BALTIMORE
AIRCOIL COMPANY

DFCV Dry Cooler
DFCV-AD Adiabatic Cooler

OPERATING AND MAINTENANCE INSTRUCTIONS

Recommended maintenance and monitoring programme

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 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.

Checks and adjustments	Start-Up	Every month	Every 3 months	Every 6 months	Every start of adiabatic season, Spring
Adiabatic pre-cooler water flow	X		X		X
Adiabatic controller set-point	X		X		X
Tighten electrical connections	X			X	X
Rotation of fan(s)	X				
Motor voltage and current	X			X	X
Unusual noise and/or vibration	X		X		X

Inspections and monitoring	Start-up	Every month	Every 3 months	Every 6 months	Every start of adiabatic season, Spring
General condition of the equipment	X		X		X
Adiabatic pre-cooling pads	X		X		X
Heat transfer coil	X			X	
Water distribution pipe	X			X	X
City water strainer	X	X			X

Cleaning procedures	Start-up	Every month	Every 3 months	Every 6 months	Every start of adiabatic season, Spring
Adiabatic pre-cooling media	X		X		X
Adiabatic gutter system				X	X

Auxiliary equipment integrated in the cooling system may require additions to the table above. Contact suppliers for recommended actions and their required frequency.

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DFCV
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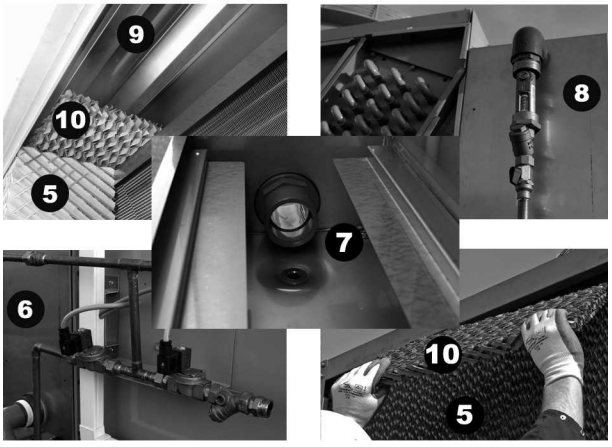
CONSTRUCTION DETAILS

TrilliumSeries Cooler

1. Heat exchanger
2. Coil headers
3. Casing
4. Fans
5. Pre-cooler media
6. Pre-cooler solenoid valve and water filter
7. Pre-cooler drain
8. Pre-cooler flow valve/meter
9. Pre-cooler water distribution header
10. Pre-cooler water distribution pads
11. Ambient temperature sensor



Details

DFCV
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GENERAL INFORMATION

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.

Ambient temperature at continuous full speed; full load operation ranges from -10°C to + 45°C. For cold climates, if optional thermostatically controlled heaters are employed, the temperature range can be extended from -40°C to + 45°C.

HEAT EXCHANGER COIL

- Design working pressure: 21 bar
- Design test pressure: 30 bar
- Design temperature: -20°C / +120°C

ADIABATIC PRE-COOLER OF TRILLIUMSERIES COOLER

- Design pressure: 10 bar
- Maximum fluid inlet temperature: 60 °C
- Fluids circulated through the inside of the coils must be compatible with the coil construction material.
- Design pressure: 3-7 bar
- Maximum fluid inlet temperature: +/- 20°C
- The water distributed on the adiabatic pre-coolers should be of potable supply.
- Water temperature not to exceed 20°C to avoid microbiological proliferation.

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.
The equipment outlet piping must be installed under the operating level of the equipment to prevent air suction and pump cavitation.

Safety precautions

All electrical, mechanical and rotating machinery constitutes 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 advice.
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.

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, personal protective equipment, procedures and tools must be used in handling, lifting, installing, operating, maintaining and repairing this equipment to prevent personal injury and/or property damage. Personnel must use personal protective equipment where necessary (gloves, ear plugs, etc...)

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 in place.
Since the equipment operates at variable speeds, steps must be taken to avoid operating at or near the installation's "critical speed".
For more information consult your local BAC Balticare representative.

ELECTRICAL SAFETY

All electrical components associated with this equipment should be installed with a lockable disconnect switch located within sight of the equipment.
In the event of multiple components, these can be installed after a single disconnect switch but multiple switches or a combination thereof are also allowed.
No service work should be performed on or near electrical components unless adequate safety measures are taken. These include, but are not limited to the following:

- Isolate the component electrically
- Lock the isolation switch in order to prevent unintentional restart
- Measure that no electrical voltage is present anymore
- If parts of the installation remain energized, make sure to properly demarcate these in order to avoid confusion

Fan motor terminals and connections may have residual voltage after unit shut-down. Wait five minutes after disconnecting the voltage at all poles before opening the fan motor terminal box.

LOCAL REGULATIONS

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

Disposal requirements

Dismantling of the unit and treatment of refrigerants (if applicable), oil and other parts must be done with respect to the environment whilst protecting workers from potential risks related to exposure to harmful substances.
National and regional legislation for material disposal and protection of workers should be taken into account with regard to:

- Appropriate handling of construction and maintenance materials when dismantling the unit. In particular when dealing with materials that contain harmful substances, such as asbestos or carcinogenic substances.
- Appropriate disposal of the construction and maintenance materials and components such as steel, plastics, refrigerants and waste water according to local and national requirements for waste management, recycling and disposal.

Non-walking surfaces

Access to and maintenance of any component needs to be performed in accordance with all local applicable laws and regulations. If the proper and required access means are not present, temporary structures need to be foreseen. Under no circumstance can one use parts of the unit, that are not designed as an access mean, unless measures can be taken to mitigate any risks that might occur from doing so.

Modifications by others

Whenever modifications or changes are made by others to the BAC equipment without written permission of BAC, the party who has done the modification becomes responsible for all consequences of this change and BAC declines all liability for the product.

Warranty

BAC will guarantee all products to be free from manufactured defects in materials and workmanship for a period of 24 months from the date of shipment. In the event of any such defect, BAC will repair or provide a replacement. For more details, please refer to the Limitation of Warranties applicable to and in effect at the time of the sale/purchase of these products. You can find these terms and conditions on the reverse side of your order acknowledgement form and your invoice.

About water care

The adiabatic pre-cooler of the unit has been designed as direct-water system, without water re-circulation, without pump. Therefore it is essential that the main cold-water supply connected to the adiabatic pre-cooler has adequate pressure and flow rate for the pre-cooler being installed.
The primary water treatment control method for the adiabatic pre-cooler is to provide sufficient water to the pre-cooler medium to keep it flushed. If sufficient water is not provided to completely wet and flush the entire pre-cooler medium surface, deposition will occur.

Many water related problems can be avoided if good system design and basic housekeeping practices are followed. However, water treatment chemicals should NOT be used INSTEAD of following these practices:

- Provide, good, even water distribution (See table: Minimum recommended adiabatic pre-cooler water flow rates)
- Clean distribution header on a regular basis
- Clean city water strainer on a regular basis
- Replace damaged or spent pre-cooler media

Refer to "Construction details" on page 4. Mains cold water is supplied to (6), and is fed to the water distribution system (9), via a flow valve/meter (8). The recommended mains water supply pressure is minimum 3 bar, and the flow valve/meter (8) needs to be adjusted at installation to feed a minimum water flow over the adiabatic pre-cooler (See table: "Minimum recommended adiabatic pre-cooler water flow rates")
The minimum water flow to be distributed over the adiabatic pre-cooler depends on:

- Climate conditions, i.e. evaporation rate at design conditions
- General water quality
- Water scaling tendency (practical scaling index)

The minimum water flow rates given in table "Minimum recommended adiabatic pre-cooler water flow rates", are valid for the following operating conditions:

- Maximum ambient temperature of 35 ºC at minimum relative humidity of 30 %.
- Minimum supply water quality (See table below "Minimum supply water quality").
- Practical scaling index of 5.5 – 8.0.

To control corrosion and scale, the water chemistry of the circulated water has to be kept within the water quality guidelines of the specific materials of construction used, as listed in the following table(s).

Water quality guidelines for adiabatic pre-cooler frame	Baltiplus 800™ coating
Temperature	< 20 °C
PH	6.5 – 9
Hardness as ($CaCO_3$)	50 – 500 mg/l
Alkaline as ($CaCO_3$)	< 500 mg/l
Total dissolved solids	< 1500 mg/l
Chlorides	< 200 mg/l
Sulfates	< 250 mg/l
Conductivity	1800 µS/cm
Bacteria Rate (CFU/ml, KBE/ml)	< 1000

Minimum supply water quality

For Ozone water treatment application:
- Stainless steel 316L execution is required.
- Ozone levels are to be maintained to 0.2 ppm ± 0.1 ppm for at least 90% of the time, with absolute maximum peaks of 0.5 ppm

Model	Number of fans	Minimum pre-cooler water flow per unit
DFCV-S9122-*	4 fans	14 l/min
DFCV-S9123-*	6 fans	22 l/min
DFCV-S9124-*	8 fans	28 l/min
DFCV-S9125-*	10 fans	36 l/min
DFCV-S9126-*	12 fans	44 l/min

Recommended adiabatic pre-cooler water flow rates

If any of the following happens:
- at ambient conditions exceeding the given maximum ambient conditions,
- with supply water quality data exceeding one or more of the concentration limits of above table "Minimum supply water quality",
- if the supply water has a Practical Scaling Index below 5.5,

Then:
- the water flow needs to be increased to higher levels to avoid rapid fouling and scaling of the pre-cooler medium. Contact your local BAC-Balticare representative for support.

Data for rapid calculations of Practical Scaling Index for adiabatic pre-cooler									
Conductivity (µS/cm) A		Temperature °C B		Calcium hardness (PPM as $CaCO_3$) C		Total alkalinity (PPM as $CaCO_3$) D		Alkalinity (PPM as $CaCO_3$) pHeq	
50-300	0.1	10-13	2.3	10-15	0.70	10-15	1.10	50	7.0
301-1000	0.2	14-17	2.2	16-25	0.90	16-25	1.30	100	7.5
1001-3000	0.25	18-21	2.1	26-40	1.10	26-40	1.50	200	7.9
3001-5000	0.27	22-27	2.0	41-70	1.35	41-70	1.75	300	8.2
				71-100	1.55	71-100	1.90	400	8.4
				101-140	1.70	101-140	2.10	500	8.5
				141-200	1.85	141-200	2.25		
				201-250	1.95	201-250	2.35		
				251-300	2.05	251-300	2.45		
				301-350	2.12	301-350	2.52		
				351-400	2.18	351-400	2.58		
				401-450	2.24	401-450	2.63		
				451-500	2.28	451-500	2.68		

Calculation of Practical Scaling Index

Instructions:

1. Obtain values of A, B, C and D from above tables
2. pHs = (9.3 + A + B) – (C + D)
3. Practical Scaling Index = 2 pHs – pHeq
   - if Index is 6.0, water is stable
   - if Index is above 6.0, water is scale dissolving
   - if index is below 6.0, water is scale forming

With Practical Scaling Index below 5.5, minimum recommended water flow in table "Minimum water flow rates" needs to be increased, contact your local BAC-Balticare representative for support.

Biological control

The adiabatic pre-cooler and its controls have been designed to minimize the risk of uncontrolled growth of algae, slimes and other micro-organisms such as Legionella:

1. Direct water system, no water recirculation
2. Complete drying of the pre-cooling system after each adiabatic cycle
3. Complete draining of all water distribution piping installed on the unit after each adiabatic cycle

CAUTION

The owner of the equipment is responsible for draining of all water piping feeding the adiabatic pre-cooler to avoid stagnant water conditions.

4. Use of potable water supply at temperatures of 20 °C or less, where Legionella is dormant
5. Aerosol free operation

When basic housekeeping practices are followed, and when the guidelines for operation and maintenance of this bulletin are followed, problems related to uncontrolled growth of micro-organisms will be avoided.

Chemical treatment

A biocide program for biological control can be implemented in conjunction with the maintenance program for increased operational safety. However, biological control should not be used in place of good housekeeping.
The two most commonly available biocides are chlorine and bromide. These chemicals have widespread success in general application; however, caution should be practiced when using them in the adiabatic pre-cooling system. Continuous dosages of chlorine or bromide could delignify the cellulose fibres of the pre-cooler media, and degrade the stiffening agents.

RECOMMENDED CHLORINE / BROMIDE DOSAGES

Continuous Treatment: Not required when basic housekeeping practices are followed, and when the guidelines for operation and maintenance of this bulletin are followed.
Shock Treatment: 3.0 – 5.0 PPM Free Halogens. Not recommended more often than once per quarter.

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COLD WEATHER OPERATIONS

About cold weather operation

BAC cooling equipment can be operated in sub freezing ambient conditions provided the proper measures are taken. Listed below are general guidelines which should be followed to minimize the possibility of coil 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 coil freezing

The best protection is the use of glycol or other anti freeze solutions in appropriate concentrations. The use of such solutions influences the thermal performance of the cooler and this should be taken into account, when selecting the model(s). The table below indicates the freeze protection range for various ethylene glycol concentrations (% by volume).

% Ethylene	Freeze protection
20%	-10°C
30%	-16°C
40%	-25°C
50%	-39°C

Freeze protection of ethylene glycol solutions

Glycol systems require specific inhibitors compatible with the materials of construction they come into contact with. These inhibitors generally come pre-mixed with the glycol additive for the cooling circuit.

If the process load is extremely light or shut off, it may be necessary to apply an auxiliary heat load during freezing conditions. Consult your local BAC Balticare representative for advice.

A full coil drain of the heat exchangers is not possible and as such, this method cannot be relied upon to protect fluid coolers operating under ambient temperatures that could drop below freezing point, from damage to the coil.

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OPERATING INSTRUCTIONS

TrilliumSeries Coolers with factory installed control panel with variable frequency drive

For units equipped with an electrical panel with variable frequency drive, the fan speed is controlled and the adiabatic pre-cooling is activated by a digital controller integrated into the electrical panel.

Control Panel with Variable Frequency Drive

Control logic

The fan speed is controlled on the basis of the actual process fluid temperature at the exit of the unit and the design leaving temperature, ensuring a minimum in electrical consumption and noise levels.
The adiabatic pre-cooling will be activated and stopped on the basis of a pre-programmed logical combination of the fan speed and the ambient temperature (release set-point). Default settings will not activate adiabatic pre-cooling unless all fans are running at maximum permissible speed and the dry-to-adiabatic release set-point is reached.
The adiabatic control logic is pre-programmed and is ready for operation.
Depending on the actual size of the installation, the controller pre-programmed PI process parameters may need to be adjusted.

Electrical Panel

At the outside of the electrical panel, the following components can be found:

- Emergency stop:
  Push to activate; rotate to de-activate

- Pad maintenance switch
  - AUTO: Pads will be (de)activated based on the units programming
  - HAND: Pads will be forced in wet mode resulting in adiabatic operation
- Power failure reset
  After a loss of main power, the unit may not start automatically. This button needs to be pressed after a technician has verified that it is safe to restart the unit.

Operating instructions Variable Frequency Drive

VFD CONTROL UNIT LCP:

1. The variable frequency drive installed on the unit is supplied with an LCP (Local Control Panel). The LCP can be used for local VFD control and changing program parameters locally.
2. For instructions on how to control the VFD and change its parameters, refer to VFD manufacturer's Operating Instructions delivered separately with the equipment.

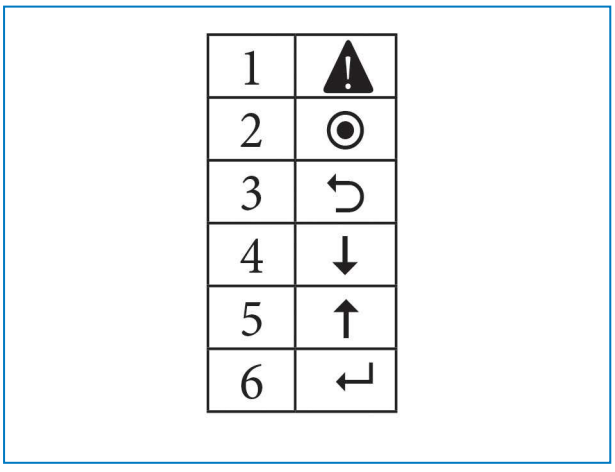
CAUTION

Changing the VFD parameters may result in a loss of communication and/or in a "hunting" phenomenon. Minimum frequency should not be set lower than 10Hz.

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

Operating instructions Digital Controller

There are four different menu's:
- Default Menu (consultation)
- Operator Menu (operational settings)
- Factory Menu (not accessible)



1. Alarm
2. Programme
3. Escape
4. Down
5. Up
6. Enter

Symbols on digital controller

DEFAULT MENU

The overview of different operational parameters and their settings (ex: temperatures, set point, theoretical frequency, actual frequency, and some general statuses)

ALARMS

This menu can be accessed by pressing on the Alarm button (*Triangle with exclamation mark*).
To acknowledge an alarm, press the Alarm button (*Triangle with exclamation mark*). If the source of the alarm has disappeared, so will the alarm message, otherwise the alarm will stay present.

OPERATOR MENU

To access this menu press ⊙.
After you select the desired menu, press ↵.
You can return to the default menu by pressing ↺.
Before you can enter the actual menu, a password needs to be given. The standard password is *"1234"*
The following items are available:

- Local on/off
- Set point (both summer and winter)
- PI parameters
- Cleaning cycle activation/deactivation + duration
- Day/night operation activation/deactivation + start/stop
- Day/night operation maximum frequency
- Restriction on water usage period
- Status of pre-cooler authorization
- Time delay on alarm messages
- Reset function on internal timers (VFD, pre-coolers)
- Communication address + baud rate
- Time/date
- Change access code

CAUTION

Changing the controller's parameters may result in an undesired operation of the unit such as a 'hunting' phenomenon, premature activation of pre-cooling (hence increased water consumption) or in late pre-cooling activation resulting in fluid outlet temperatures exceeding the design temperature.

Monitoring of process information

DRY CONTACTS AT TERMINAL STRIP IN ELECTRICAL PANEL

- Input:
  - Free cooling (NO)
- Output:
  - General Alarm (NO+NC)

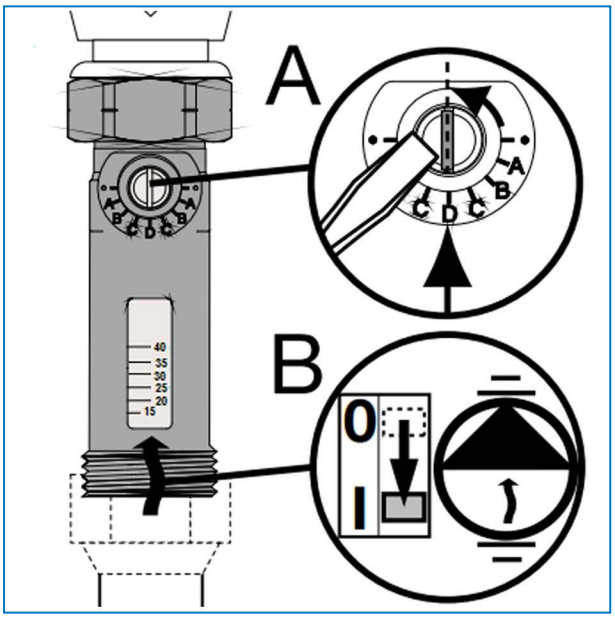
DIGITAL BUS SYSTEM

A bus connection from the digital controller for monitoring can be wired to the terminal strip. Depending on the required communication protocol, a different optional communications card can be installed in the controller.

Checks and adjustments

ADIABATIC PRE-COOLER WATER FLOW

A minimum water flow must be distributed over the adiabatic pre-cooler as per minimum water flow rates. (See table below "Minimum recommended adiabatic pre-cooler water flow rates").
The water flow will depend on the supply water pressure, and can be set by adjusting the adjustment screw on the water flow valve on the flow meter (See figure below). Read off the water flow at the underside of the float.



Water flow adjustment screw

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DFCV-S9124-*	8 fans	28 l/min
DFCV-S9125-*	10 fans	36 l/min
DFCV-S9126-*	12 fans	44 l/min

Recommended adiabatic pre-cooler water flow rates

The operation of the adiabatic pre-cooling sections is controlled by the digital controller.

ELECTRICAL CONNECTIONS

Check and tighten electrical contacts if required before commissioning the unit. Transport may loosen some of the contacts, posing a risk for overheating or voltage drops. Also during operation, half-yearly checks are recommended.

ROTATION OF FANS

Fans must rotate without obstruction in the direction indicated by arrows on the equipment.

MOTOR VOLTAGE AND CURRENT

Check the voltage and the current of all three legs of the fan 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.
The voltage must not fluctuate more than +/-10% and the imbalance between phases must not be greater than +/-2%.

CAUTION

Do not run/start the fan motor(s) when there is no heat load.

UNUSUAL NOISE AND VIBRATIONS

Unusual noise and/or vibration are the result of malfunctioning of mechanical components or operational problems (e.g. unwanted ice formation). If this occurs, a thorough 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

Once a year the general condition of the equipment should be inspected.
The inspection should focus on:

- Signs of corrosion
- Accumulation of dirt and debris

If there are any signs of blemishes or corrosion, the affected area should be thoroughly wire brushed and re-coated. The recommended procedure is to use a base coat of ZRC (Zinc Rich Compound). The ZRC is available from your local BAC-Balticare representative.

ADIABATIC PRE-COOLING MEDIA

About Adiabatic Pre-Cooling

Airborne debris is caught in the adiabatic pre-cooling media. They act as an air filter and as such protect the heat exchanger coil from rapid and excessive fouling. During adiabatic operation the media is 'rinsed' by water overfeed. The debris, that is rinsed from the media, will drain together with the excess water.

The pre-cooling media can be removed during cold seasons, as soon as it is guaranteed that the ambient temperature will no longer exceed the dry-to-adiabatic switch point. This will extend the service lifetime of the media. It will however increase the speed of fouling of the dry heat exchanger coil.
At least every quarter an inspection of the adiabatic pre-cooler media is recommended, also during mid-season and winter season when usually no adiabatic cycles would be needed.
The inspection should focus on:

- Signs of excessive fouling and scaling of the media
- Full and even wetting of the face area

Fouling

If excessive dirt and debris has accumulated on the pre-cooling media, it is recommended to rinse the media.
Refer to "Adiabatic pre-cooling media" on page 26 for the recommended procedure for cleaning and rinsing of the media.

Scaling

Scaling will deposit on the pre-cooling media, every time that the pre-cooling media dries at the end of each adiabatic cycle. The rate of scaling will depend upon:

- The number of adiabatic starts and stops per day
- The water quality
- The water flow over the adiabatic pre-cooler

The expected service lifetime of the pre-cooling media is 5 to 7 years if basic housekeeping practices and these operating and maintenance guidelines are followed.
If excessive scaling is accumulating too fast on the pre-cooling media, the following checks and adjustments need to be made:

- Check and adjust number of adiabatic starts and stops:
  refer to "Checks and adjustments" on page 17, section "Adiabatic Controller Set-Point".
- Check and adjust water quality:
  refer to section "About water care" on page 8
- Check and adjust water flow distributed over Adiabatic Pre-Cooler:
  refer to section "About water care" on page 8.

HEAT EXCHANGER COIL

The finned heat exchanger coil is susceptible to corrosion and entrapment of airborne particulates (coil fouling). The speed of coil fouling can be reduced, and the service lifetime of the finned coil can be extended, if the pre-cooling media is kept in place also during cold seasons, to act as air filter.
The heat exchanger coil requires periodic cleaning to maintain the highest operating efficiency possible under the environmental conditions in which the dry unit operates. Regularly scheduled coil cleaning makes a significant contribution to extending equipment lifetime and is an excellent source of energy conservation.
Periodic cleaning of the heat exchanger coil can be accomplished by a vacuum cleaner and/or pressurised air stream. In polluted environments cleaning will require commercially available coil cleaning agents. Cleaning coils by spraying them with water may remove large deposits but do little to remove pollutants. Removing dirt and salts requires a detergent to break the bond between the soil and the surface of the heat exchanger. However, if water spray is applied, the water pressure must never exceed 2 bar and the water jet must never be applied at an angle to the surface of the fin, but only in parallel to it.
Selecting a coil cleaner is important since the cleaner must neutralise and remove deposits on the surface of the coil. BAC does not recommend the use of alkaline and acidic coil cleaners. These coil cleaners can cause foaming action (oxides or hydroxides of aluminium) resulting in the stripping away of minute layers of the base alloy and the attached soil. Most of these foaming cleaners are harsh and known as reactive cleaning products. One way to recognise this type of cleaner is that normally it will be labelled as corrosive. The base ingredient of a coil cleaner should not be so harsh that it attacks the metal, coil coating or the personnel applying the cleaner.

An important concern when applying coil cleaners is rinse-ability. Most hydroxides tend to cling the surface unless sufficient wetting agents have been added to the formula to reduce surface tension of the solution. If the solution does not have enough wetting agents and is not rinsed thoroughly from the surface, the residual material can settle at the fin/tube interface and continue to attack the fin.
BAC recommends the use of the more sophisticated cleaners, known as a "surfactant system". They reduce surface tension, penetrate, emulsify, and dissolve the soils without the base alloy. Surfactant systems are safe for the coil alloy, they are free rinsing, they lift and remove deposits better than alkaline cleaners, and they are environmentally safe, as well as safe and easy to apply and rinse. Surfactant systems are almost always non-corrosive.

Fan replacement

If the circumstances arise and a fan assembly is required to be removed or replaced, great attention must be placed in the following notes:

1. The fans are always shipped completely with fan cowl and motor.
2. The fan cowl is bolted to the fan deck with a special bolt which needs to be reused to install the new fan assembly.
3. After the fan has been put in to position use the same screws and tighten with a torque wrench to 11 Nm.

CAUTION

If the bolts are too heavily tightened, the thread forming in the fan deck will be damaged which will result in an improper fan installation.

Cleaning procedures

CAUTION

Stainless steel parts can be sharp.
Avoid risk for cutting injury by wearing the proper protective equipment !

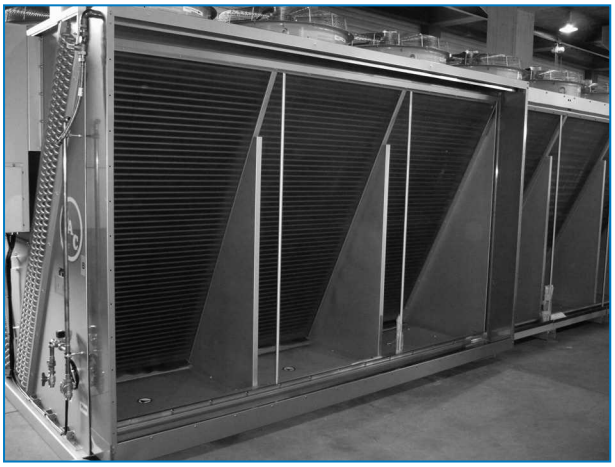
WATER DISTRIBUTION PIPE AND STRAINERS

The water distribution piping of the adiabatic pre-cooling section is supplied with in line water filters, filtering water particles from the incoming water.
Some solids in the water may accumulate in the water distribution header and need to be rinsed out at least twice a year. Also the city water filters or strainers need to be cleaned out at least once per month as follows: remove water filter access cap, remove strainer mesh and rinse mesh with clean water.

Water filter

The recommended procedure for cleaning of the water distribution header is:

1. Remove all the pre-cooling media from the pre-cooler section to give access to the water distribution header ends. Refer to "Cleaning procedures", section "Adiabatic pre-cooling media", subsection "Removal and replacement".



2. Unscrew the flexible sleeve connection by loosening the sleeve clamps. Use a 7 mm spanner or other appropriate tool.

Flexible sleeve connection

3. Gently pull out the water feed assembly.

Waterfeed connection

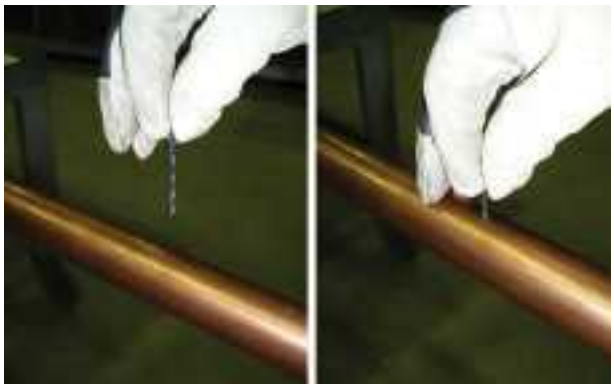
4. Pull the copper tube pipe downwards to release it from the plastic holders.

Release copper collector from plastic holders

5. Carefully remove the collector from the pre-cooler.

Remove copper waterfeed pipe

6. Use a 3,5 mm drill to clean by hand the spraying holes from any dirt accumulation.



Clean spraying holes

7. On the collector there is an alignment hole. Mark its position on the opposite side of the collector to assist you in placing the collector back in the pre-cooler section.

Alignment hole

8. One of the plastic holders has a longer screw to assist in the alignment of the collector. Make sure that you have the correct side of the collector facing the plastic holder.

Plastic clip with longer screw

9. First put the collector through the hole of the side gable. Note that this is the opposite side of the alignment hole.

Installation of copper waterfeed pipe

10. Use the mark you made on the collector to locate the correct position of the alignment hole. Push the collector upward to clamp it securely into the plastic holders.

Alignment of waterfeed pipe

11. Reposition the water feed assembly. Note that it should go +/- 30 mm inside the rubber tube.

Waterfeed assembly

12. Tighten the sleeve clamps to secure the water feed assembly in place.

Flexible sleeve connection with sleeve clamps

13. Connect the flexible pipe to the city water supply. Use the "pad maintenance" switch to open the city water valve. Check the collector for any holes that remain clogged. If some holes are still clogged, repeat the procedure.

14. Place the pre-cooling media back in the pre-cooler section. Refer to section "Adiabatic pre-cooling media" on the next page.

Adiabatic pre-cooling media

CLEANING

The digital controller provides automatic periodic cleaning of the pre-cooling media.
In extraordinary circumstances, if manual rinsing is required, the recommended procedure for cleaning of the pre-cooling media is to turn the "pad maintenance switch", provided on the door of the electrical panel, to the "Hand" position for a period of 1 to 2 hours. Never use a brush or high-pressure hose for cleaning of the adiabatic pre-cooling media.

REMOVAL AND REPLACEMENT

The expected service lifetime of the pre-cooling media is 5 to 7 years if basic housekeeping practices and these operating and maintenance guidelines are followed. If severe disposition causes reduced humidification efficiency and reduced airflow, it is recommended that the pre-cooling media is replaced. New adiabatic pre-cooling media are available from your local BAC-Balticare representative.
Media removal/replacement procedure:

1. Verify that the pre-cooling media are DRY! Removing a wet pad will create debris falling into the unit.
2. Remove top plate.
3. Remove water distribution pad.
4. Remove pre-cooling media.

For re-installation of the media follow steps 4 to 1 in reverse sequence.

Remove top plate

Removal water distribution pads

Removal pre-cooling media

CAUTION

The pre-cooling media have a front side and a back side and need to be (re)installed in the correct position to ensure full wetting over the depth of the media and to ensure maximum efficiency. The blue coloured side needs to be at the outside.

GUTTER SYSTEM

Connect bottom water drains of all pre-cooler sections at both sides of the unit to evacuate excess water.
The surplus of water distributed over the adiabatic pre-cooling media during adiabatic operation is collected into a gutter and drained to the sewer via one or two different drains per pre-cooler side.
8-fan, 10-fan and 12-fan coolers are equipped with 4 separately shipped adiabatic pre-cooling sections, 2 per side.
Each adiabatic pre-cooler section is equipped with a separate bottom drain guaranteeing full emptying and drying of the gutter system after each adiabatic cycle.
Refer to the table below for the number of adiabatic pre-cooler sections and number of drains per model.

Model	Number of fans	Number of adiabatic pre-cooling sections/cooler	Number of bottom drains/cooler
DFCV-S9122-*	4	2	2
DFCV-S9123-*	6	2	2
DFCV-S9124-*	8	4	4
DFCV-S9125-*	10	4	4
DFCV-S9126-*	12	4	4

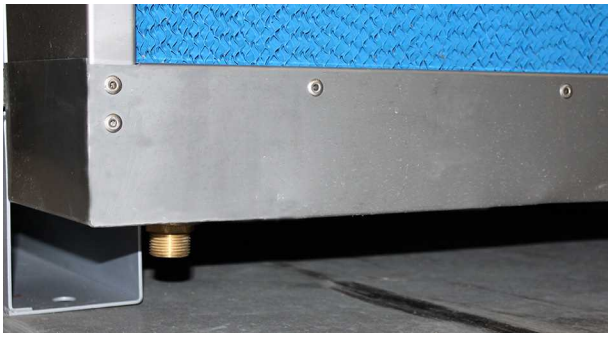
Model	Number of fans	Number of adiabatic pre-cooling sections/cooler	Number of bottom drains/cooler
DFCV-EC9122-*	4	2	2
DFCV-EC9123-*	6	2	2
DFCV-EC9124-*	8	4	4

Model	Number of fans	Number of adiabatic pre-cooling sections/cooler	Number of bottom drains/cooler
DFCV-EC9125-*	10	4	4
DFCV-EC9126-*	12	4	4
DFCV-EC9127-*	14	4	4

Number of adiabatic pre-cooler sections and drains

Each pre-cooler section has a sloping pan, assuring complete water drainage and discharge of any floating solids to the sewer. Larger debris will however accumulate and settle in the gutter system and may be too large to drain via the bottom drain and finally may block the bottom drain.

Draining system – inside



Draining system - outside

It is therefore necessary to regularly clean the adiabatic gutter system to remove all solids. Access for cleaning is given to the inside of the gutter system after removal of the pre-cooling media. For cleaning sequence see table "Recommended Maintenance and Monitoring Programme" on page 1.

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DFCV
DFCV-AD
COMPREHENSIVE MAINTENANCE

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, it also ensures 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. Make sure you include the unit serial number when ordering any parts.

Prolonged outdoor stay

Should the unit(s) be stored outside prior to installation and/or start-up for approximately one month (shelf life) 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 of all motors installed on the unit(s) once per month, at least 10 revolutions. This includes the pump motor.
- Add desiccants to control panel interiors.
- Wrap motor in non-plastic protective material.
- Keep drains open on the cold water basins.
- Ensure unit(s) is stored on level ground surface.
- If the unit is equipped with VFD (Variable Frequency Drive), the VFD must be activated at least once every 6 months to prevent damage to the VFD. This means that power supply is needed.

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

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DFCV
DFCV-AD
FURTHER ASSISTANCE & INFORMATION

Assistance

BAC has established a specialized 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.
For more details, 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 WEBSITES

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

ORIGINAL DOCUMENTATION

This manual is originally made in English. Translations are provided for your convenience. In the event of discrepancies, the English original text shall prevail over the translation.

COOLING TOWERS

CLOSED CIRCUIT COOLING TOWERS

ICE THERMAL STORAGE

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