OPERATING AND MAINTENANCE INSTRUCTIONS

FXT Cooling Towers

Baltimore Aircoil Company equipment needs to be properly installed, operated and maintained. Documentation of the equipment used, including a drawing, technical data sheet and this manual should be kept on record. To achieve long, trouble-free and safe operation, it is necessary to establish an operating plan including a programme of regular inspection, monitoring and maintenance. All inspections, maintenance and monitoring actions should be recorded in a cooling system logbook. The operating and maintenance instructions published here can be used as a guide to achieve these goals.

In addition to establishing the operating plan and the cooling system logbook it is recommended to conduct a cooling system risk analysis, preferably by an independent third party.

For the cooling system, scale, corrosion and biological control must be established and initiated when the system is first filled with water and administered on a regular basis thereafter in accordance with recognized Codes of Practice, (such as EUROVENT 9 - 5/6, ACOP HSC L8, Guide des bonnes pratiques, Legionella et tours aéroréfrigérantes, etc.). Water sampling, test results and corrective actions should be recorded in the cooling system logbook.

For more specific recommendations on keeping your cooling system efficient and safe, contact your local BAC Balticare service provider or representative. Name, e-mail and phone number can be found on the website www.BACservice.eu.

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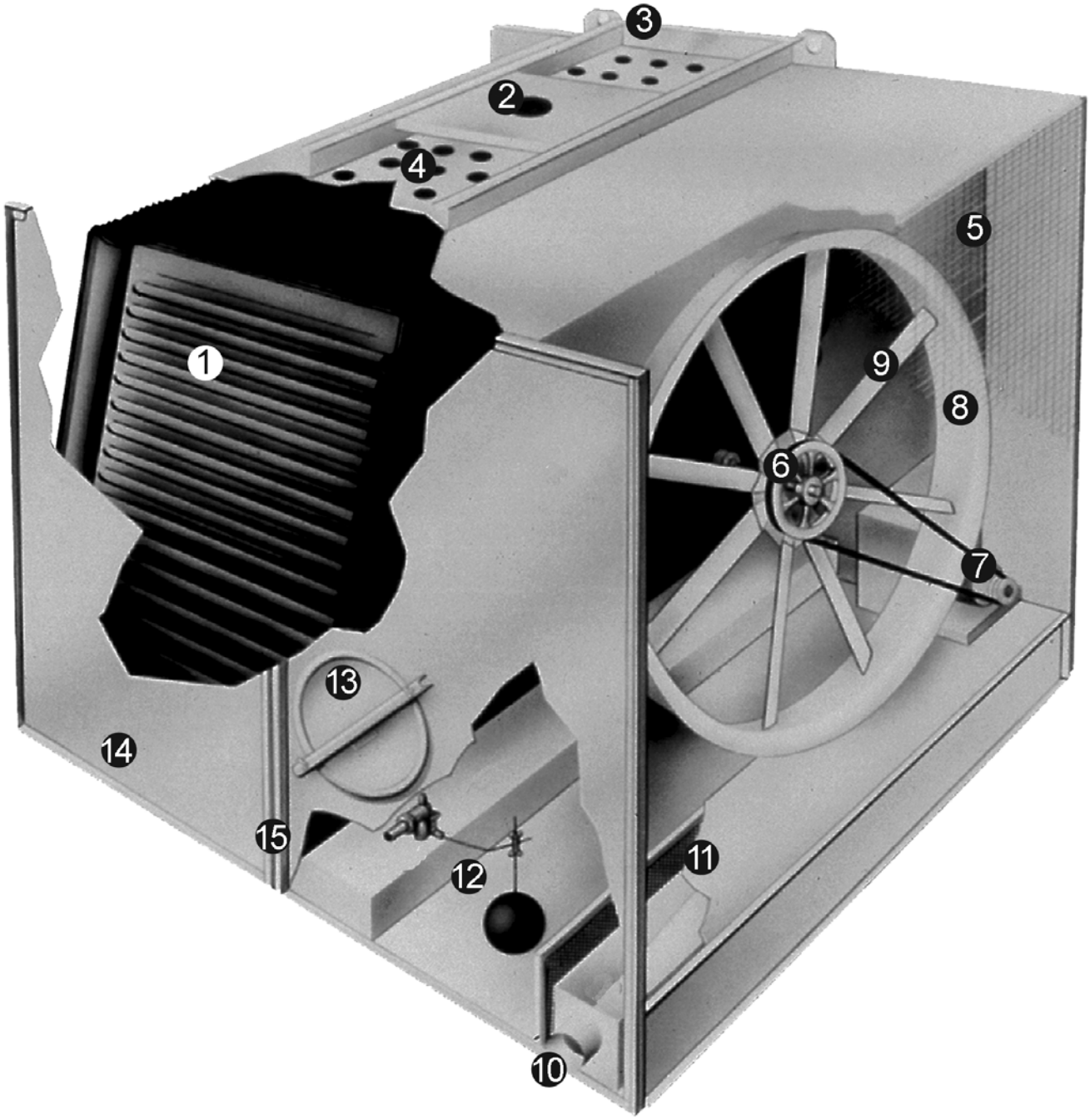
FXT cooling towers

TYPICAL CROSS SECTION



1. Wet Deck Surface with Integral Drift Eliminators
2. Top Water Inlet
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4. Plastic Metering Orifices
5. Fan Screens
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Operating Conditions

BAC cooling equipment is designed for the operating conditions specified below, which must not be exceeded during operation.
Wind Load: For safe operation of unshielded equipment exposed to wind speeds above 120 km/h installed at a height above 30 m from the ground contact your local BAC-Balticare representative.
Seismic Risk: For safe operation of equipment installed in moderate and high hazard area's contact your local BAC Balticare representative.
Standard electrical motors are suitable for an ambient temperature range from -25°C to +40°C.
Maximum inlet pressure : 0.5 bar
Water inlet temperature : max. 50°C (std. fill) or 55°C (high temperature option)
Water outlet temperature : min. 5°C
For circulating water quality compatible with construction materials refer to section Water Care on page 4.

Connecting Pipework

All piping external to BAC cooling equipment must be supported separately. In case the equipment is installed on vibration rails or springs, the piping must contain compensators to eliminate vibrations carried through the external pipework.
Suction pipe sizing should be done according to good practice, which may for larger flows require larger pipe diameters than the cooling tower outlet connection. In such cases adapter pieces need to be installed.

Safety Precautions

All electrical, mechanical and rotating machinery constitute a potential hazard, particularly for those not familiar with its design, construction and operation. Accordingly, adequate safeguards (including use of protective enclosures where necessary) should be taken with this equipment both to safeguard the public (including minors) from injury and to prevent damage to the equipment, its associated system and the premises.
If there is doubt about safe and proper rigging, installation, operation or maintenance procedures, contact the equipment manufacturer or his representative for advise.
When working on operating equipment, be aware that some parts may have an elevated temperature. Any operations on elevated level have to be executed with extra care to prevent accidents.

Do not cover units with PVC eliminators or fill with a plastic tarpaulin. Temperature increase due to sun radiation could deform the fill or eliminators

AUTHORIZED PERSONNEL

The operation, maintenance and repair of this equipment should be undertaken only by personnel authorized and qualified to do so. All such personnel should be thoroughly familiar with the equipment, the associated systems and controls and the procedures set forth in this and other relevant manuals. Proper care, procedures and tools must be used in handling, lifting, installing, operating and repairing this equipment to prevent personal injury and/or property damage.

MECHANICAL SAFETY

Mechanical safety of the equipment is in accordance with the requirements of the EU machinery directive. Depending upon site conditions it also may be necessary to install items such as bottom screens, ladders, safety cages, stairways, access platforms, handrails and toe boards for the safety and convenience of the authorized service and maintenance personnel. At no time this equipment should be operated without all fan screens, access panels and access doors in place.
When the equipment is operated with a variable fan speed control device, steps must be taken to avoid operating at or near to the fan's «critical speed». For more information consult your local BAC Balticare representative.

ELECTRICAL SAFETY

Each fan and pump motor associated with this equipment should be installed with a lockable disconnect switch located within the sight of the equipment. No service work should be performed on or near the fans, motors, drives or inside the equipment unless fan and pump motors, heaters etc. are electrically isolated.

LOCATION

All cooling equipment should be located as far away as possible from occupied areas, open windows or air intakes to buildings.

LOCAL REGULATIONS

Installation and operation of cooling equipment may be subject of local regulations, such as establishment of risk analysis. Ensure regulatory requirements are consistently met.

About Water Care

In all cooling equipment, operating in evaporative mode, the cooling is accomplished by evaporating a small portion of the re-circulating water as it flows through the equipment. When this water evaporates, the impurities originally present in the water remain. Unless a small amount of water is drained from the system, known as blow down, the concentration of dissolved solids will increase rapidly and lead to scale formation or corrosion or both. Also, since water is being lost from the system through evaporation and blow down, this water needs to be replenished.

The total amount of replenishment, known as make-up, is defined as:

Make-up = evaporation loss + blow down

In addition to the impurities present in the make-up water, any airborne impurities or biological matter are carried into the equipment and drawn into the re-circulating water. Over and above the necessity to blow down a small quantity of water, a water treatment programme specifically designed to address scale, corrosion and biological control should be initiated when the system is first installed and maintained on a continuous base thereafter. Moreover there must be an ongoing programme of monitoring in place to ensure the water treatment system is maintaining the water quality within the control guidelines.

Check and adjustments of blow down depends on the blow down device actual in use.

To prevent excessive build-up of impurities in the circulating water, a small amount of water must be « bled » from the system at a rate to be determined by the water treatment regime. The amount of blow down is determined by the design cycles of concentration for the system. These cycles of concentration depend on the quality of the make-up water and the design guidelines for the quality of the recirculating water given below.

Make-up water to the evaporative unit should have minimum 30 ppm hardness as $CaCO_3$.

Where use of a softener is necessary to achieve this, the supply to the evaporative unit should not be totally softened, but blended with the incoming unsoftened water to achieve the minimum hardness between 30 and 70 ppm as Ca CO_3.

Maintaining a minimum hardness in the make-up water offsets the corrosive properties of totally softened water and reduces the reliance on corrosion inhibitors to protect the system.

	BALTIBOND® Hybrid Coating and SST304
pH	6.5 to 9.2
pH during initial passivation	Below 8.2 (for units with HDG coil only)
Total hardness (as $CaCO_3$)	70 to 750 mg/l
Total alkalinity (as $CaCO_3$)	600 mg/l max.
Total Dissolved Solids	2050 mg/l max.
Conductivity	3300 µS/cm
Chlorides	250 mg/l max.
Sulfates*(*)*	350 mg/l max.*(*)*
Total suspended solids	25 mg/l max
Chlorination (as free chlorine): continuous	1.5 mg/l max.
Chlorination (as free chlorine): batch dosing for cleaning & disinfection	5-15 mg/l max. for 6 hours max. 25 mg/l max. for 2 hours max. 50 mg/ max for 1 hour max.

Table 1: Circulated Water Quality Guidelines for Baltibond® Hybrid Coating

Note: (°) Higher concentration of sulfates are allowed, provided the sum of chlorides + sulfates parameters does not exceed 600 mg/l for Balticond/ SST304.

	Baltiplus Protection
pH	7.0 to 9.0
pH during initial passivation	Below 8.2
Total hardness (as $CaCO_3$)	70 to 600 mg/l
Total alkalinity (as $CaCO_3$)	500 mg/l max.
Total Dissolved Solids	1250 mg/l max.
Conductivity	2000 µS/cm
Chlorides	200 mg/l max.
Sulfates*(*)*	200 mg/l max.*(*)*
Total Suspended Solids	25 mg/l max.
Chlorination (as free chlorine): continuous	1 mg / l max.
Chlorination (as free chlorine): batch dosing for cleaning & disinfection	5-15 mg / l max. for 6 hours max. 25 mg / l max. for 2 hours max. 50 mg / l max. for 1 hour max.

Table 2: Circulated Water Quality Guidelines for Baltiplus Protection

Note: (*) Higher concentration of sulfates is allowed provided the sum of chlorides + sulfates parameters does not exceed 400 mg/l for Baltiplus Protection.

Cycles of concentration are the ratio of the dissolved solids concentration in the circulating water compared to the dissolved solids concentration in the make-up water. The blow down rate can be calculated as follows :

Blow down = Evaporation loss / (Cycles of concentration – 1)

The evaporation loss is not only function of the heat load but also depends on climatic conditions, the type of equipment used and the method of capacity control, which is applied. The evaporation loss at summer conditions is approximately 0.431 l/ 1000 kJ heat rejection. This number should be used for blow down valve sizing only and not for the calculation of annual water consumption.

Biological Control

The growth of algae, slimes and other micro-organisms, if uncontrolled, will reduce system efficiency and may contribute to the growth of potentially harmful micro-organisms, such as Legionella, in the recirculating water system.

Accordingly a treatment programme specifically designed to address biological control should be initiated when the system is first filled with water and administered on a regular base thereafter in accordance with any regulations (national, regional) that may exist or in accordance with accepted codes of good practice, such as EUROVENT 9-5/6, VDMA Detailsheet 24649 etc.

It is strongly recommended to monitor the bacteriological contamination of the recirculating water on a regular base (for example, TAB test with dip slides on a weekly base) and record all results.

Water treatment should meet the following requirements:

Certain products used for water treatment, particular some dispersant and bio-dispersant additives, might change the properties of the water (such as the surface tension), which can cause excessive drift loss (water passing through the eliminators). In such case we recommend to review the water treatment (product type, dosage) with your water treatment expert.

In case of doubt, a short test can be performed, after cleaning & disinfection, using fresh water without addition of the concerned chemical (within the limits of the local legislation).

Chemical Treatment

1. Water treatment chemicals or non-chemical systems need to be compatible with the materials of construction used in the cooling system including the evaporative cooling equipment itself.
2. In case of chemical water treatment, chemicals should be added to the recirculating water by an automatic feed system. This will prevent localised high concentrations of chemicals, which may cause corrosion. Preferably the water treatment chemicals should be fed into the cooling system at the discharge of the recirculation pump. The chemicals should not be fed in concentrated form, nor batch fed directly into the cold water sump of the evaporative cooling equipment.
3. B.A.C. specifically discourages acid dosing as mean of scale control (unless under certain strict circumstances for open circuit cooling towers with very large system volume and remote sump, or constructed from stainless steel
4. A competent water treatment company should be consulted for the specific water treatment programme to be applied. Next to the supply of dosing and control equipment and chemicals, the programme should include regular monthly monitoring of the circulating and make up water quality.
5. If it is proposed to operate a treatment program outside the B.A.C. Water Quality Control Guidelines, the B.A.C. factory warranty may be invalidated if the water quality is persistently outside the Control Guidelines., unless specific prior written B.A.C. approval. (some parameters may be exceeded under certain strict circumstances.).

It is strongly recommended to check the key parameters of the circulating water quality on a monthly base. See table: Circulated Water Quality Guidelines. All test results need to be recorded.

Passivation

When new systems are first commissioned, special measures should be taken to ensure that galvanized steel surfaces are properly passivated to provide maximum protection from corrosion. **Passivation** is the formation of a protective, passive, oxide layer on galvanized steel surfaces. To ensure that galvanized steel surfaces are passivated, the pH of circulating water should be kept between 7.0 and 8.2 and calcium hardness between 100 and 300 ppm (as $CaCO_3$) for four to eight weeks after start-up, or until new zinc surfaces turn dull grey in colour. If white deposits form 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 units and units protected by the BALTIBOND® coating without galvanized coil, do not require passivation.

In case you can't keep the pH below 8.2, a secondary approach is to conduct a chemical passivation using inorganic phosphate or film-forming passivation agents. Consult your water treatment specialist for specific recommendation

Overflow Connection

A slight loss of water through the overflow on forced draft cooling towers is normal when the fans are in operation, since the unit is in overpressure and some saturated air will be blown out to the unit, carrying several droplets of water.

About Cold Weather Operations

BAC equipment can be operated in subfreezing ambient conditions provided the proper measures are taken :

1. Protection against sump water freezing, when the system is idle.
2. Capacity control to prevent ice formation during operation.

Listed below are general guidelines, which should be followed to minimise the possibility of freeze-up. As these guidelines may not include all aspects of the anticipated operation scheme, system designer and operator must thoroughly review the system, location of the equipment, controls and accessories to ensure reliable operation at all times.

Protection Against Sump Water Freezing

To prevent sump water from freezing, either sump heaters or a remote sump located in a heated indoor area must be installed. For a seasonal shut down during the cold weather period, it is recommended to drain the sump.

Thermostats for electrical sump heaters for this equipment are set to maintain a sump water temperature of 4°C.

Capacity Control

In addition to protecting the sump water, all exposed water piping, in particular make-up water lines should be heat traced and insulated. It is necessary to prevent the recirculating water from approaching freezing conditions when the system is operating under load. The most « critical » situation occurs, if operation at subfreezing conditions coincides with light load conditions. The key to protecting the recirculating water is capacity control by adjustment of airflow to maintain the temperature of the recirculating water minimal above freezing point. As a rule of thumb this minimum temperature is 5°C, but there are applications, where even lower temperatures can be accepted. (Contact your local BAC Balticare representative for advice.)

Whenever two speed motors are used for capacity control, a time delay of at least 15 seconds is required when switching form high to low speed. Sudden switch over might damage the drive system or the motor.

Note: When operating with VFD drives above nominal frequency be aware of the potential risk for motor overload or mechanical damages.

Note: It is recommended to provide sinus filters on the VFD to prevent bearing damage on fan motors.

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Refer to fan motor nameplate data when programming a VFD

The purpose of a Low Level Cut out Switch is to protect the pump from running dry in case of make-up failure or extreme water loss. The status of the alarm can be checked prior to pump start-up, but should not be considered during the first minute after start-up, since activation of the pump can cause a water level drop, that might trigger the alarm. Normal make-up will stabilize the water level after a short period of time.

Checks and Adjustments

HOT WATER BASINS

The system water enters the cooling tower through the hot water basin(s). (See figure below). At design flow, the operating level should not be less than 50 mm or greater than 125 mm deep. 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.

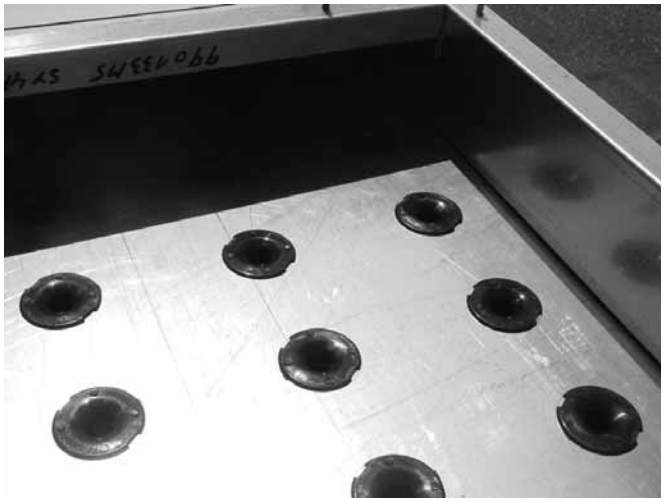

Figure 1: Hot Water Basin

COLD WATER BASIN AND BASIN STRAINERS

The cold water basin should be inspected regularly. Any debris which may have accumulated in the basin or on the strainers should be removed. Quarterly, or more often if necessary, the entire cold water basin should be drained, cleaned and flushed with fresh water to remove the silt and sediment which normally collects in the basin and under the wet deck surface during operation.

When flushing the basin, the strainers should be left in place to prevent the sediment from re-entering the unit system. After the basin has been flushed, the strainers should be removed, cleaned, and replaced before refilling the basin with fresh water.

DO NOT USE ACID TO CLEAN THE STRAINERS

Remote Basin

The water level in the basin of equipment designed for remote basin operation is a function of the circulating water flow rate; water outlet connection size, quantity and location, and outlet piping size and configuration. The remote basin unit is supplied without a water make-up assembly or a strainer and the basin operating level during remote basin operation is not adjustable.

Figure 2: Cold Water Basin and Basin Strainer

OPERATING LEVEL AND MAKE-UP

As the water circulating through the tower is cooled, it collects in the cold water basin and passes through the strainers into the system. The operating water level is controlled by the make-up valve and should be maintained at the operating water level shown in the table below.

Model No.	Height of Water in the cold Water Basin (mm)
FXT27-32	130
FXT43-250; FXT194-500t	150

Table 3: Cold Water Basin Operating Heights FXT

The operating water level in the cold water basin will vary somewhat with system thermal load (evaporation rate), the bleed rate employed and the make-up water supply pressure. Because the typical winter load is less than the summer load, the winter evaporation rate is frequently less than the summer evaporation rate. With this reduced evaporation rate in winter, the water level in the cold water basin will increase unless the float is readjusted. The operating water level should be checked monthly and float re-adjusted as necessary to maintain the recommended operating level.

A float operated water make-up assembly is furnished as standard equipment on cooling towers. It is located inside the unit within easy reach from the access door.

The standard make-up assembly (see figure below) consists of a make-up valve connected to a float arm assembly and actuated by a large diameter plastic float. The float is mounted on an all-thread rod which is held in place by wing nuts. The operating water level in the cold water basin can be adjusted by repositioning the float and all-thread rod using the wing nuts provided.

The make-up assembly should be inspected monthly and adjusted as necessary. The valve itself should be inspected annually for leakage and the valve replaced if necessary. The make-up water supply pressure should be maintained between 100 and 450 kPa for proper operation of the valve.

To make the initial basin water level setting, fill the sump with water until 2 cm above the operating level. Adjust the wing nuts of the float ball so that the make-up valve is completely closed. Before starting the unit for the first time, fill the sump until 1 cm below overflow level (push float ball under). Under normal load conditions this setting should produce the correct operating level. At low load conditions the operating level will rise and needs to be adjusted. The unit basin should be closely monitored and water level adjusted as necessary during the first 24 hours of operation.

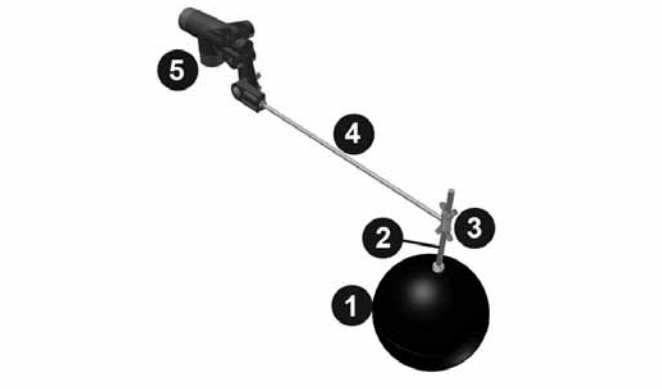

Figure 3: Water Make-up Valve Assembly

1. Float Ball
2. All Threaded rod
3. Wing Nuts
4. Float Arm Assembly
5. Float Valve

To check the operating level, proceed as follows :

1. Shut off fan(s) but keep pump(s) running.
2. Measure height from sump bottom to water level and compare with face value from table.
3. Check valve for leakage and replace valve, if necessary.
4. Check that float arm can move freely and that float ball floats and closes valve.
5. Ensure that make-up water supply is adequate.

Note: This procedure does not apply for
- equipment equipped with electrical water level control
- remote sump applications

BLOW DOWN

In case of a continuous blow down with a metering valve in the bleed line, ensure that the valve is unobstructed and that blow down water can drain freely. Measure the blow down flow rate by recording the time needed to fill a given volume.
For automatic blow down using conductivity control, ensure that the conductivity probe is clean and that the blow down solenoid valve is operational. Unless you have a specific adjustment procedure, your water treatment company should check and adjust set points.

SUMP HEATER PACKAGE

Sump heaters must only operate in the winter to prevent the sump water from freezing, when the water pump(s) and the fan(s) are shut off. Under no circumstances should sump heaters operate at other times as they could potentially heat the water to temperature levels, which are favourable to bacteriological growth. Ensure every six months the heater thermostat is properly set and clean. Also ensure that control and safety devices, such as low level cut out switches, are operational, clean and properly incorporated into the control circuit.

Figure 4: Sump Heaters

SUMP HEATERS CAN BE HOT.

BELT TENSIONING

Belt tensioning can be adjusted by changing the position of the fan motor(s) by rotating the motor base adjustment screw, which extends through the bottom frame angel. Check belt tension as follows :

1. Shut off fan(s) .
2. Rotate the fan sheave half a turn to evenly distribute the tension in the belt before measuring.
3. Check belt tension by verifying both following conditions.
   - The deflection amounts 10 mm / m free belt length (see figure below)
   - The deflection force required is between the minimum and maximum values given in the table below.

Fan has to be blocked while replacing belts

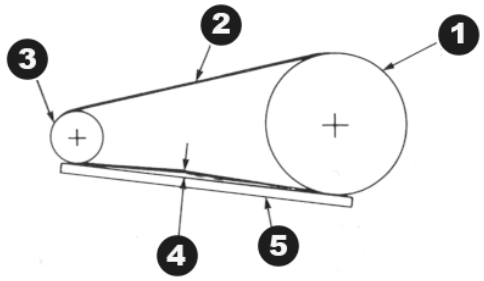

Figure 5: Fan Belt Check and Adjustment

1. Fan Sheave
2. Belt
3. Motor Sheave
4. 10 mm/m Deflection = Proper Belt Tension
5. Straight Edge

Belt Profile	Diameter (mm) Motor Sheave	Deflection Force (kg)	
		Min.	Max.
XPA	80 through 125 135 through 200 >200	1.5 2.0 2.5	2.5 3.0 3.5
SPA	100 through 125 132 through 212 >212	1.5 2.0 2.0	2.0 2.5 3.0

Table 4: Belt Tension Forces

New belts have to be re-tensioned after 24 hours operation.
If belt tensioning is required, please proceed as follows:

1. Loosen the lock nuts on the Motor Base Adjusting Screws.
2. Turn the Motor Base Adjusting Screws clockwise to tension the belt, or counter-clockwise to relieve belt tension. During adjustment of belt tension the drives should be rotated several times by hand to evenly distribute the tension throughout the belt.
3. When the belt is properly tensioned, retighten the locking nuts on the Motor Base Adjusting Screws.

Note: There should be no "chirp" or "squeal" when the fan motor is started.

DRIVE ALIGNMENT

Proper drive alignment ensures maximum belt life. Alignment is checked for standard drives **after correct belt tensioning** by placing a straightedge across both sheaves as shown in the Figure below.
When the drives are properly aligned the gap measured between straightedge and sheave does not exceed 0,5 mm per 100 mm of fan sheave diameter.

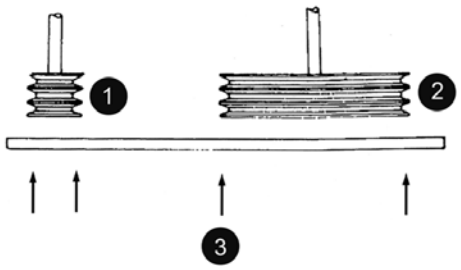

Figure 6: Checking sheave alignment

1. Motor Sheave
2. Fan Sheave
3. Points of Contact

LOCKING COLLAR

The excentric locking collar of the bearing at the drive end ensures that the inner bearing race is secured to the fan shaft. Locking collars can be set using the following procedure. (See Figure below)

1. Stop fan(s) and remove side access panel(s).
2. Loosen the set screw.
3. Using a drift pin centerpunch, tap the collar (in the hole provided) tangentially in the direction of rotation while holding the shaft.
4. Retighten the screw.
5. Install access panel(s) and start fan(s).

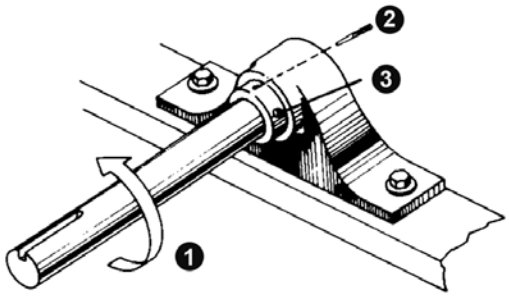

Figure 7: Locking Collar Assembly

1. Direction of Rotation
2. Drift Pin: Tap the locking collar in direction of fan rotation until cam is locked.
3. Tighten set screw.

ROTATION OF FAN(S) AND PUMP(S)

Fans must rotate without obstruction and both fans and pumps must rotate in the correct direction, which is indicated by arrows on the equipment. Check proper functioning as follows:

1. Stop fan(s) and pump(s).
2. Turn the fan by hand to ensure rotation without obstruction. Remove obstruction, if present.
3. Start the pump(s) and check for the proper rotation as indicated by the arrow on the pump cover. If rotation is wrong, stop pump and correct electrical wiring.
4. Start the fan(s) and check for proper rotation as indicated by the arrow on the fan housing. If rotation is wrong stop fan(s) and correct fan motor wiring.

MOTOR VOLTAGE AND CURRENT

Check the voltage and the current of all three legs of the fan and pump motors. The current should not exceed the nameplate rating. After prolonged shutdown the motor insulation should be checked with a megger insulation tester prior to restarting.

Some models have only one upper section and one or two fan motors. Fan cycling results in only on-off operation. For these units, all fans need to operate simultaneously.
Other models have two upper sections and one or two fan motors per upper section. Fan cycling results in only on-off operation. For these units, all fans need to operate simultaneously per upper section.

UNUSUAL NOISE AND VIBRATIONS

Unusual noise and/or vibration are the result of malfunctioning of mechanical components or operational problems (unwanted ice formation). If this occurs, a thoroughful inspection of the entire unit followed by immediate corrective action is needed. If required, consult your local BAC Balticare representative for assistance.

Inspections and Corrective Actions

GENERAL CONDITION OF THE EQUIPMENT

The inspection should focus on following areas:

- damage of corrosion protection
- signs of scale formation or corrosion
- accumulation of dirt and debris
- presence of biofilms

Smaller damages of the corrosion protection can be repaired. For BALTIBOND® protection use kit (part number RK1057). Larger damages should be reported to the local BAC Balticare representative.
If there is evidence of scale formation (more than 0,1 mm) or corrosion, water treatment regime must be checked and adjusted by the supplier.
Any dirt and debris need be removed following the CLEANING PROCEDURES described in this manual (See page 11).
If there is evidence of biofilms the system, including piping should be drained, flushed and cleaned of slimes and other organic contamination. Refill system with water and apply biocide shock treatment. Check pH value and functionality of ongoing biocide treatment.

HEAT TRANSFER SECTION AND DRIFT ELIMINATORS

The fill and integral eliminators should be inspected and cleaned at least quarterly or more regularly if required by local authorities.
The inspection procedure is as follows:

1. Shut off fan(s) and pump(s).
2. Remove the access panel.
3. Inspect the wet deck surface for
   - obstructions
   - damages
   - corrosion
   - fouling.

Remove any obstructions from heat transfer section(s).
Any damages or corroded areas need to be repaired. Call your local BAC Balticare representative for assistance.
Minor fouling can usually be removed chemically or by temporary changes to the water treatment programme. Contact your water treatment supplier for advice. Major fouling requires cleaning and flushing according to the CLEANING PROCEDURES (See page 11).
Regular checking of the Total Aerobic Bacteria count (TAB) and maintaining it within acceptable levels are the key to prevent fouling.

SPRAY NOZZLES

The spray nozzles should be inspected and cleaned each month. The inspection procedure is as follows:

1. Shut of fan(s) and pump(s).
2. Remove hot water basin cover (if present) and clean any nozzles that are clogged.

FAN SHAFT

The exposed areas of the fan shaft are coated with a soft seal for added corrosion protection. It is recommended that the coating be inspected for continuity quarterly or at least every 6 months. Any signs of surface corrosion must be treated. This involves:

1. Removal of the protective coating with a suitable cleaning medium
2. The removal of any surface corrosion with emery cloth
3. The re-coating of the shaft with soft seal.

AXIAL FAN

Due to its size and speed, the axial fan has great potential for injury and destruction if damaged. Inspect closely, and as required, replace damaged or deteriorating fan blades. Inspection should include the fan, fan cylinder and fan guard, and these should be inspected for

- Fan blade tip clearance
- Bolt torque
- Excessive vibration
- Deterioration of fan assembly

Correct or adjust if necessary.

No service work should be performed on or near the fans, motors, and drives or inside the unit without first ensuring the fan and pump motors have been isolated, tagged and locked in the off position.

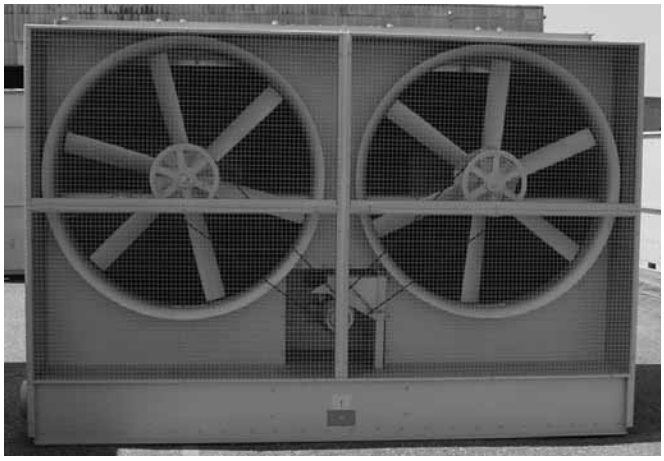

Figure 8: Axial Fan

FAN MOTOR

During operation it is required to clean the outside surface of the motor at least every 6 months (or more often depending on site conditions) to ensure proper motor cooling. Do not wash down the motor unless it is IP 66 rated. On a quarterly or six monthly basis check:

- Electric connections
- Motor protection devices
- Check amp draw
- Motor bearings for noise/overheating
- Motor holding bolts
- External surface of motor for corrosion

HOT WATER BASIN(S)

Inspection procedure is as follows:

1. With fan(s) and pump(s) running visually check condition of hot water basin internally and externally.
2. Remove any dirt or debris which may clog the orifices
3. If necessary balance the water flows to obtain operating water level. (Flow balance valves are by others.)
4. Operating level in the two tower basins should be equal and not lower than 50 mm or higher than 125 mm.

ELECTRIC WATER LEVEL CONTROL PACKAGE (OPTIONAL)

The electric water level control package (optional) maintains a constant water level in the cold water sump independent of cooling load changes and water supply pressure variations. Ensure every six months that all components (valve, float switches) are operational and clean.

During commissioning the tower should be filled manually till overflow level (push float ball under) to prevent air suction of the pump during first start-up.

When disassembling the float switch for cleaning, make sure to reassemble it in <u>exactly</u> the same position, otherwise it will not function correctly.

Lubrication

FAN SHAFT BEARINGS

The fan shaft is supported by two pillow block ball bearings (see Figure below), each equipped with a lubrication fitting and a flinger/locking collar to keep out moisture.

Under normal operating conditions the bearings should be greased every 1000 operating hours or at least every three months. The bearings should be lubricated with one of the following water resistant inhibited greases, which are good for ambient temperature ranging from - 20 °C to 120 °C.

Figure 9: Ball Bearing

1. Bearing with Locking collar
2. Lubrication Fitting
3. Extended Lubrication Line

The bearings should be lubricated only with a hand grease gun. Do not use high-pressure grease guns, since they may rupture the bearing seals. When lubricating, purge the old grease from the bearing by gradually adding grease until a bead of new grease appears at the seal. In particular when extended lubrication lines are fitted ensure that ALL old grease is removed and that new grease is leaving the seal.

If bearings are replaced, grease must be added to the new bearings after installation. Make sure new bearings are fully greased (spare bearings may not be fully filled with grease).

Note: For grease products see Table below

MOTOR BEARINGS

Motors with frame size >200L (>30 kW) have grease fittings

- grease intervals : twice a year unless otherwise shown on the nameplate of the motor
- grease products : see below

The bearings should be lubricated only with a hand grease gun. Do not use high-pressure grease guns, since they may rupture the bearing seals. When lubricating, purge the old grease from the bearing by gradually adding grease until a bead of new grease appears at the seal.

GREASE PRODUCTS

Shell	Alvania grease RL3	-20°C to +120°C
Texaco	Multifak Premium 3	-30°C to +140°C
Klüber	Isoflex LDS Special A	-50°C to +120°C
Mobil	Mobilith SHC 100	-40°C to +175°C
Total Fina Elf	Multis 3	-20°C to +120°C

Table 5: Grease Products

ADJUSTABLE MOTOR BASE

The motor base adjusting screw (see figure below) should be coated every six months using a good quality corrosion inhibiting grease, such as one of those recommended for lubricating the fan shaft bearings.

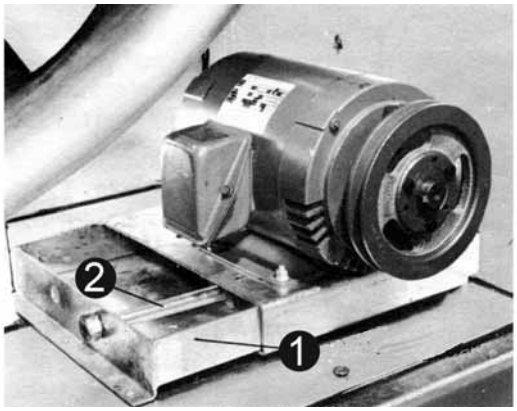

Figure 10: Adjustable Motor Base FXT – Single Fan

1. Motor Base Slide
2. Adjusting Screw

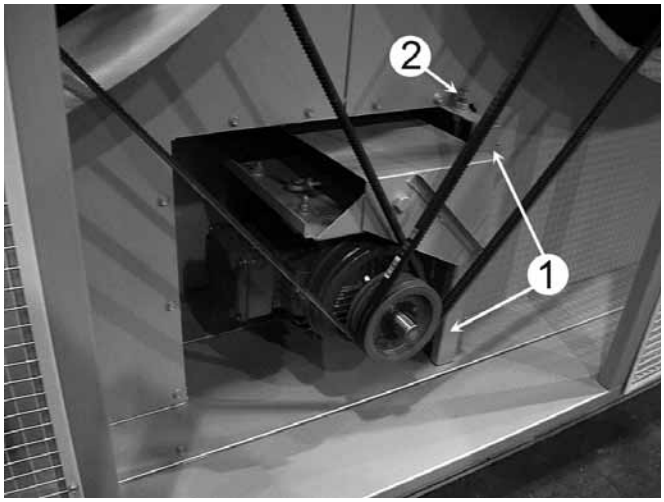

Figure 11: Adjustable Motor Base FXT – Multiple Fan

1. Motor Base Slide
2. Adjusting Screw

Cleaning Procedures

MECHANICAL CLEANING

Keeping your evaporative cooling equipment (and the associated system) clean will maintain its efficiency and help to prevent uncontrolled bacteriological growth. The recommended cleaning procedures are described below :

1. Disconnect fan(s) and shut off make-up supply.
2. Remove screens, access panels and doors and drain system. Do not remove sump strainer.
3. Clean debris from exterior and fan(s) with soft brush, if necessary use water and soap.
4. Clean interior with (soap) water and soft brush, if necessary use high pressure water jet.
5. Remove any debris from water distribution system and clean any nozzles if clogged. If necessary nozzle and grommet may be removed for cleaning.
6. Remove debris from heat transfer section (fill) and integrated drift eliminators. Do not use steam or high pressure water to clean cooling tower wet deck surface.
7. Flush with clean water and drain to remove accumulated dirt.
8. Remove, clean and replace sump strainer(s).
9. Clean debris from screens with water jet and install.
10. Remove debris from access doors and panels with soft brush and (soap) water and install.
11. Close drain and open make-up supply. Fill system to overflow level with clean water.

DISINFECTION

Disinfection of your cooling system may be needed in case of high concentration of aerobic bacteria and/or Legionella. Disinfection is also recommended for evaporative cooling systems with known or suspected high bacteriological levels, prior to a cleaning procedure.
Some local or national guidance also recommends disinfection prior to initial start up, after a prolonged shut down, after routine cleaning operations or when significant alterations have been made to the cooling system.
Disinfection must be carried out in accordance with a proper procedure and take into account the safety of the cleaning and disinfection staff.
Typically disinfection is achieved using a sodium hyperchloride solution to maintain a residual value of 5 - 15 mg/l of free chlorine and circulate this around the system for up to 6 hours. Higher chlorine levels for a shorter period are possible, but require a higher level of corrosion protection than galvanized steel only. Consult your BAC Balticare representative for further information.
Excessive levels of chlorine must be avoided as this quickly can lead to corrosion and damage to your system.
Chlorinated water should be de-chlorinated before draining and after disinfection the system must be thoroughly flushed through with clean water.

Note: A proper regularly monitored biocide programme reduces the need for cleaning and disinfection actions significantly.

About Comprehensive Maintenance

In order to ensure maximum efficiency and minimum downtime of your evaporative cooling system, it is recommended to establish and execute a programme of preventive maintenance. Your local BAC Balticare representative will assist you in establishing and implementing such programme. The preventive maintenance programme must not only avoid that excessive downtime occurs under unforeseen and unwanted conditions, but must also ensure that factory authorized replacement parts are used, which are designed to fit and for their purpose carry the full factory warranty.
To order factory authorized parts, contact your local BAC Balticare representative. Be sure you include the unit serial number when ordering any parts.
To facilitate servicing of the equipment, it is suggested that the following parts be carried on hand :

- Make-up float ball (if applicable)
- Water make-up valve (if applicable)
- Fan shaft bearings
- Spray nozzles and grommets
- Spray distribution branch grommets
- Set of belts (if applicable)
- BALTIPLUS/BALTIBOND® repair (touch-up) kits

Insist on factory authorised parts to avoid loss of efficiency or an operational risk, which may occur if non-authorised parts are used.

Prolonged Outdoor Storage

Should the unit(s) be stored outside prior to installation and/or start-up for approximately one month or longer, or stored in severe climates, it is imperative that certain actions be performed by the installing contractor in order to maintain the unit in “as shipped” condition. These actions include but are not limited to:

- Rotate the fan(s) once per month, at least 10 revolutions.
- Rotate the motor shaft once per month, at least 10 revolutions
- Add desiccants to control panel interiors.
- Wrap motor in non-plastic protective material.
- Ensure hot water basins are covered.
- Keep drains open on the cold water basins.
- Remove and store fan belts and access door gaskets.
- Ensure unit(s) is stored on level ground.
- Purge old bearing grease by new grease at start of storage period and repeat before start-up.
- Protect all black steel components with RUST VETO or equivalent corrosion protective material.

For complete instructions, please contact your local BAC-Balticare Representative

Balticare

BAC has established a specialized independent total care company called Balticare . The BAC Balticare offering involves all elements required to ensure a safe and efficient operation of your evaporative cooling products. From a full range of risk assessment to selective water treatment, training, testing, record keeping and annual system overview. For more details, contact BAC Balticare at www.balticare.com or you can also contact your local BAC representative for further information and specific assistance at www.BaltimoreAircoil.eu.

More Information

REFERENCE LITERATURE

- Eurovent 9-5 (6) Recommended Code of Practice to keep your Cooling System efficient and safe. Eurovent/Cecomaf, 2002, 30p.
- Guide des Bonnes Pratiques, Legionella et Tours Aéroréfrigérantes. Ministères de l'Emploi et de la Solidarité, Ministère de l'Economie des Finances et de l'Industrie, Ministère de l'Environnement, Juin 2001, 54p.
- Voorkom Legionellose. Minsterie van de Vlaamse Gemeenschap. December 2002, 77p.
- Legionnaires' Disease. The Control of Legionella Bacteria in Water Systems. Health & Safety Commission. 2000, 62p.
- Hygienische Anforderungen an raumlufttechnische Anlagen. VDI 6022.

INTERESTING WEB SITES

www.BaltimoreAircoil.eu;
www.Balticare.com;
www.eurovent-certification.com;
www.ewgli.org;
www.ashrae.org;
www.uniclima.org;
www.aicvf.org;
www.hse.gov.uk

Schedule

Type of Action	Action	Start-Up	Weekly	Monthly	Quarterly	Every Six Months	Annually	Shutdown
Checks and Adjustments	Hot water basin	X			X			
	Cold water basin and basin strainer	X			X			
	Operating level and make-up	X		X				
	Blow down	X		X				
	Sump heater Package	X				X		
	Belt tension	X		X				
	Drive alignment	X					X	
	Rotation of fan(s) and pump(s)	X						
	Locking Collar	X						
	Motor voltage and current	X			X			
	Unusual noise and/or vibration	X		X				
Inspections and Monitoring	General condition	X		X				
	Heat transfer section and drift eliminators	X			X			
	Spray Nozzles	X		X				
	Fan shaft	X				X		
	Axial Fan	X				X		
	Fan Motor	X				X		
	Electric Water Level Control Package (optional)	X				X		
	Hot water basin	X				X		
	TAB test (dip slides)	X	X					
	Circulating water quality	X		X				
	System overview	X					X	
	Record keeping	As per event						
Lubrication	Fan shaft Bearings	X			X			
	Motor Bearings*	X				X		
	Adjustable motor base	X				X		
Cleaning procedures	Mechanical cleaning	X					X	
	Disinfection **	(X)					(X)	(X)
	Drain Basin							X

Table 6: Recommended Maintenance & Monitoring Schedule

* only for motors with grease fittings with typical frame size > 200L (>30 kW)
** depends on applied code of practice

Notes:

1. Water Treatment and auxiliary equipment integrated in the cooling system may require additions to the table above. Contact suppliers for recommended actions and their required frequency.
2. Recommended service intervals are for typical installations. Different environmental conditions may dictate more frequent servicing.
3. When operating in ambient temperatures below freezing, the unit should be inspected more frequently (see Cold Weather Operations in the appropriate Operating and Maintenance Instructions).
4. For units with Belt Drive, tension on new belts must be readjusted after the first 24 hours of operation and monthly thereafter.

Model: ..... Serialnumber: .....

www.BaltimoreAircoil.eu
info@BaltimoreAircoil.eu
www.balticare.com
info@balticare.com

Baltimore Aircoil Int. nv
Industriepark - Zone A,
B-2220 Heist-op-den-Berg,
Belgium

Please refer to our website www.BaltimoreAircoil.eu for local contact details