

# OPERATING AND MAINTENANCE INSTRUCTIONS



DFCV  
DFCV-AD










Dry Cooler  
TrilliumSeries Cooler

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](http://www.BACService.eu).



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### DFCV - V-Type Dry Cooler



- 1. Heat Exchanger Coil
- 2. Coil Headers
- 3. Casing
- 4. Fans

### DFCV-AD - TrilliumSeries Cooler



## TrilliumSeries Cooler



- 5. Pre-Cooler Media
- 6. Pre-Cooler Solenoid Valve and Water Filter
- 7. Pre-Cooler Drains
- 8. Pre-Cooler flow Valve/Meter
- 9. Pre-Cooler Water Distribution Header
- 10. Pre-Cooler Water Distribution Pads
- 11. Ambient Temperature Sensor

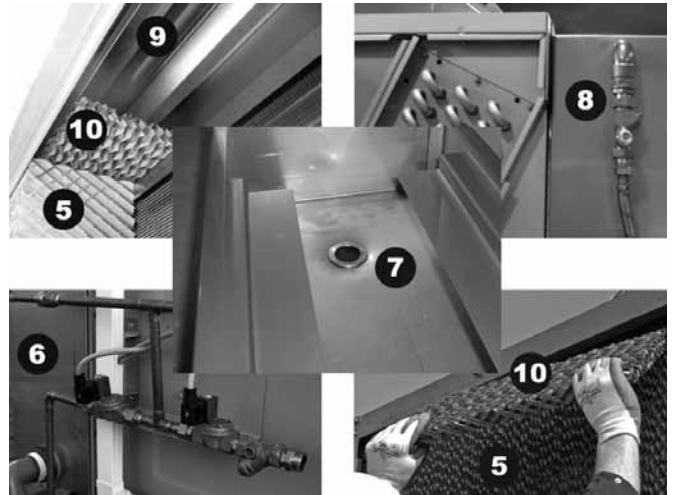


Figure 1: Details

## 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 down -40°C to +45°C.

### HEAT EXCHANGER COIL

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.

### ADIABATIC PRE-COOLER OF TRILLIUMSERIES COOLER

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.

## 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.

### 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 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.

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 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, unless motors are electrically isolated.

### 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

### ONLY FOR TRILLIUMSERIES COOLER

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 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 of the unit on page 2: Mains cold water is supplied to (6), and is fed to the water distribution header (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 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 2, are valid for the following operating conditions:

- maximum ambient temperature of 35 °C at minimum relative humidity of 30 %.
- minimum supply water quality (See Table 1)
- practical scaling index of 5.5 – 8.0

### Water Quality Guidelines For Adiabatic Pre-Cooler

Temperature	< 20 °C
PH	6.5 – 9
Hardness as (CaCO <sub>3</sub> )	30 – 500 mg/l
Alkaline as (CaCO <sub>3</sub> )	< 500 mg/l
Total Dissolved Solids	< 1500 mg/l
Chlorides	< 200 mg/l
Sulfates	< 300 mg/l
Conductivity	1800 μS/cm
Bacteria Rate (CFU/ml, KBE/ml)	< 1000

Table 1: Minimum Supply Water Quality

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

Table 2: Minimum Recommended Adiabatic Pre-Cooler Water Flow Rates

At ambient conditions exceeding the given maximum ambient conditions

or

with supply water quality data exceeding one or more of the concentration limits of above Table: Minimum Supply Water Quality

or

if the supply water has a Practical Scaling Index below 5.5, 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 <sub>3</sub> ) C		Total Alkalinity (PPM as CaCO <sub>3</sub> ) D		Alkalinity (PPM as CaCO <sub>3</sub> ) 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		

Table 3: Calculation of Practical Scaling Index





Instructions:

1. Obtain values of A, B, C and D from above tables
2.  $pH_s = (9.3 + A + B) - (C + D)$
3. Practical Scaling Index =  $2 pH_s - pH_{eq}$

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 2 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.

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**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.



## About Cold Weather Operation

BAC dry coolers can be operated in subfreezing ambient conditions provided the proper measures are taken against coil freezing. 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 Freeze-up

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 dry 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

Table 4: Freeze Protection of Ethylene Glycol Solutions

If the system must be operated with water, both of the following conditions must be met simultaneously :

1. Maintain a minimum flow through the unit at all times.
2. Maintain a minimum heat load, so that the temperature of the water leaving the coil(s) will not fall below 10° C based on -14° C ambient temperature and 20 m/s wind velocity.

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, Fluid Coolers operating under ambient temperatures that could drop below freezing point, must contain liquid with an antifreeze agent.



## 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.



Figure 2: 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 high speed and the dry-to-adiabatic release set-point is reached.

The adiabatic control logic is pre-programmed in the digital controller and into the variable frequency drive, and is ready for operation.

Depending on the actual size of the installation, the 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 DIGITAL CONTROLLER

There are four different menu's:

- default menu (consultation)
- alarms (status of different alarms)
- operator menu (operational settings)
- factory menu (not accessible)

### Default Menu

The overview of different operational parameters and there 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", represented by an alarm bell.

To acknowledge an alarm, press the alarm button. 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 the "Prg" button.

After you select the desired menu, press "Enter".

You can return to the default menu by pressing "Esc".

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

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**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.**

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### OPERATING INSTRUCTIONS VARIABLE FREQUENCY DRIVE

#### VFD Control Unit LCP:

1. The variable frequency drive installed on the unit is supplied with a 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.

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

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

### MONITORING OF PROCESS INFORMATION

A bus connection from the digital controller and monitoring is wired from the terminal strip. For a specific communication protocol, if required, an optional communications card can be installed in the controller.

#### Dry Contacts

Input:

- On/off release (NO)
- Free cooling (NO)

Output:

- General Alarm (NO+NC)



## Checks and Adjustments

### ADIABATIC PRE-COOLER WATER FLOW OF TRILLIUMSERIES

A minimum water flow must be distributed over the Adiabatic Pre-Cooler as per Minimum Water Flow Rates. ( See Table "Minimum Recommended Adiabatic Pre-Cooler Water Flow Rates on page 5). 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.



Figure 3: Water Flow Adjustment Screw

### ADIABATIC CONTROLLER SET-POINT

The operation of the Adiabatic Pre-Cooling sections can be controlled by an ambient temperature signal and a digital controller. Whatever the control signal used, the method of control should limit the start and stop to maximum 1 per day per Adiabatic Pre-Cooling side, this to increase the service life of the Pre-Cooler media. If the number of daily starts and stops exceeds 1 per day, it is recommended that the controller's set points are adjusted. The Pre-Cooler can be operated to allow a higher number of starts and stops which could reduce total annual water consumption, however, this practice will reduce the service lifetime of the Adiabatic Pre-Cooler media drastically.

### ELECTRICAL CONNECTIONS

If during transport, some of the electrical contacts may have loosened, these should be tightened to prevent overheating or voltage drops. Also during operation, half-yearly checks are recommended.

### ROTATION OF FANS

Fans must rotate without obstruction and must rotate in the correct direction, which is 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%.



**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. 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 of the casing
- accumulation of dirt and debris on the casing

If there are any signs of blemishes or corrosion, the affected area only should be thoroughly wire brushed and recoated. The recommended procedure is to use a base coat of ZRC (Zinc Rich Compound). The externals of the unit can be touched up with Zinc Aluminium paint (Baltiplus), if necessary. Both the ZRC and the Baltiplus paint are available from your local BAC-Balticare representative.

### ADIABATIC PRE-COOLING MEDIA OF TRILLIUMSERIES

#### About Adiabatic Pre-Cooling

Airborne debris is caught in the Adiabatic Pre-Cooling media acting as an air filter and as such protecting the heat exchanger coil from rapid and excessive fouling. During adiabatic operation the media is 'rinsed' by water overfeed. The debris, which is rinsed from the media, will drain together with the excess water.

The Pre-Cooling Media can be removed during cold season's, as soon as it is guaranteed that the ambient temperature will no longer exceed the dry-to-adiabatic switchpoint. 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 *Cleaning Procedures* 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 2 to 3 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 Adjustment", section "Adiabatic Controller Set-Point" on page 8

- Check and adjust water quality:  
refer to section "About Water Care" on page 4
- Check and adjust water flow distributed over Adiabatic Pre-Cooler:  
refer to section "About Water Care" on page 4

## HEAT EXCHANGER COIL

The Dry Cooler 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 cooler 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 rinseability. 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.

## Cleaning Procedures

### 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 however 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.



Figure 4: 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" on page 12.



Figure 5: Unit without Pre-cooling Media

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



Figure 6: Flexible Sleeve Connection



3. Gently pull out the water feed assembly



Figure 7: Waterfeed Connection

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



Figure 8: Release Copper Collector from Plastic Holders

5. Carefully remove the collector from the pre-cooler



Figure 9: Remove Copper Waterfeed Pipe

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



Figure 10: 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.



Figure 11: 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.



Figure 12: 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.



Figure 13: 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.



Figure 14: Alignment of Waterfeed Pipe

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



Figure 15: Waterfeed Assembly

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



Figure 16: 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.



Figure 17: Waterfeed Assembly connected to City Water Connection with Flexible Pipe

14. Place the Pre-Cooling Media back in the pre-cooler section. Refer to "Cleaning Procedures", section "Adiabatic Pre-Cooling Media", subsection "Removal and Replacement" on page 12.

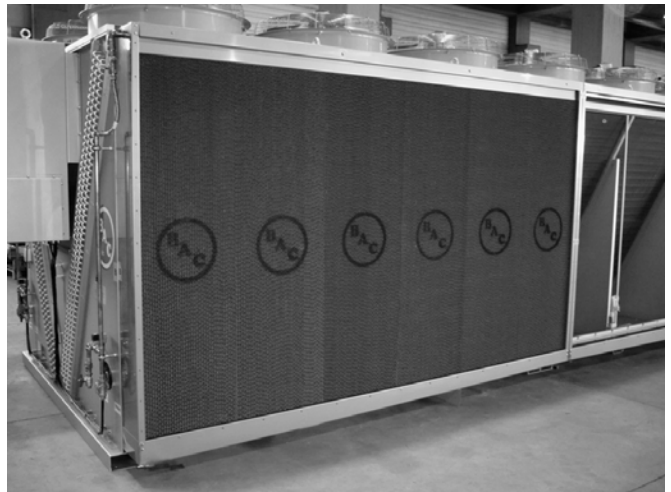


Figure 18: Unit with adiabatic Pre-Cooling Media installed



## 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 internal 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 2 to 3 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 is available from your local BAC-Balticare representative.

Media removal/replacement procedure:

1. Remove top plate.
2. Remove water distribution pad.
3. Remove pre-cooling media.

For re-installation of the media follow steps 3 to 1 in reverse sequence.



Figure 19: Remove Top Plate



Figure 20: Removal Water Distribution Pads



Figure 21: Removal pre-cooling media

### Important Note:

The pre-cooling media has a front side and a back side and needs 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 colored side needs to be at the outside.

### Gutter System

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 TrilliumSeries 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

Table 5: 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.



Figure 22: Draining System – inside



Figure 23: 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.

## 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.

!

**IMPORTANT: 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.**



## About Comprehensive Maintenance

In order to ensure maximum efficiency and minimum downtime of your adiabatic 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 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 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.
- 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

## 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](http://www.balticare.com) or you can also contact your local BAC representative for further information and specific assistance at [www.BaltimoreAircoil.eu](http://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. Ministerie 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 raumluftechnische Anlagen. VDI 6022.

### INTERESTING WEB SITES

[www.BaltimoreAircoil.eu](http://www.BaltimoreAircoil.eu);  
[www.Balticare.com](http://www.Balticare.com);  
[www.eurovent-certification.com](http://www.eurovent-certification.com);  
[www.ewgli.org](http://www.ewgli.org);  
[www.ashrae.org](http://www.ashrae.org);  
[www.uniclima.org](http://www.uniclima.org);  
[www.aicvf.org](http://www.aicvf.org);  
[www.hse.gov.uk](http://www.hse.gov.uk)



## Schedule

Type of Action	Action	Start-Up	Every Month	Every Three Months	Every Six Months	Every Start of Adiabatic Season, Spring
<b>Checks &amp; Adjustments</b>	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
<b>Inspections and Monitoring</b>	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
<b>Cleaning Procedures</b>	Adiabatic Pre-Cooling media	X		X		X
	Adiabatic gutter system				X	X

Table 6: Recommended Maintenance & Monitoring Schedule

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

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