OPERATING AND MAINTENANCE INSTRUCTIONS

RCT 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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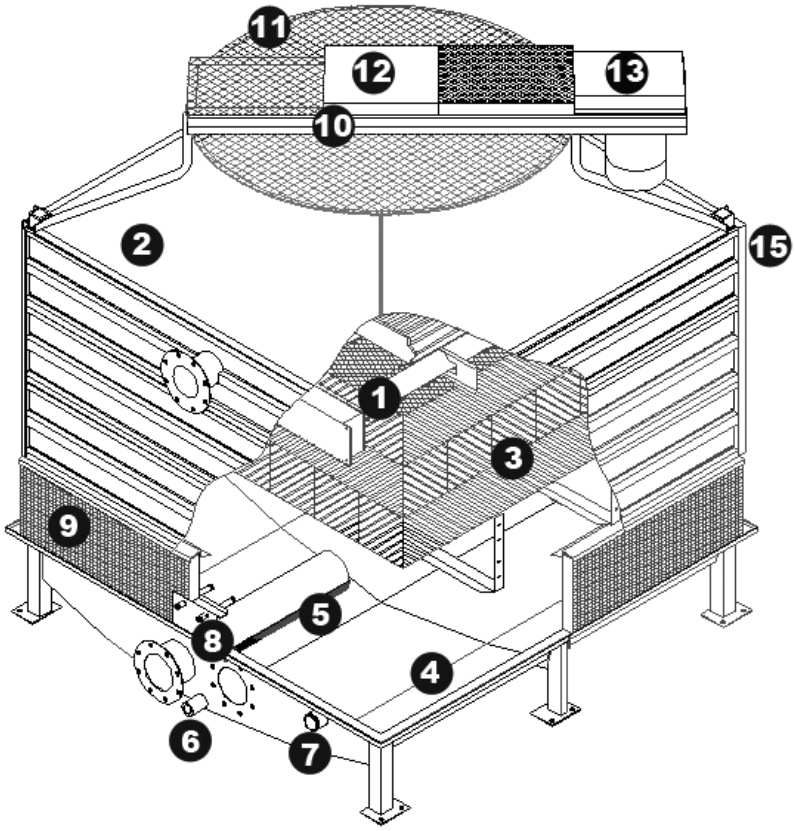
RCT Cooling Towers

TYPICAL CROSS SECTION



1. Water Distribution System
2. Eliminators (not shown)
3. Fill
4. Cold Water Basin
5. Strainer
6. Drain
7. Overflow
8. Make-up Assembly & Quick Fill
9. Louvres
10. Fan Shaft (not shown)
11. Fan (not shown)
12. Drive Train (not shown)
13. Motor Base (not shown)
14. Motor
15. Access door (not shown)

Note: Models RCT-2118 and RCT-2129 are direct drive and do not have drive train.

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 ambiant temperature range from -25°C to +40°C.

COOLING TOWERS

Maximum inlet pressure : 0.5 bar
Water inlet temperature : max. 55°C (std. fill) or 65°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.

Note: Actual spray pressure is indicated on technical data sheet supplied with order acknowledgement.

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.

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.

	Pultruded Composite
pH	6.5 to 9.5
pH during initial passivation	Not Applicable
Total hardness as ($CaCO_3$)	750 mg/l
Total alkalinity as ($CaCO_3$)	600 mg/l max.
Total Dissolved Solids	2500 mg/l max.
Conductivity	4000 µS/cm
Chlorides	750 mg/l max.
Sulfates*(*)*	750 mg/l max.*(*)*
Total suspended solids	25 mg/l max.
Chlorination (as free chlorine): continuous	2 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 1: Circulated Water Quality Guidelines for Pultruded Composite

Note: (*)Higher concentration of sulphates is allowed, provided the sum of chlorides + sulphates paramteters does not exceed 1500 mg/l for Pultruded composite.

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:

Chemical Treatment

1. The chemicals must be compatible with the materials of construction used in the cooling system.
2. Chemicals should be fed into the re-circulated water to avoid localised high concentrations, which may cause corrosion. Chemicals are normally fed into the pump discharge line. Batch feeding of chemicals does not afford adequate control of water quality and is not recommended.

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 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® hybrid 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

About Cold Weather Operation

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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Please 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

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.

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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.

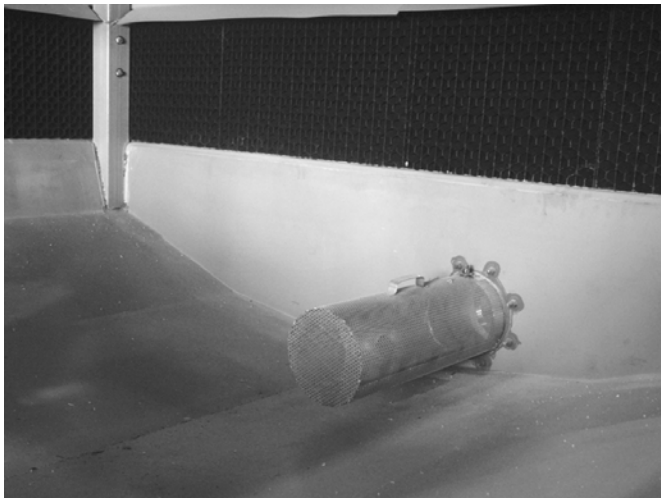

Figure 1: Basin Strainer

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 an operating water level of 140 mm below ledge on which louvres rest.

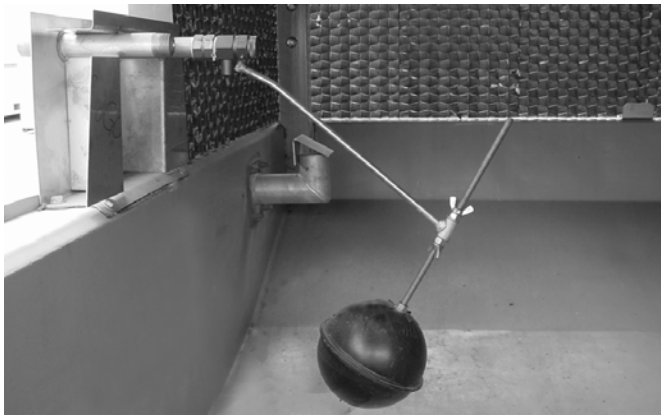

Figure 2: Mechanical Float Assembly

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 seat 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

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.

SUMP HEATERS CAN BE HOT.

BELT TENSIONING

Belt tensioning can be checked 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.

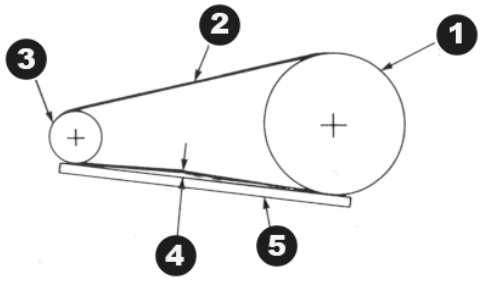

Figure 4: Fan Belt Check and Adjustment

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.
B	100 through 118	1.5	2.0
	125 through 140	1.5	2.5
	150 through 170	2.0	2.5
	>180	2.5	3.0

Table 2: 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.

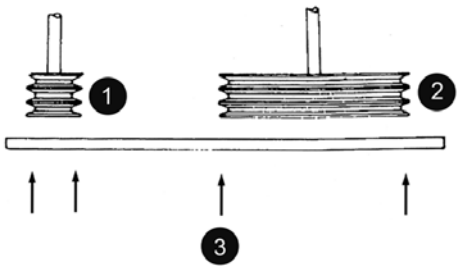

Figure 5: Checking sheave alignment

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).

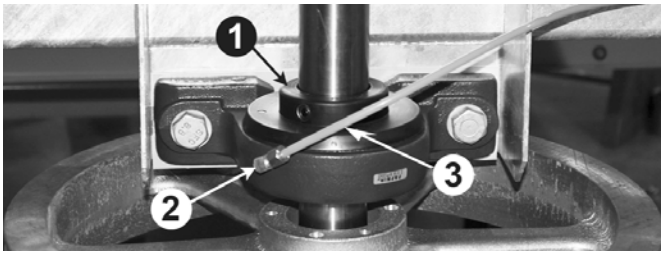

Figure 6: Locking Collar Assembly

1. Locking Collar
2. Lubrication Fitting
3. Extended Lubrication Line

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 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.

1. Insulation resistance test – minimum value should be 1 Mega Ohm (1.000.000 Ohms).
2. Thermistors, if fitted, should be checked for continuity with a multi-meter but never megger-tested.
3. Ensure supply voltage and frequency correspond to the motor nameplate rating.
4. Ensure shaft turns freely.
5. Wire the motor in accordance with the wiring diagram as shown on the motor nameplate and/or in the motor terminal box.
6. Turn on unit and check amp draw does not exceed nameplate rating.

Note: If motor is stored, it should be in a clean, dry place & have the shaft rotated occasionally. Storage areas should not be subject to vibration.

Rapid on-off cycling can cause the fan motor to overheat.

It is recommended that controls be set to allow a maximum of 6 on/off cycles per hour. When two speed motors are used, the motor starter should include a 15 seconds time delay when switching from high to low speed.

DRIVE TRAIN

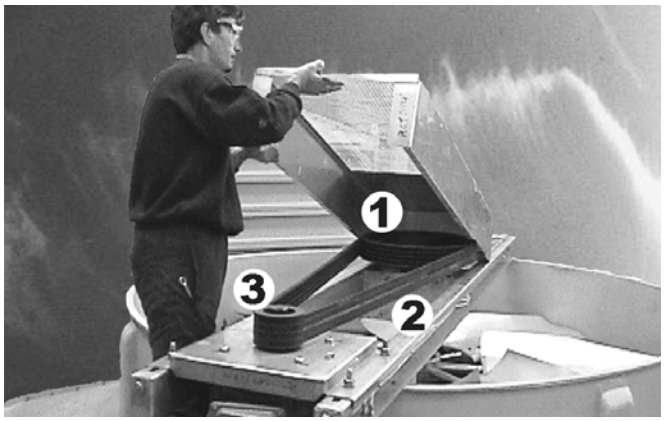

Figure 7: Drive Train

1. Fan Sheave
2. Belt
3. Motor Sheave

The DRIVE TRAIN consists of a specially designed belt, a fan sheave and a motor sheave. The high efficiency belt provides the premium quality necessary for evaporative cooling equipment service.

Together these components provide a highly reliable system with low maintenance requirements. The DRIVE TRAIN should be inspected periodically to check the belt tension, condition of the sheaves and belt, and when necessary adjust the tension. The recommended service intervals are specified elsewhere.

Initial Start-up: If the equipment was supplied in assembled major sections, no servicing is required prior to initial unit start-up since the drive has been tensioned and aligned at the factory. If equipment was supplied completely knocked-down (KD) then check drive alignment & belt tensioning as per procedures outlined above.

Seasonal Start-Up: Readjust the tension on the belt. Check condition of sheaves.

Operation: After initial unit start-up or the installation of a new belt, the tension must be readjusted after the first 24 hours of operation. Thereafter the condition of the belt should be checked monthly and the tension adjusted as necessary, but at least once every 3 months.

No service work should be performed on the drive train without first ensuring the fan and pump motors have been isolated, tagged and locked in the off position.

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 an debris
- presence of biofilms

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 PROCEDURE described in this manual (see page 12).

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.

The RCT Cooling Towers are constructed of corrosion resistant materials. The wet deck surface is made of en inert synthetic material that requires no protection against rot, decay, rust or biological attack. Other materials used in construction of the equipment, that are listed below, should be inspected regularly.

Stainless Steel Components

Stainless steel components should be inspected for sighs of blemishes or corrosion and cleaned with stainless steel wool as necessary. If more extensive corrosion is prevalent, contact you local BAC-Balticare Representative.

Fibreglass Re-Inforced Polyester (FRP) Components

FRP components should be inspected for accumulation of dirt and cleaned with soap and water as necessary. Also FRP components should be inspected for any penetration of gelcoat or veil. Such penetrations should be repaired immediately.

HEAT TRANSFER SECTION

Figure 8: Removable Fill

The fill 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 12).
Regular checking of the total aerobic bacteria count (TAB) and maintaining it within acceptable levels are the key to prevent fouling.

Note: When working on fill section or above fill section, fill bundle edges should be protected from damage by service personnel, tools or debris by placing a temporary cover of plywood, or other suitable material, over the top of the fill bundles.

DRIFT ELIMINATORS

Figure 9: Removable Drift Eliminators

The inspection procedure is as follows :

1. With fan(s) and pump(s) running visually check for areas with excessive drift loss.
2. Shut off fan(s) and pump(s) and visually check eliminators for
   - obstructions
   - damages
   - cleanliness
   - proper fit
3. If any of the above problems have been observed, stop fan(s) and pump(s) and remove eliminators.
4. Clean eliminators from debris and foreign matter. Remove dirt and obstructions. Replace damaged or ineffective eliminators.
5. Install eliminators and ensure they fit tightly with no gaps.

WATER DISTRIBUTION

The inspection procedure is as follows :

1. Shut off the fan(s), but leave the pump(s) running.
2. Check and adjust spray pressure, if required.
3. Remove the eliminators.
4. Check to see if the nozzles are producing the spray pattern shown in figure(s) below
5. Clean water distribution from dirt and debris. Ensure spray branches and nozzles are in place and clean. Replace damaged or missing nozzles.
6. Install eliminators and ensure they fit tightly with no gaps.
7. Start fan(s) and pump(s).

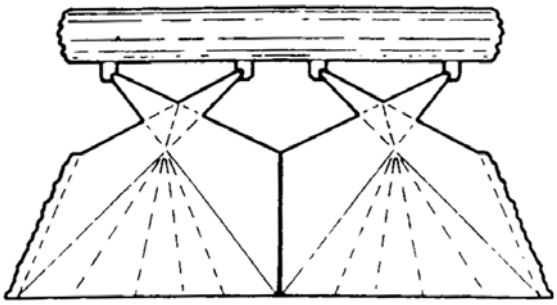

Figure 10: Nozzle Spray Distribution Type Cooling Tower

Figure 11: Removable Spray System

COMBINED INLET SHIELDS

Combined inlet shields are installed at the air inlet side. These will prevent UV light from shining into the sump water and will eliminate the suction of large airborne impurities and debris. In addition, they will prevent water from splashing out of the air intake side of the unit during fan cycling.

Inspect regularly and remove foreign objects that might impair air passage. Replace broken and missing parts when necessary. Failure to replace broken shields will result in water loss due to splash out.
You can remove the Combined Inlet Shields by simple loosening a single bolt on both ends of the air intake side. This allows simple removal of the combined inlet shields in small and easy to handle sections allowing full access to the sump section for maintenance.

Figure 12: Remove Combined Inlet Shields

FAN SHAFT

The fan shaft is fabricated from stainless steel. 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
- Pitch angle
- Bolt torque
- Excessive vibration
- Deterioration of fan assembly

Correct or adjust if necessary.

Note: Before any disassembly, fan blades and hub should be match marked to ensure proper blade pitch angle when reassembled.

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 13: Axial Fan on Direct Drive Unit

FAN MOTOR

The standard fan motor for this line of units is a TEFC (Totally Enclosed Fan Cooled) motor. The motor with frame size smaller or equal than 200L has permanently lubricated ball bearings and special moisture protection on the bearings, shaft and windings. The only servicing required during operation is to clean the outside surface of the motor at least quarterly to ensure proper motor cooling. After prolonged shutdowns, the motor insulation should be checked with a “megger” insulation tester before restarting the motor.
Do not wash down the motor unless it is IP66 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

If the motor is equipped with space heaters, these must be activated when the motor is idle in order to prevent condensation inside the motor.

Do no run/start the fan motor(s) when there is no heat load.

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.

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

ACCESS DOOR

The large access door is easily removed to provide complete access to drift eliminators, spray system and fill.

The access door should not be removed without first ensuring the fan and pump motors have been isolated, tagged and locked in the off position.

To remove the door, take out the louvres from door side. Loosen and remove the knobs that hold the door in place. Larger units are provided with convenient anchor points to assist in removing the door and securing the door to the unit when removed.

Figure 14: Access Door Anchor Points.

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 slinger/ 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.

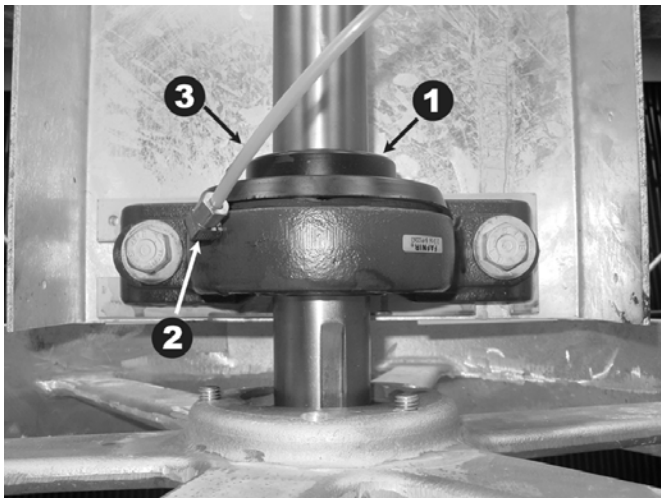

Figure 15: Ball Bearing

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

Figure 16: Ball Bearing

1. Bearing with Locking collar
2. Lube Fitting

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 3: 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.

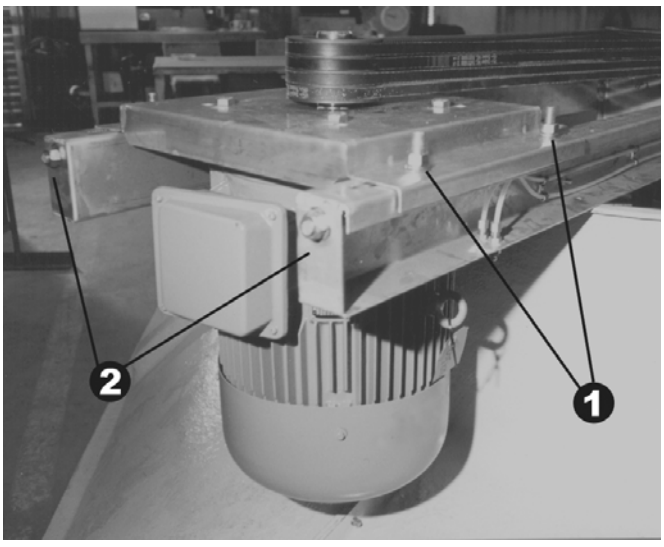

Figure 17: Adjustable Motor Base

1. Motor Base locking nuts (both sides)
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 and pump motor(s) and shut off make-up supply.
2. Remove screens, eliminators, 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 (coil/fill) . 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 and eliminators 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)
- Valve seal for water make-up valve
- Fan shaft bearings
- Spray nozzles and grommets
- Spray distribution branch grommets
- Set of belts

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 stor fan belts and access door gaskets.
- Ensure unit(s) is stored on level ground.
- For coil products N_2 is recommended to prevent internal corrosion.
- 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	Cold water basin and 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	
	Locking Collar	X						
	Rotation of fan(s) and pump(s)	X						
	Motor voltage and current	X					X	
	Drive train	X				X		
	Unusual noise and/or vibration	X		X				
Inspections and Monitoring	General condition	X		X				
	Heat transfer section	X				X		
	Combined Inlet Shields				X	X		
	Drift eliminators	X				X		
	Water distribution	X				X		
	Electric Water Level Control Package (optional)	X				X		
	Fan shaft					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			
	Adjustable motor base	X						
Cleaning procedures	Mechanical cleaning	X					X	
	Disinfection **	(X)					(X)	(X)

Table 4: Recommended Maintenance & Monitoring Schedule

** 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: .....

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