightly wrap the motor. This will allow the captive air space to breathe, minimizing formation of condensation.
2. Care must also be taken to protect the motor from flooding or from harmful chemical vapors.
3. The storage area should be free from ambient vibration. Excessive vibration can cause bearing damage.
4. Precautions should be taken to prevent rodents, snakes, birds, or other small animals from nesting inside the motors. In areas where they are prevalent, precautions must also be taken to prevent insects from gaining access to the interior of the motor.
5. If fan motors are not stored indoors in a controlled environment, some form of heating must be utilized to prevent condensation from accumulating in the motor. Heating should maintain the winding temperature at a minimum of 9ºF (-12.8ºC) above the ambient temperature of the surrounding environment, keeping it from dropping below the dew point where condensation could form inside the motor. If space heaters are supplied, they should be energized. Request the required voltage and transformer capacity from your local BAC representative. A third option is to use an auxiliary heat source and keep the winding warm by either convection or blowing warm air into the motor.
6. Rotate the motor shaft monthly to redistribute bearing grease.

Maintenance Requirements

1. Rotate all fans and motor shafts monthly by hand. Hand-turning will ensure that the shafts and bearings are free and will redistribute grease within the bearings. Keep hands away from pinch points such as bolts and sheaves.
2. Inspect cold-water basin monthly to ensure that the drain is open and remove any leaves or debris that may have accumulated in cold-water basin.

3. Inspect axial fans prior to start-up and at least once annually to ensure that the blades are tight and that there is no obvious corrosion between the hub and the fan blade.
4. Inspect the rust preventative coating on all motor external machined surfaces including shaft extensions monthly. If necessary, re-coat the surfaces with Rust Veto®.

Start-Up Preparation After Prolonged Storage

Keep in mind that start-up procedures after long periods of storage are just as important as pre-shutdown procedures.

1. Motors should be thoroughly inspected and cleaned and restored to pre-storage conditions.
2. Inspect the axial fan(s) prior to start-up to ensure that the blades are tight and that there is no obvious corrosion between the hub and the fan blades. Do not energize the fan(s) if there is obvious corrosion of fan components. Loose fan blades could result in fan failure and possible injury or damage.
3. Reinstall all fan belts, motors, door gaskets, and drain plugs (as applicable), and remove all protective coverings.
4. For units stored prior to installation, conduct rigging procedures as directed in the unit's **Rigging and Assembly Instructions**, available on www.BaltimoreAircoil.com or by Contacting your local BAC representative.
5. Perform an insulation test of motor windings to ensure satisfactory insulation resistance.
6. Conduct the full start-up procedure as stated in the **"Start-Up"** section on page 11. Be especially thorough for cleaning and inspection prior to start-up.

6. Component Maintenance Procedures

6.1 Cold-water Basin

⚠ CAUTION Openings and/or submerged obstructions may exist in the bottom of the cold-water basin. Use caution when walking inside this equipment.

As water that circulates though the cooling tower is cooled, it gets collected in cold-water basin and passes through suction strainer into the system. Cold-water basin is constructed from one of the following materials of construction and the following maintenance applies to all basin materials of construction:

- Galvanized steel
- Thermosetting Hybrid Polymer
- Welded Type 304 stainless steel

Water Levels

Model Number	At Overflow Level (in.)	At Operating Level (in.)
FXT-0506A-X	13-5/8"	6”
FXT-0709B-X	13-5/8"	6”
FXT-0706B-X	13-5/8"	6”
FXT-0712B-X	13-5/8"	6”
FXT-0712C-X	15-5/8"	6”

Table 2. Cold-water basin water levels (measured from inside of cold-water basin floor)

1. Make-up valve controls the water operating level. Refer to **Table 2** for the unit model numbers and their operating levels.
2. The operating water level in the cold-water basin will vary with system thermal load (evaporation rate), the bleed rate employed, and the make-up water supply pressure.
3. Check the operating water level monthly and readjust the float when necessary to maintain the recommended operating level.
4. Consult **“Water Level Control”** on page 26 for information on how to set and maintain the basin operating level.

Inspection and Maintenance

1. Inspect the cold-water basin regularly. Remove trash or debris accumulated in the basin or on the strainer.
2. Quarterly, or more often, if necessary, drain, clean, and flush the entire cold-water basin with fresh water. This will remove the silt and sediment, which normally collects in the basin during operation. If not removed, sediment can become corrosive and cause deterioration of the protective finish of metallic basins.
   a. When flushing the basin, leave strainer in place to prevent the sediment from re-entering the system.
   b. Remove strainer after the basin has been flushed.
   c. Clean and replace the strainer before refilling the basin with fresh water.
3. Adjust the float to maintain the design operating level. See **Table 2** on page 17.

6.2 Fan

⚠ DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

FXT Cooling Tower uses an axial fan(s). Thoroughly inspect the fan(s) for damaged or deteriorated fan blades and replace the fan(s) as required.

Inspection and Maintenance

1. If the unit is already in operation, while the fan(s) is(are) running, check for any unusual noise or vibration.
2. With the fan(s) off and motor disconnected, locked out and tagged out, check general condition of the fan:
   a. Inspect for any loose or missing bolts in the fan shaft bushing, the fan hub, and the fan shaft bearing(s).
   b. Check the fan blades for looseness, first by twisting the blade by hand; and then, by moving the blade tip up and down. There should be no play or slippage.
   c. Inspect each blade for excessive scale build-up that could cause vibration.

d. Check each blade, in the area of shank, for any signs of cracking. If cracking is found, the fan motor should be locked out immediately. Contact your local BAC representative for assistance.

3. With the fan(s) off and the motor disconnected, locked out, and tagged out, check the general condition of the fan:
   a. **Tip Clearance:** Check the clearance between the tip of the blade and the fan cowl. The clearance should be sufficient to prevent the fan blades from contacting the fan cowl during operation. Contact your local BAC representative if there are any concerns.
   b. **Blade Pitch:** Check to ensure that the blades are all at the same pitch. If uncertain, measure the pitch with an inclinometer. All blades should be within -1/2° to 0°.
   c. **Rotation:** Turn the fan by hand to ensure that it moves freely with no rough spots, binding or other malfunctions that could cause vibration or fan motor overload. While rotating the fan, check the blade tracking. All blades should track within a 3/4” to 1” band at any single point around the cowl.
   d. **Direction of Rotation:** On initial start-up, or if the fan motor has been rewired, bump the fan motor and note the direction of rotation. It should rotate in the direction indicated by the arrow on the fan cowl.
   e. **Operation:** On initial start-up, run the fan in the manual position for several minutes and check for any unusual noises or vibration.

6.3 Fan Drive System

DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

NOTICE When the belts are correctly tensioned, the fan motor should start without producing any chirping or squealing noises.

FXT Cooling Towers use V-belts. Belt tension should be checked and adjusted at least quarterly, or as needed.

Inspection and Maintenance

1. These drives require a periodic check of the belt condition and, when necessary, tension adjustment. The recommended service intervals are as follows:
   a. **Initial Start-up:** Servicing is not required prior to initial tower start-up. Drive has been tensioned and aligned at factory.
   b. **Seasonal Start-up:** Readjust the belt tension.
   c. **Operation:** After the first 24 hours of operation, readjust the belt tension on a new unit start-up or installation of a new belt. Thereafter, check the belt condition monthly, and adjust tension as necessary. Readjust tension at least once every 3 months.

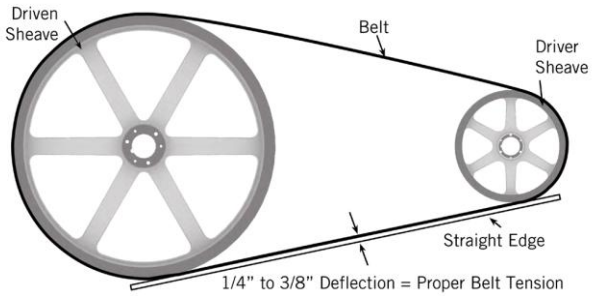

Figure 2. Belt Tension with a Straight Edge

2. Belt tension check:
   a. Place a straight edge along the belt from sheave to sheave as shown in **Figure 2** or use a tape measure as shown in **Figure 3**, to measure belt deflection.
   b. Apply a moderate force by hand (approximately 15 lbs/6.8 kg) evenly across the width of the belt in the center of the span between the sheaves.
   c. There is adequate belt tension if the belt deflects between 1/4" and 3/8" as shown in **Figure 2** and **Figure 3**.

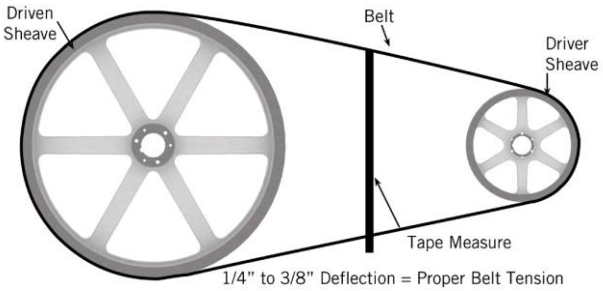

Figure 3. Belt Tension with a Tape Measure

3. Belt tension adjustment (if required):
   a. Loosen the lock nut on the motor base adjusting screw.
   b. Turn the motor base adjusting screw clockwise to tension the belt, or counterclockwise to relieve belt tension. During adjustment of belt tension, rotate the drives several times by hand to evenly distribute the tension throughout the belt.

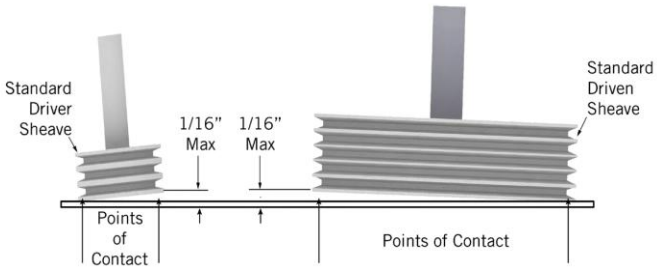

Figure 4. Drive Alignment

c. When belt is properly tensioned, retighten lock nut on the motor base adjusting screw.

4. Drive alignment check and adjustment:
   a. Check drive alignment annually to ensure maximum belt life.
   b. Place a straight edge across the driver and the driven sheaves as shown in **Figure 4**.
   c. The straight edge should contact all four points as shown in **Figure 4** indicating proper drive alignment.
   d. There should be no more than 1/16” deviation from four points of contact.
   e. In case of realignment, loosen the motor sheave and align it with the fan sheave. Allow 1/4” for draw-up as the bushing screw is retightened.

6.4 Fan Motors

⚠ DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

⚠ DANGER Performing work on an energized unit poses a risk of electrocution, which can cause severe personal injury, death, and/or property damage. Do not perform any service on or near the unit without first ensuring the unit is de-energized and all lockout / tagout procedures have been followed. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.

NOTICE Check to ensure the controls for the fan motor are set to allow a maximum of six on-off cycles per hour to prevent motor overload.

FXT Cooling Towers use cooling tower duty, premium efficient, totally enclosed, single-speed, single-winding, reversible ball bearing type motor(s).

Inspection and Maintenance

1. Clean the outside of the motor at least quarterly to ensure proper motor cooling.
2. After prolonged shutdowns, check the motor insulation with an insulation tester prior to restarting the motor.

3. Check the motor voltage and current following start-up and every three months while in operation.

Adjustable Motor Base

Coat the motor base slides and the adjusting screws prior to start-up, every three months while in operation, and following shutdown. Use good quality corrosion inhibiting grease such as one of those recommended for lubricating the fan shaft bearings on page 23.

1. Single Fan Units:
   a. If motor needs to be adjusted for 5X units, use J-Bolts and respective nuts to adjust motor base as required **Figure 5.**
   b. For 7X units, loosen the lock nut first and then adjust the motor base using adjustment screw **Figure 6.**
2. Dual Fan Units: If motor needs to be adjusted for dual fan units, loosen the lock nut first and then adjust the motor base using adjustment screw **Figure 7.**

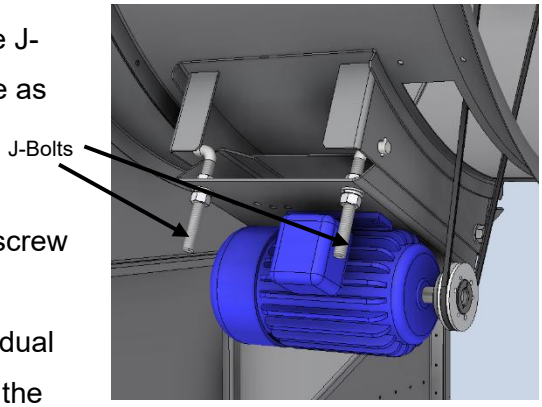

Figure 5. Adjustable Motor Base FXT-0506A-X

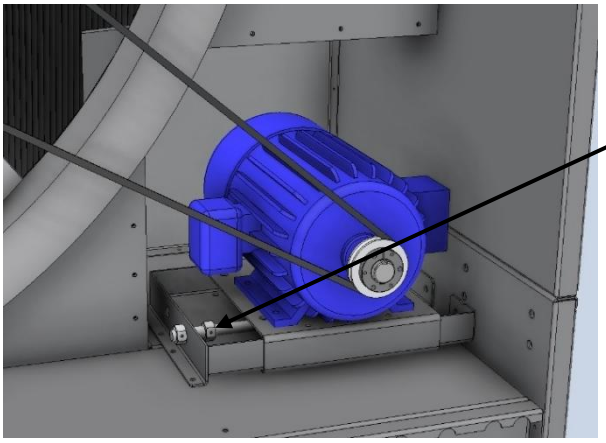

Figure 6. Adjustable Motor Base FXT-0706B-X and FXT-0709B-X

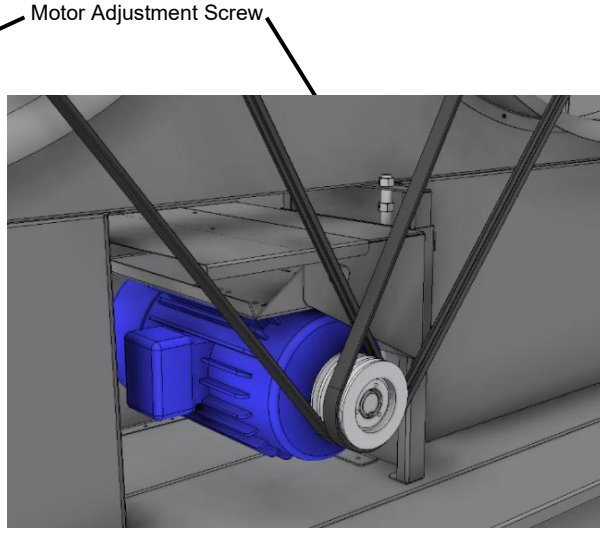

Figure 7. Adjustable Motor Base FXT-0712B-X and FXT-012C-X

6.5 Fan Shaft Bearing

DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

Two pillow block ball bearings support the fan shaft. Each bearing is equipped with a lubrication fitting and locking collar. Lubrication lines are extended to the outside of the unit as standard.

Inspection and Maintenance

1. Lubricate the bearings with only a manual grease gun. Do not use high-pressure grease guns since they may rupture the bearing seals.
2. Lubricate the bearings with only one of the compatible water-resistant grease listed in **Table 3** which are suitable for ambient temperatures ranging from -65ºF (-53.9ºC) to +250ºF (121.1ºC).

NOTE: List of brand names is for identification only and are not exclusive recommendations.

Amoco - Rycon Premium #3	Exxon - Polyrex® EM	Shell - Alvania #3
Chevron - SRI	Exxon - Unirex N™	Shell - Dolium “R”
Citgo - Polyurea MP2™	MobilGrease® - AW2	SKF - LGHP2™
Conoco - Polyurea 2™	Shell - Alvania RL3™	Unocal 76 - Unilife Grease™

Table 3. Brand names for grease

3. Lubricate the bearings as follows:
   a. **Initial Start-up**: Normally, no lubrication is required since the bearings have been lubricated at the factory prior to shipment. However, if the cooling tower has been stored at the job site for more than three months, both bearings should be lubricated with new grease before initial operation. When lubricating, purge the old grease from the bearing by gradually adding grease until a bead of new grease appears at the seal on the underside of the bearing.
   b. **Seasonal Start-up:** Purge both bearings with new grease prior to start-up.
   c. Operation: Purge bearings every 2,000 hours of operation or once every three months, whichever occurs first.

d. **Extended Shutdown:** Purge bearings with new grease prior to any prolonged storage or downtime.

6.6 Locking Collars

DANGER This unit has rotating fan equipment that can cause severe personal injury or death upon contact. Always disconnect, lock out, and tag out all power sources to the fan motor(s) before performing any inspection or maintenance. Adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment to safeguard public from injury and to prevent property damage.

Each eccentric locking collar should be checked quarterly to ensure that the inner bearing race is secured to the fan shaft.

Locking collar can be set using the following procedure (see **Figure 8**):

1. Loosen the set screw.
2. Using a drift pin or centerpunch, tap the collar (in the hole provided) tangentially in the direction of rotation while holding the shaft.
3. Retighten the set screw.

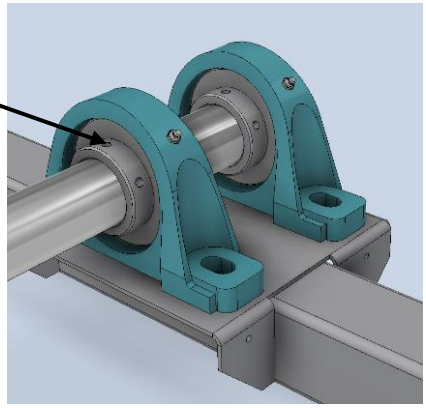

Figure 8. Bearings with locking collar

6.7 Heat Transfer Section

DANGER Performing work on an energized unit poses a risk of electrocution, which can cause severe personal injury, death, and/or property damage. Do not perform any service on or near the unit without first ensuring the unit is de-energized and all lockout / tagout procedures have been followed. Wait five minutes after disconnecting the voltage at all poles before opening the fan and motor assembly.

CAUTION Openings and/or submerged obstructions may exist in the bottom of the cold-water basin. Use caution when walking inside this equipment.

Fill and Drift Eliminator

The FXT Cooling Tower has PVC fill with integral drift eliminators.

Inspection and Maintenance:

1. Inspect and clean the fill with the integral eliminators at least quarterly.
2. The inspection procedure is as follows:
   a. Shut off the fan and the system pump.
   b. Inspect the fill for obstructions, damage and fouling.
3. Remove any obstructions from the fill.
4. Remove any minor fouling chemically. Contact your local water treatment consultant for advice.
5. Major fouling requires cleaning and flushing of the unit.

6.8 Water Distribution System

⚠ WARNING When access to the top of the unit is desired, the purchaser/end-user is cautioned to wear proper equipment and use appropriate means to comply with applicable safety standards related to working on elevated surfaces.

NOTICE Do not use steam or high pressure water to clean PVC eliminators or materials other than steel.

Hot-water Basin

The hot-water basin is located on the top of the unit. The system water enters the cooling tower through the hot-water basin (see **Figure 9**). A series of nozzles, which distribute water over the fill, are located in the hot-water basin. There are three materials of construction for the hot-water basin: galvanized steel, thermosetting hybrid polymer and type 304 stainless steel.

Operating Level

At design flow, the hot-water basin operating level should be between 3/4 and 4-1/2 inches.

Inspection and Maintenance

1. Quarterly, or as required, remove any dirt or debris which may clog the nozzles. Seasonally, clean and flush the hot-water basin with fresh water.

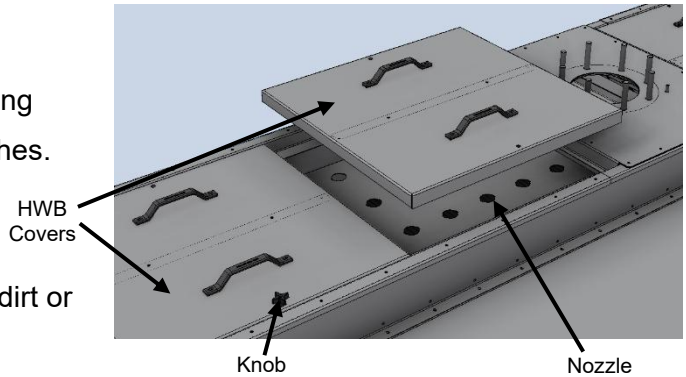

Figure 9. Hot-water basin covers (model FXT-0712C-X shown)

2. Access to the nozzles requires removal of the hot-water basin covers.
   a. If accessing the hot-water basin for the first time, remove the hot-water basin shipping retainers. Discard the hot-water basin shipping retainers (see **Figure 10**).
   b. To remove the covers, turn the knobs to remove the threaded studs (see **Figure 9**). Then, lift the hot-water basin covers vertically by using the attached handles. Once the hot-water basin covers are removed, the nozzles may be cleaned.
3. If access to the nozzles under the pre-distribution box is required, remove the hardware that fastens the pre-distribution box to long hot-water basin panels. Retain the hardware to re-install pre-distribution box.

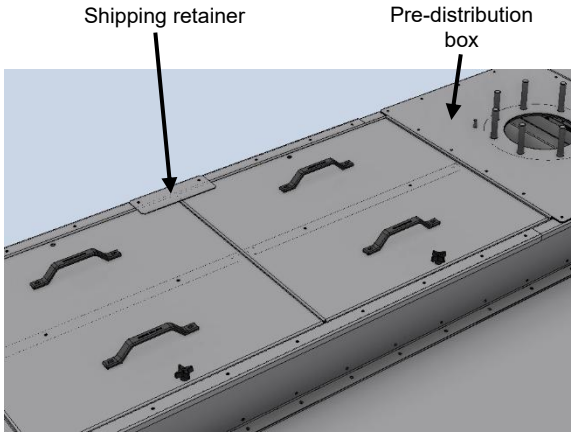

Figure 10. Shipping retainer and pre-distribution box (model FXT-0712C-X shown)

6.9 Water Level Control

There are two types of water level controls used on BAC cooling towers:

- Mechanical make-up valve assembly
- Optional electric water level control package

NOTE: If the unit has been ordered with the optional electric water level control package or is intended for remote sump application, a mechanical water make-up valve will not be provided.

FXT water make-up valve assembly is located on the inlet face of the unit.

Mechanical Make-up Valve Assembly

A float-operated mechanical water make-up assembly is furnished as standard equipment on the cooling tower. The standard make-up assembly consists of a corrosion resistant make-up valve connected to a float arm assembly actuated by a polystyrene-filled plastic float. The float is mounted on an all-thread rod held in place by wing nuts. The cold-water basin operating water level can be adjusted by repositioning the float and all-thread rod using the wing nuts provided.

Inspection and Maintenance

1. Inspect the make-up valve assembly monthly and adjust if necessary.

2. Inspect the valve annually for leakage. Replace the valve seat if necessary.
3. Maintain the make-up water supply pressure between 15 psig and 50 psig for proper operation. BAC recommends a surge protector (provided by others) for pressures over 50 psig.
4. Set the initial basin water level by adjusting the wing nuts, so that the make-up valve is completely closed when the water level in the cold-water basin is at the overflow level.
5. With design thermal load and average water pressure (15 psig to 50 psig) at the valve, above setting will produce operating water levels as stated in **Table 2** on page 17.
6. If the thermal load is less than the design load at the time of unit start-up, the procedure may produce operating levels greater than those shown in **Table 2**. If operating levels are higher than specified, readjust the float in order to attain recommended operating level.
7. Closely monitor the water level in the cold-water basin and adjust the level if necessary, during the first 24 hours of operation.
8. Operating at the recommended water level will ensure that the unit basin contains sufficient water volume to prevent air entrainment in the circulating pump during system start-up and provides sufficient excess basin capacity to accept the total system pull-down volume.

Optional Electric Water Level Control Package

As an option, an electric water level control package is available in lieu of the mechanical make-up assembly. The package consists of a probe-type liquid level control assembly and a slow-closing solenoid valve. Stainless steel electrodes, factory-set at predetermined lengths, extend from an electrode holder into the cold-water basin. For more information, refer to **Electric Water Level Control Operation & Maintenance Manual** available at www.BaltimoreAircoil.com.

Inspection and Maintenance

1. Clean the stainless-steel electrodes periodically to prevent accumulations of scale, corrosion, sludge or biological growth, which could interfere with the electrical circuit.
2. The water level is maintained at the recommended operating level regardless of the system thermal load. Therefore, it is not recommended that the operating level be adjusted.
3. During the start-up of units equipped with the electric water level control package, bypass the control unit in order to fill the unit to the overflow connection.

7. Corrosion Protection

BAC products are constructed of corrosion-resistant materials. The fill is made of a polyvinyl chloride (PVC) which requires no protection against rot, decay, rust or biological attack. Other materials listed below are used in the equipment construction:

- **Galvanized Steel Components:** Inspect the galvanized steel components for blemishes or corrosion. Wire brush and recoat the affected areas with a cold galvanizing compound such as zinc rich compound (ZRC).
- **Thermosetting Hybrid Polymer Components:** Galvanized steel components protected with the thermosetting hybrid polymer can be scratched, scraped or blemished. To touch up these, use a repair kit (**BAC p/n 160133**) available from your local BAC representative.
- **Stainless Steel Components:** Inspect stainless steel components for signs of blemishes or corrosion. See **"Long Term Care of Stainless Steel"** on page 31 for cleaning and care instructions.

7.1 Water Treatment

A proper water treatment program, administered under the supervision of a competent water treatment specialist, is an essential part of routine maintenance to ensure the safe operation and longevity of evaporative cooling equipment, as well as other system components.

In evaporative cooling products, cooling is accomplished by evaporating a small portion of the recirculating water as it flows through the unit. As the water evaporates, the dissolved solids originally present in the water remain behind and if not controlled, the concentration of dissolved solids will increase rapidly. This can lead to corrosion, scale or biological fouling which may negatively affect heat transfer as well as the longevity of system components.

- **Corrosion:** Red rust on steel components and white rust on galvanized surfaces may affect the longevity of system components.
- **Scale Formation:** Scale not only reduces heat transfer and system efficiency but also may lead to under deposit corrosion. If scale is not controlled, it may continue building on critical components such as the fill and severely impact thermal performance.
- **Biological Fouling:** Slime and algae formations may reduce heat transfer, promote corrosion, and harbor pathogens such as Legionella.

NOTE: Since the quality of the ambient air and make-up water varies significantly from jobsite to job site, BAC strongly recommends obtaining the services of a competent water treatment

specialist prior to the initial start-up of the evaporative cooling equipment. Additionally, to protect against the risk of Legionella contamination, never operate the cooling equipment without adequate biological control.

7.2 Corrosion and Scale Control

1. To control corrosion and scale, maintain the water chemistry of the recirculating water within the parameters listed in **Table 4**. The specific measures required vary from system to system and are dependent on the chemistry of the make-up water, the metallurgy of the piping and heat transfer devices exposed to the recirculating water, and the temperatures at which the system will be operating.
2. Bleed/blowdown, continuous flow of a small portion of the recirculating water to a drain, is used to control concentration of dissolved solids. On rare occasions, this may be adequate to control scale and corrosion. More often, chemical scale and corrosion inhibitors are necessary, which raise allowable level of dissolved solids without risk of scale and corrosion
3. In cases where bleed/blowdown alone is being employed for corrosion and scale control without chemical treatment your water treatment specialist may recommend more conservative limits than those shown in **Table 4**.

Property of Water	Recommended Level
pH	6.5 to 9.0 [5]
Hardness as CaCO3	30 to 750 ppm[2] [6]
Alkalinity as CaCO3	500 ppm maximum [6]
Total Dissolved Solids (TDS)	1500 ppm maximum
Conductivity	2400 micromhos [7]
Chlorides	250 ppm maximum Cl (410 ppm maximum as naCl)
Sulfates	250 ppm maximum
Silica	150 ppm maximum

Table 4. Quality guidelines for circulating water

[5] Galvanized steel units require passivation to prevent white rust (refer to “Passivation” on Page 30).

[6] Hardness and alkalinity limits may be exceeded under certain circumstances. Consult your water treatment specialist for recommendations.

[7] The conversion factor used to determine conductivity is 0.625 (TDS = 0.625 x Conductivity).

7.3 Biological Control

The warm, oxygen and nutrient rich environment inside evaporative cooling equipment provides an ideal environment conducive to the growth of algae, slime, and other micro-organisms. Uncontrolled, this can reduce heat transfer, promote corrosion, and promote the growth of potentially harmful organisms such as Legionella.

1. To avoid biological contamination and minimize the risk of Legionella, initiate the biocide treatment program at start-up and continue on a regular basis thereafter in accordance with the treatment supplier's instructions.
2. Bleed/blowdown or chemical treatment used for corrosion and scale control alone is not adequate for control of biological contamination.
3. Introduce solid or granular biocides through a chemical "pot" feeder installed in parallel with system circulating pump. Diluted liquid biocides may be added directly to cold-water basin.
4. If ozone water treatment is used, at no point should concentration exceed 0.5 ppm to avoid corrosion.

7.4 Chemical Treatment Requirements

Chemical treatment programs must meet the following requirements:

1. The chemicals must be compatible with the unit materials of construction as well as other materials used in the system (pipe, heat exchanger, etc.).
2. Chemical scale and corrosion inhibitors, particularly acid (if used), should be introduced into the circulating water through automatic feeders. This should be done at a point in the system where total mixing and dilution occurs before reaching the evaporative cooling equipment. The preferred injection point for chemical scale and corrosion inhibitors is on the discharge side of the system circulating pump(s). These chemicals should not be batch fed directly into unit's cold-water basin or water distribution system, as this can severely damage areas directly contacted.
3. When chlorine is added to the system, free residual chlorine should not exceed 1 ppm, except during start-up if biological shock treatment is utilized during treatment. Refer to **11.a** and **11.b** in **"Start-Up"** section on page 12 for limits, exceeding it may accelerate corrosion.

7.5 Passivation

Passivation is the formation of a protective, passive, carbonate layer on galvanized steel surfaces.

1. To provide maximum protection from corrosion on newly installed units take special measures to passivate galvanized steel surfaces.
2. To ensure proper passivation of the galvanized steel, keep the pH of the circulating water between 7.0 to 8.2 for four to eight weeks after start-up, or until new zinc surfaces turn dull gray in color.
3. If white rust forms on galvanized steel surfaces after the pH is returned to normal service levels, it may be necessary to repeat the passivation process.

NOTE: Stainless steel cold-water basins and basins protected by thermosetting hybrid polymer do not require passivation. However, if the upper structure is galvanized steel, passivation is required on the galvanized area.

7.6 Long Term Care of Stainless Steel

NOTICE Never use chloride or chlorine based solvents such as bleach or muriatic (hydrochloric) acid to clean stainless steel. It is important to rinse the surface with warm water and wipe with a dry cloth after cleaning.

When the percentage of chromium in steel exceeds 10.5%, it is called stainless steel. The chromium in the steel reacts with the oxygen in the air to form a chromium-oxide surface layer, also called the passivation layer. Galvanized steel also has a passivation layer, but it is of less rugged zinc-oxide. It is stainless steel's chromium-oxide passivation layer that provides corrosion resistance in stainless steel.

BAC's Manufacturing Process

BAC takes precautions to prevent cross-contamination, processing galvanized and stainless steel parts separately. Also, stainless steel brushes are used to clean welds on stainless parts and care is taken to avoid scratching parts during processing. Organic cleaners are used to clean the finished product prior to shipping.

Jobsite Considerations

While stainless steel itself does not rust so long as the chromium-oxide surface layer is intact, it is not immune to contamination from its surroundings. Some common sources of surface contamination are:

- Dirt and soil
- Shop oil or grease that may carry other contaminants such as metal chips

- Machining or welding galvanized steel at the jobsite may cause debris to impinge itself into the stainless steel

These contaminants can deposit on the surface and scratch the passivation layer or prevent it from re-forming. They can also get trapped underneath the passivation layer and reduce corrosion resistance.

Recommended Cleaning Procedure

Stainless steel needs to be cleaned regularly to maintain corrosion resistance as well as to maintain the overall aesthetics of the stainless steel.

It is fairly simple to clean most contaminants off the surface of stainless steel. Most dirt and soil can be cleaned with clean cloth, warm water, and mild detergent. For persistent dirt, a little vinegar can be added in the cleaning water. It is important to always rinse the surface with warm water and wipe with dry cloth after any cleaning, whether mild or aggressive.

1. Fingerprints, mild stains or grease spots can be cleaned using organic solvents such as acetone, methyl, or ethyl alcohol, or mineral spirits. Stainless steel wipes or glass cleaners commonly available in stores may also be used.
2. Occasionally the surface of stainless steel can get iron chips or shavings embedded in it from having galvanized steel machined or welded in the vicinity. The iron chips can start to rust, reducing the corrosion resistance of the stainless steel, and stain the surface giving the impression that the stainless steel is rusting. These types of contaminants require more aggressive cleaning. Mild abrasives such as Scotch-Brite™ products may be used where aesthetic considerations are not important followed by solvent cleaning with organic solvents as described above. It is important to rinse the surface with warm water and wipe with dry cloth after cleaning.
3. If the iron chips are not removed with the Scotch-Brite™ Products, electro-chemical cleaning may be required. BAC uses commercially available equipment for electro-chemical cleaning in the field. Contact your local BAC representative for more information or to arrange a service call.

8. Bleed Rate

In evaporative cooling, evaporation of a small portion of the recirculating spray water as it flows through the equipment causes the cooling effect. As this water evaporates, the impurities originally present remain in the recirculating water. The concentration of the dissolved solids increases over time and can reach unacceptable levels.

In addition, airborne impurities are often introduced into the recirculating water. If these impurities and contaminants are not effectively controlled, they can cause scaling, corrosion, and sludge accumulations that reduce heat transfer efficiency and increase system-operating costs, potentially shortening the useful life of the equipment.

The degree to which dissolved solids and other impurities build up in the recirculating water may be defined as the cycles of concentration. Specifically, cycles of concentration equals the ratio of the concentration of dissolved solids (for example - chlorides, sulfates, etc.) in the recirculating water to the concentration of the same material in the make-up water.

NOTE: A proper water treatment program, administered under the supervision of a competent water treatment specialist, is an essential part of routine maintenance to ensure the safe operation and longevity of evaporative cooling equipment, as well as other system components.

- In order to optimize heat transfer efficiency and maximize equipment life, bleed or blowdown a small amount of recirculating water from the system. This controls the cycles of concentration to maintain the quality of the recirculating water within the guidelines given in **Table 4** on page 29.
- Replenish the “bleed” water with fresh make-up water, thereby limiting the build-up of impurities.
- **Bleed/blowdown:**
  1. Accomplish the bleed automatically through a solenoid valve controlled by a conductivity meter. The set point is the water conductivity at the desired cycles of concentration and should be determined by a competent water treatment expert.
  2. Alternatively, use a bleed line with a valve to continuously bleed from the system. In this arrangement, adjust the rate of bleed using the valve in the bleed line. Measure the rate of bleed by filling a container of known volume while noting the duration. Check the bleed rate and water quality periodically to ensure that adequate control of the water quality is being maintained.

NOTE: The solenoid valve and conductivity meter must be supplied by others. Evaporation is proportional to the load and will vary seasonally. BAC recommends the use of a conductivity meter to maximize water conservation.

Bleed Line Calculations

Bleed rate is determined by the following formula:

Bleed Rate, $B = \frac{E}{(n-1)}$

Where: B = Bleed Rate (USGPM)

E = Evaporation Rate (USGPM) = $\mathrm{Q\ (USGPM)} * \mathrm{R\ (°F)} * 0.001$

Q = Process Fluid Flow Rate (USGPM)

R = Range

n = Number of Cycles of Concentration = CR/CM

CR = Concentration in Recirculating Water

CM = Concentration in Make-up Water

The following example illustrates a bleed rate calculation:

Given:

- Water Flow Rate = 800 USGPM
- Maximum Allowable Chloride Concentration = 250 ppm
- Concentration of Chlorides in Make-up Water = 45 ppm
- Range = 10°F

Find: Bleed Rate

Solution:

$$\mathrm{E} = \mathrm{Q} * \mathrm{R} * 0.001 = 800 * 10 * 0.001 = 8\ \mathrm{USGPM}$$

$$\mathrm{n} = \frac{\mathrm{CR}}{\mathrm{CM}} = \frac{250\ \mathrm{ppm}}{45\ \mathrm{ppm}} = 5.55$$

$$\mathrm{B} = \frac{\mathrm{E}}{(\mathrm{n}-1)} = \frac{8\ \mathrm{GPM}}{(5.55-1)} = 1.75\ \mathrm{USGPM}$$

Therefore, in this case we must bleed approximately 1.75 USGPM to limit the concentration of impurities.

This example focuses on a single parameter (chloride concentration) of water only. The bleed rate required for a system (when evaluating more than one parameter) is the highest bleed rate required to keep all parameters within recommended limits.

NOTE: The evaporation rate (E) can be determined by any one of the following methods:

- Evaporation rate is approximately 2 USGPM per 1 million BTUH of heat rejection.
- Evaporation rate is approximately 3 USGPM per 100 tons of refrigeration.
- Evaporation rate, E = $\mathrm{Q\ (USGPM)} * \mathrm{R\ (°F)} * 0.001$

9. Cold Weather Operation

9.1 Inspection and Maintenance

BAC products can be operated at subfreezing ambient temperatures provided proper operating methods are established and diligently followed.

1. Carry out frequent visual inspections and routine maintenance services during operation in subfreezing weather.
2. Ensure all controls for capacity and freeze protection are set properly and functioning normally.
3. Prevent excessively high water levels and possible overflow of cold-water basin due to over pumping, clogged strainers, or make-up valve malfunction.
4. Some unit icing can be expected in very cold weather. Usually, this will not affect the operation of the unit. Resolve any icing conditions that may damage the unit or the supports, impair the system performance or create a safety hazard.

9.2 Fan Section Icing Protection

There are two basic operational methods which can be used to provide the system's required cooling: temperature setting and fan control. The method of control employed on a given application depends upon the climatic extremes which are expected, the variations in heat load that will be encountered, and the compatibility of the control system with other portions of the installation.

In subfreezing ambient temperatures, effective icing control may require a combination of these two methods. Operate each unit with the highest thermal load it can handle, rather than evenly dividing the total heat load across all cells. During prolonged cold weather periods, bypass the idle units and drain the basins.

Temperature Setting

Low leaving fluid temperatures promote ice formation. During operation in subfreezing ambient temperatures, maintain the leaving fluid temperature as high as possible. Ensure the unit operates with the maximum possible heat load. The recommended minimum process fluid temperature is 43° F (6.1° C).

Fan Control

The following are fan control methods to reduce icing:

- **Variable Frequency Drives:** Cycle fans down to 100% speed for 5 minutes, every 15 to 20 minutes for each cell.
- **Multi-Speed Motors:** If the unit is equipped with 2-speed motors, operation at a lower speed may be sufficient to prevent icing. The motor starter should include a minimum 15 second time delay when switching from high to low speed. If icing is observed, use the fan cycling method.
- **Fan Cycling:** Set the controls to allow a maximum of six on-off cycles per hour. Cycle the fan off for five minutes every 15 to 20 minutes for each cell. If ice continues to build on the air intake, decrease the on-time. Observe the air intake of the unit at least every four to eight hours.
- **Fan Reversal:** This procedure should be used only after the other methods of fan control fail. If utilized, the fans should be run in reverse for no longer than 20 minutes at no more than 20% speed, and the cooling tower should be observed during this time. Before returning to normal operation, visually inspect the fan blades for ice formation.

NOTE: Modulating the water flow rate to the unit is NOT a recommended method of controlling cooling capacity.

9.3 Basin Water Freeze Protection

Cold-water Basin Protection

The basin water could freeze when the unit is shut down and exposed to subfreezing ambient temperatures.

- **Remote Sump:** The ideal method of protection is a remote sump located in a heated indoor area. When the circulating pump stops, the water in the connecting piping will drain by gravity to this indoor sump.
- **Basin Heaters:** On applications without a remote sump, heat must be provided to cold-water basin. Electrical immersion heaters, steam coils or hot-water coils can provide the required function. Contact your local BAC representative for details.
- **Electric Water Level Control:** An electric water level control will maintain the proper water level regardless of the thermal load or variations in make-up water supply pressure. The

two-position, slow closing solenoid valve provided with the BAC electric water level control package also minimizes valve freezing problems (see on page 27).

- **Heat Tracing:** Heat trace and insulate all exposed water piping including pump piping below the overflow level and make-up water lines with electrical heater tape.

NOTE: For remote sump applications, the water level in the basin of the equipment is a function of the design flow rate, the quantity, size and location of the remote sump connection and the pipe design between the cooling tower and the remote sump. Units installed on remote sump applications are supplied without a make-up connection.

10. Operation Considerations for Optional Accessories

NOTICE The basin heater is not designed to prevent icing during unit operation.

10.1 Basin Heater

One or more electric immersion heaters prevent cold-water basin from completely freezing over and damaging the unit during shutdown or standby. The heaters are sized for the specific unit. The heating element has an enclosure that is suitable for outdoor use. Inspect the basin heater annually, prior to the risk of reaching freezing operating conditions.

Figure 11. Basin heater

Operation

Ensure that the heating element is completely submerged before energizing the main disconnect. For installations that have a BAC controls enclosure, please consult the submittal package provided with the unit and contact your local BAC representative for support. For installations that use a standalone BAC heater control panel, see the section below.

10.2 Standalone BAC Heater Control Panel

WARNING Dangerous voltages are present in this equipment. Disconnect the electrical service of the source and tag the circuit out before servicing or replacing components.

NOTICE The heater control panel temperature/low level control can only be used with the supplied combination temperature/liquid level sensor probe. Please contact your local BAC representative for replacement parts.

The heater control system consists of a heater control panel and a combination temperature/water level sensor. Stainless steel sensor probe with 1/2” NPT mounting fitting has an on/off relay output that de-energizes the heaters whenever the basin water temperature is

above 45°F (7.2°C), or whenever the sensor probe is not fully submersed. The control panel enclosure is suitable for outdoor use.

The control system utilizes a combination temperature/low water level control sensor, which is powered by a transformer in the control panel. When the sensor provides a signal to the control panel, the panel sends a control voltage to the magnetic contactors. When energized, the magnetic contactors supply line voltage to the heaters. Annually inspect the heater control system prior to the risk of reaching freezing operating conditions.

Operation

Ensure that the element is completely submerged before energizing the main disconnect. The combination temperature/low level control is preset to energize the heater at 40°F (4.5°C) but will not energize if the water level is too low or if the water temperature is above 45°F (7.2°C).

Testing the heater when water temperatures are above 45°F (7.2°C):

NOTICE Do not operate the system unattended or for extended periods of time during test mode (resistor across terminals T1 and T2). Operation in water temperatures above 45°F (7.2°C) could damage the unit.

- Disconnect the heater control panel and tag out the circuit.
- Remove the heater control panel cover.
- Remove the sensor wires connected to terminals T1 and T2 on the combination temperature/low level control and isolate them.
- Install the 1.5K ohm test resistor supplied with the heater control panel (in bag on outside of cover) across terminals T1 and T2.
- Install the heater control panel cover.
- Energize the system and listen for the contactor closing.
- After operation, de-energize circuit, disconnect heater control panel, and tag out circuit.
- Remove the resistor and place it back in the storage bag. Check all connections, reconnect sensor wires per the wiring diagram to terminals T1 and T2, replace the cover, and place the system back in service.

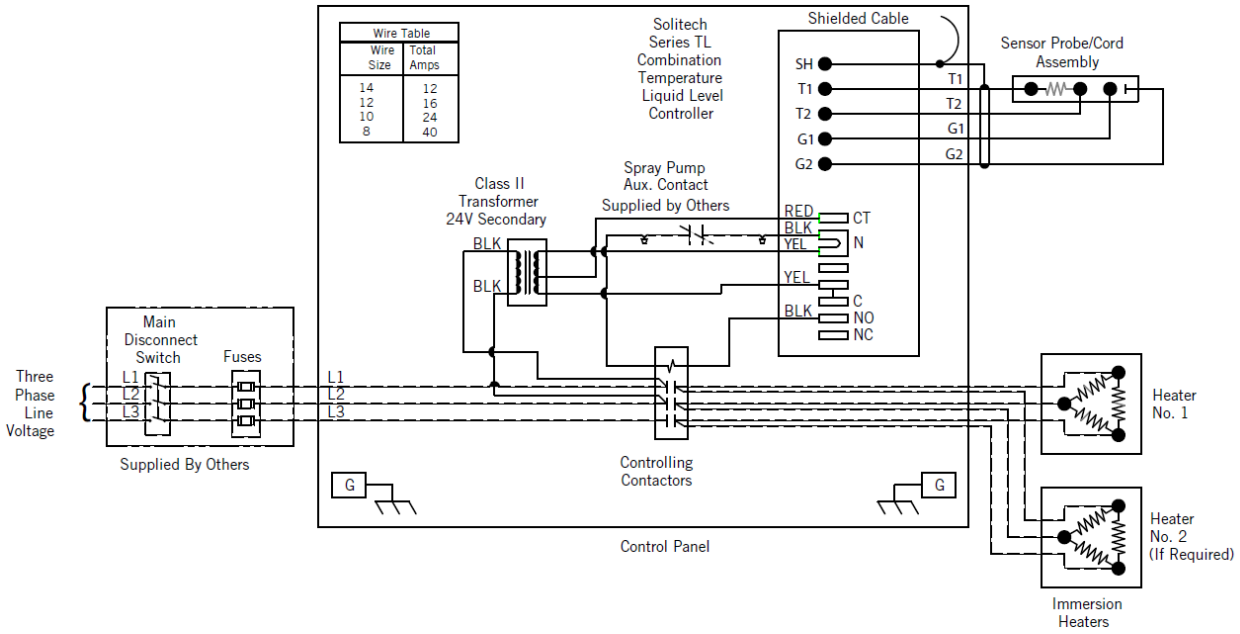

Figure 12. Example wiring diagram for standalone bac heater control panel (refer to submittal drawing for specific wiring diagram)

Operation when the sensor probe is encased in ice:

NOTICE Do not operate the system unattended or for extended periods of time with terminals G1-G2 jumpered. A low liquid level condition could occur, and the system will not shut off which could result in damage to the heater and unit.

- Disconnect the heater control panel and tag out the circuit.
- Remove the heater control panel cover.
- Install a jumper wire across terminals G1 and G2 on the combination temperature/low level control circuit board.
- Install the heater control panel cover.
- Energize the system and listen for the contactor closing.
- Operate the system until the ice is melted around the probe.
- After operation, de-energize circuit, disconnect heater control panel, and tag out circuit.
- Remove the jumper, check all connections, replace the cover, and place the system back in service.

NOTE: **Figure 12** is superseded by any drawing supplied with the panel by the manufacturer.

10.3 Vibration Cutout Switch (VCOS)

The Mechanical Vibration Cutout Switch and the Optional Electronic Vibration Cutout Switch should be tested and field adjusted at start-up and yearly thereafter.

Mechanical Vibration Cutout Switch

Set Point Adjustment When Installed:

1. For safety, turn off, then lock and tag-out the electrical supply to the fan motor(s).
2. Turn adjustment screw counterclockwise 1/8 turn at a time until you hear the control trip.
3. Once tripped, rotate adjustment screw 1/4 turn clockwise. Push in the manual reset button.
4. Start up the fan(s) to determine if the start-up will cause the cut-out switch to trip.
5. If the VCOS does not trip, start and stop the fan two more times. If the VCOS still does not trip, then calibration is complete.
6. If the VCOS trips, repeat steps 1 through 5 until calibration is complete.

Electrical Reset and Start-up Lockout (Optional):

1. If rated voltage is continuously applied to the reset circuit at unit start-up, the reset solenoid energizes for a fixed time interval (approximately 30 sec), after which time the solenoid is automatically de-energized by the thermistor. This provides a trip lockout during machine start-up roughness.
2. The voltage must be removed from the reset circuit when the machine is stopped to allow the thermistor to cool off.
3. The switch mechanism can be reset electrically by a momentary application of the reset voltage, or it can be reset manually.

Electronic Vibration Cutout Switch

⚠ WARNING Before performing an adjustment or inspection of the VCOS, make certain that all power has been disconnected and locked in the off position. Moisture inside the switch can lead to switch failure. Care must be taken when replacing the cover on the vibration switch to ensure that the proper watertight seal is obtained.

Two models of electronic vibration cutout switches are available. The single set point model contains one trip limit for shutdown. The dual set point model contains two independent trip

limits: one for alarm and one for shutdown. The shutdown set-point is factory set at 0.45 in/sec. Additional details can be found in the submittal packet.

Testing

- The test position sets in the minimum set point so that any vibration will cause a trip condition.
- The light will come on immediately, and the trip will occur after the duration of the time delay, proving the complete system is operational.
- If test position is maintained for less than the duration of the time delay, the trip will not occur, thus permitting the system test without shutdown.

Calibration

- A light adjacent to the set point control comes on the instant the measured vibration level exceeds the set point.
- The unit can be periodically calibrated by turning the set point control down until the light comes on. This setting is then compared with the vibration measured with a portable vibration meter, thus providing a calibration check of the unit.
- If the trip setting is maintained, trip will occur after the duration of the time delay.

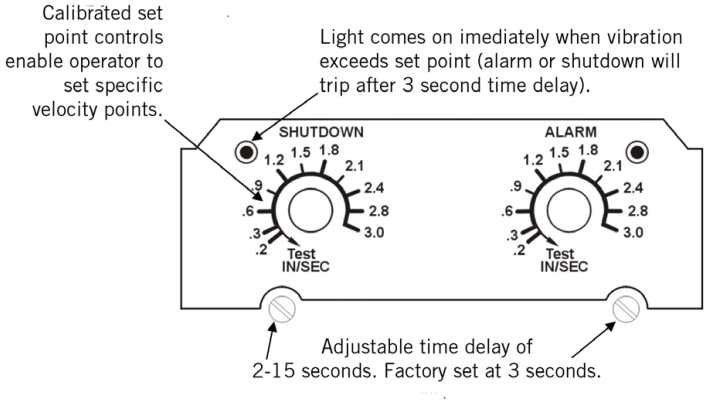

Figure 13. Electronic VCOS with alarm contact is shown

Remote Reset: Connection between terminals 6 and 7 latches electromechanical relay output in alarm state after set point is exceeded. Opening the connection will reset the output to non-alarm state.

FXT Cooling Tower

OPERATION & MAINTENANCE MANUAL

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