

FXT Cooling Tower

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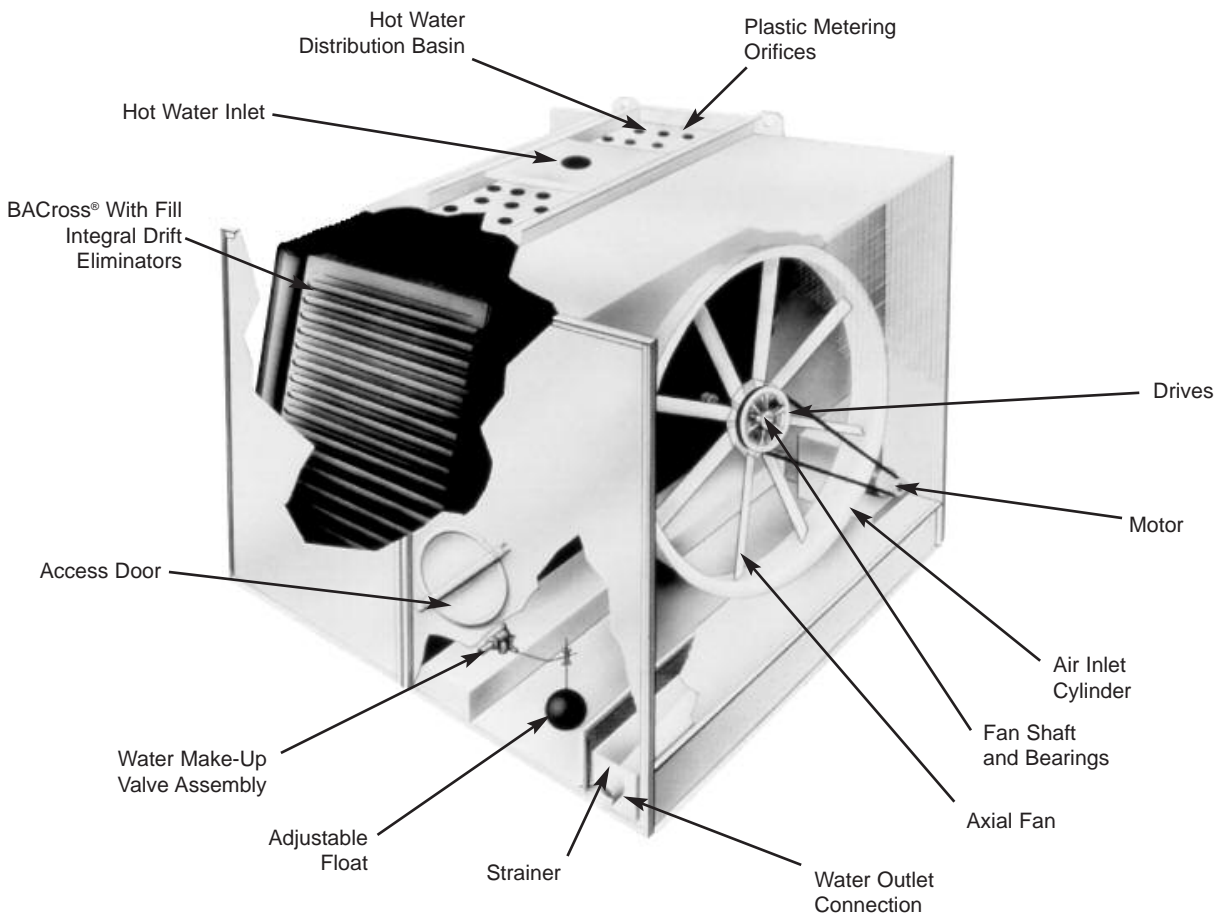


Figure 1 - FXT Cooling Tower

Table 1: Recommended Maintenance Services^[1]

Type Service	Start-Up	Monthly	Quarterly	Annually	Shutdown
Inspect and clean as necessary:					
Inspect general condition of the tower ^[2] and check unit for unusual noise or vibration	X	X			
Inspect cold and hot water basins/Spray nozzles	X		X		
Drain basins and piping			X		X
Inspect air inlet louvers	X	X			
Check and adjust water level in basins	X	X			
Check operation of make-up valve	X	X			
Check and adjust bleed rate	X	X			
Inspect tower finish				X	
Mechanical equipment system:					
Check belt condition	X	X			
Adjust belt tension ^[3]	X		X		
Lubricate fan shaft bearings	X		X		X
Lubricate motor base adjusting screw	X		X		X
Check drive alignment				X	
Check motor voltage and current	X		X		X
Clean fan motor exterior	X		X		
Check fan motor for proper rotation	X				
Check general condition of the fan			X		
Check fan for uniform pitch			X		
Check fan for rotation without obstruction	X		X		

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

NOTES:

1. Recommended service intervals are for typical installations. Different environmental conditions may dictate more frequent servicing.
2. When operating in ambient temperatures below freezing, the cooling tower should be inspected more frequently. Refer to “Cold Weather Operation” on Page N102 for more details.
3. Tension on new belts must be readjusted after the first 24 hours of operation and quarterly, thereafter.

Operation and Maintenance

Initial and Seasonal Start-up

General

- If the unit is mounted on vibration isolators or isolation rails, refer to the vibration isolation manufacturer’s guidelines before loading/unloading weight from the unit.
- Verify fan and system pump motors are disconnected and locked out.
- Conduct external inspection of the equipment. Check for leaks, corrosion, and any structural damage.
- Inspect piping and connections.

Cleaning

- Drain the cold water basin with the strainer in place.
- Open the hot water basin cover and remove any dirt or debris from the hot water basin.
- Clean and inspect the fan deck.
- Remove all dirt and debris from the fan guard.
- Clean all mechanical components, such as the fan and motor.
- Flush the cold water basin interior to remove any accumulated dirt and debris.
- Remove, clean, and replace the strainer.





Inspection

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

- Thoroughly inspect the fan(s) for any mechanical or physical damage.
- At seasonal start-up or after prolonged shutdown, check the motor insulation with an insulation tester prior to the motor start-up.
- 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 the drive will be properly tensioned at the factory prior to shipment.
- Start the fan motor(s) and check for proper fan rotation. The fan should rotate in the direction of the arrow indicated on the fan cowl.
- Run the fan in manual mode for several minutes to check for any unusual noise or vibrations.
- For two speed motors check that the starter incorporates a 15 second time delay when switching from high to low speed.
- Check that the float operated make-up valve is operating freely.

WARNING: Check to ensure the controls for the fan motor are set to allow a maximum of 6 on-off cycles per hour.

Start-up

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

- Prior to seasonal start-up, lubricate the motor base adjusting screw (see Figures 2, 6, and 7) and the fan shaft bearings. At initial start-up, no bearing lubrication is required since the bearings are factory lubricated prior to shipment.
- Fill the cold water basin with fresh water to the overflow level via the make-up valve.
 - Water treatment for new installations: Initiate the biocide water treatment program at this time. Refer to "Biological Control" on Page N106 for more details.
 - Water treatment for seasonal start-up or after a shutdown period in excess of 3 days: Resume the biocide treatment program and administer a shock treatment of appropriate biocides prior to operating the fans. This will eliminate accumulated biological contaminants. Refer to "Biological Control" on Page N106 for more details.
- Set the make-up valve float so the water shuts off at the overflow level.
- Start the system pump.
- Adjust the system flow rate to the design rate. Open the supply valve slowly until the design flow is reached, based on the hot basin water level. See "Water Distribution System" on Page N36 for details.
- For multicell arrangements, balance flow between the cells to obtain even water distribution.
- Open the valve in the tower bleed line, and adjust the bleed by closing or opening the valve.
- 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. The current must not exceed the nameplate ratings.
- Check the operation of the vibration cutout switch.



Figure 2 - Adjustable Motor Base FXT Models 26-68

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

- Check the tower for any unusual noise or vibrations.
- Check the operating water level in the hot and cold water basins.
- Adjust the balancing valves if necessary.
- Adjust make-up valve if necessary.
- Check the belt tension and readjust if necessary.

Extended Shutdown

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

Perform the following services whenever the cooling tower is shutdown in excess of 3 days:

- If the unit is mounted on vibration isolators or isolation rails, refer to the manufacturer's guidelines before loading/unloading weight from the unit.
- Drain the cold water basin and all the piping that will be exposed to freezing temperatures. Heat trace and insulate all exposed piping.
- Clean all debris, such as leaves and dirt, from the interior and exterior of the unit.
- Clean and flush the hot and cold water basins with the basin strainer in place.
- Leave the cold water basin drain open so rain and melting snow will drain from the tower.
- Clean the basin strainer and re-install.
- Cover the fan intake opening to keep out dirt and debris.
- Lubricate the fan shaft bearings, motor base, and motor base adjusting screw.
- Close the shut off valve in the make-up water line (supplied by others), and drain all exposed make-up water piping. Heat trace and insulate all exposed piping.
- Inspect the protective finish on the unit. Clean and refinish as required. Refer to "Corrosion Protection" on Page N104 for more details.
- Secure the fan motor starting device in the "OFF" position to ensure personal safety in case of future inspection or service.

Detailed Component Maintenance Procedures

Cold Water Basin

As water circulating through the cooling tower is cooled, it collects in the cold water basin and passes through the suction strainer into the system. The 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
- Type 304 stainless steel

Water Levels

Table 2: Cold Water Basin Water Levels

Model Number	At Overflow Level (in.)	At Operating Level (in.)
FXT-6 thru FXT-11	11-1/2"	4-1/2"
FXT-16 thru FXT-33	11-1/2"	5"
FXT-38 thru FXT-192	14"	6"
FXT-216 thru FXT-257	16"	6"

- The make-up valve controls the operating level, which is maintained at the levels shown in Table 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.
- Check the operating water level monthly, and readjust the float when necessary to maintain the recommended operating level.

Inspection and Maintenance

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



- Inspect the cold water basin regularly. Remove trash or debris accumulated in the basin or on the strainer.
- 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.
- When flushing the basin, leave the strainer in place to prevent the sediment from re-entering the system.
- Remove the strainer after the basin has been flushed.
- Clean and replace the strainer before refilling the basin with fresh water.
- Adjust the float to maintain the design operating level. See Table 2: "Cold Water Basin Water Levels."

Fan

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

Inspection and Maintenance

- If the unit is already in operation, while the fan is running, check for any unusual noise or vibration.
- With the fan off and the motor locked out and tagged, check the general condition of the fan:
 - Inspect for any loose or missing bolts in the fan shaft bushing, the fan hub, and the fan shaft bearing(s).
 - 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.
 - Inspect each blade for excessive scale build-up that could cause vibration.
 - Check each blade, in the area of the 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.
- **Tip Clearance:** Check the clearance between the tip of the blade and the fan cowl. The clearance should be within 5/16" to 1/2".
- **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°.
- **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.
- **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.
- **Operation:** On initial start-up, run the fan in the manual position for several minutes and check for any unusual noises or vibration.

Fan Drive System

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

NOTE: Direct drive units (FXT-6 thru FXT-20) do not employ fan shaft bearings, adjustable motor bases, fan drives or belts. The fans are driven directly by the motor and there is never a need for any adjustment.

Inspection and Maintenance:

- These drives require a periodic check of the belt condition and, when necessary, tension adjustment. The recommended service intervals are as follows:
 - **Initial Start-up:** Servicing is not required prior to initial tower start-up. The drive has been tensioned and aligned at the factory.
 - **Seasonal Start-up:** Readjust the belt tension.
 - **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 3 - Fan Belt Adjustment

- Belt tension check:
 - Place a straight edge along the belt from sheave to sheave as shown in Figure 4a, or use a tape measure as shown in Figure 4b, to measure belt deflection.
 - 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.
 - There is adequate belt tension if the belt deflects between 1/4" and 3/8" as shown in Figures 4a and 4b.

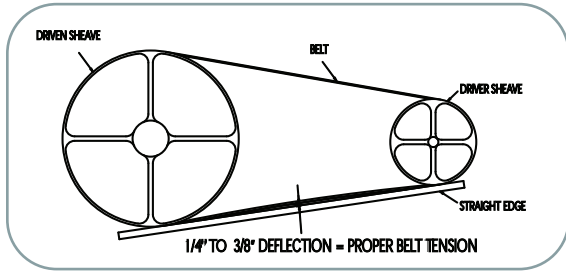


Figure 4a

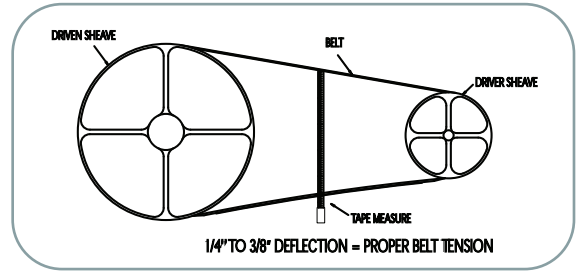


Figure 4b

Belt Tension

- Belt tension adjustment (if required):
 - Loosen the lock nut on the motor base adjusting screw.
 - 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.
- When the belt is properly tensioned, retighten the lock nut on the motor base adjusting screw.

NOTE: There should be no “chirp” or “squeal” when the fan motor is started.

Alignment:

- Check the drive alignment annually to ensure maximum belt life.
- Drive alignment check and adjustment:
 - Place a straight edge across the driver and the driven sheaves as shown in Figure 5.
 - The straight edge should contact all four points as shown in Figure 5 indicating proper drive alignment.
 - There should be no more than 1/16" deviation from four points of contact.
 - 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.

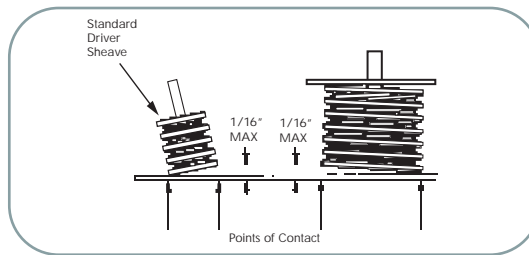


Figure 5 - Drive Alignment

Fan Motors

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

Inspection and Maintenance

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



Adjustable Motor Base

Coat the motor base slides and adjusting screws (refer to Figures 2 (on Page N31), 6, and 7) every 3 months using good quality corrosion inhibiting grease such as one of those recommended for lubricating the fan shaft bearings below.

WARNING: Check to ensure the controls for the fan motor are set to allow a maximum of 6 on-off cycles per hour.

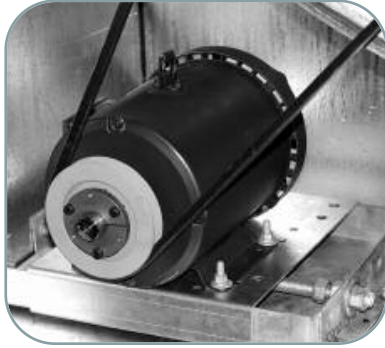


Figure 6 - Adjustable Motor Base
FXT Models 74-136 and 230-272



Figure 7 - Adjustable Motor Base
FXT Models 160-257 and 320-514

Fan Shaft Bearings

Two pillow block ball bearings support the fan shaft. Each bearing is equipped with a lubrication fitting.

Inspection and Maintenance

- Lubricate the bearings with only a manual grease gun. Do not use high-pressure grease guns since they may rupture the bearing seals.
- Lubricate the bearings with only one of the following compatible water resistant greases* which are suitable for ambient temperatures ranging from -65°F (-53.9°C) to +250°F (121.1°C).

*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™

- Lubricate the bearings as follows:
 - o **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 1 year, 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.**
 - o **Seasonal Start-up:** Purge both bearings with new grease prior to start-up.
 - o **Operation:** Purge bearings every 2,000 hours of operation or once every 3 months, whichever occurs first.
 - o **Extended Shutdown:** Purge bearings with new grease prior to any prolonged storage or downtime.

Locking Collars

Each eccentric locking collar should be checked quarterly to ensure that the inner bearing race is secured to the fan shaft. The locking collar can be set using the following procedure (see Figures 8a and 8b).

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



Figure 8a

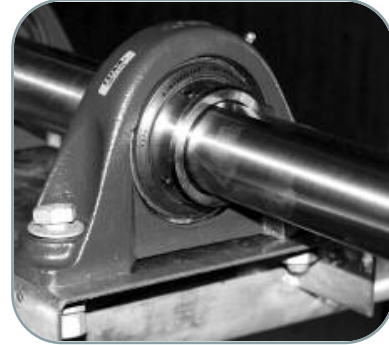


Figure 8b

Bearing with Locking Collar

Heat Transfer Section

Fill and Drift Eliminator

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

Cooling Tower Inspection and Maintenance:

- Inspect and clean the fill with the integral eliminators at least quarterly.
- The inspection procedure is as follows:
 - Shut off the fan and the system pump.
 - Inspect the fill for obstructions, damage and fouling.
- Remove any obstructions from the fill.
- Remove any minor fouling chemically. Contact your local water treatment consultant for advice.

Water Distribution System

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. A series of nozzles, which distribute water over the fill, are located in the hot water basin. The materials of construction for the hot water basin are galvanized steel, Thermosetting Hybrid Polymer, and Type 304 stainless steel.

Operating Level:

At design flow, the operating level should not be less than 3/4 inches or greater than 4-1/2 inches deep.

Inspection and Maintenance:

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



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

The 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.

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.

Inspection and Maintenance:

- Inspect the make-up valve assembly monthly and adjust if necessary.
- Inspect the valve annually for leakage. Replace the valve seat if necessary.
- 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.
- 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.
- With the design thermal load and the average water pressure (15 to 50 psig) at the valve, the above setting will produce operating water levels as stated in Table 2 on Page N32.
- 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 the recommended operating level.
- Closely monitor the water level in the cold water basin and adjust the level if necessary during the first 24 hours of operation.
- 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.

Inspection and Maintenance:

- Clean the stainless steel electrodes periodically to prevent accumulations of scale, corrosion, sludge or biological growth, which could interfere with the electrical circuit.
- 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.
- 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.

Recommended Spare Parts

BAC parts are the “Perfect Fit” for your cooling tower. These parts are specifically designed, engineered and manufactured to work in a cooling tower environment. They are the right parts, at competitive pricing levels, and BAC offers the best deliveries in the industry.

BAC stocks most common repair and retrofit parts in our Parts DepotSM and can ship other parts, often overnight, from any of our three manufacturing facilities strategically located in California, Delaware, and Illinois. In addition, most BAC Representatives maintain a local inventory of commonly used parts.

Even with this fast delivery capability, it is still recommended that certain essential, emergency repair parts be maintained in your local inventory, to minimize any potential downtime.

Basic Recommended Spare Parts

Bearing set

Float valve or repair kit

Float ball

Solenoid valve (if unit is equipped with electric water level control)

Powerband or set of belts

Spray nozzle kit with grommets

Basin heater and low water cut out

Door gasket

Strainer (inlet and suction)

Fan and sheave bushings

Pump seal and gasket kit for coil products

Automatic bearing greaser refill kit



Parts to Consider if Extended Downtime is a Concern

Spray pump for coil products

Fan or fan wheel

Fan shaft

Sheave set

Fan motor