



**BALTIMORE
AIRCOIL AUSTRALIA**

TrilliumSeries™ Fluid Cooler With ECOFLEX Controls

RIGGING, OPERATION & MAINTENANCE MANUAL



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OPERATIONS & MAINTENANCE »

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Introduction

Congratulations on the purchase of your new BAC heat rejection system.

The system is designed for straightforward installation, operation and maintenance.

This manual has been provided to help you install and operate your BAC system so that it gives you many years of efficient and trouble free service.

Please spend the time to acquaint yourself with your system by reviewing this manual.

IMPORTANT NOTE: The contents of this manual are subject to change without notice. Please check with your BAC representative for any updates that may apply since your receipt of it.

This manual has been specifically prepared for Economech against BAC Job 14J0376,
Customer order number PO1143 2100



Caution

- **CAUTION:** To prevent serious injury, damage to property or equipment, it is important that all instructions, warnings and labels are read and adhered to before operating the unit.



Warning

- **WARNING:** HIGH voltage is used in the operation of this equipment. DEATH or SERIOUS INJURY may result if personnel fail to observe safety precautions.
Work on electrical equipment should not be undertaken unless the individual(s) have been trained in the proper maintenance of equipment and is (are) familiar with its potential hazards.
Lockout procedures must be followed. Take care to discharge any capacitors likely to hold dangerous potentials.



Information

Warranty regarding potential coil leaks is very specific:

A 12 month coil warranty is offered for non mechanical punctures, external corrosion or coil deterioration rendering the coil ineffective. Accordingly it is important the purchaser (or agent) satisfy themselves that upon delivery, and before installation, the coil has been delivered free of leaks (and remains pressurised). After the purchaser/agent has accepted delivery and is satisfied that the system delivered is as per order and is free of any faults and is holding pressure, leaks as a result of mechanical damage (AFTER DELIVERY) are not the responsibility of BAC and are excluded from the warranty.

IF A SYSTEM IS IDENTIFIED AS NOT HOLDING PRESSURE UPON DELIVERY, IT IS COVERED BY THE 12 MONTH WARRANTY PROVIDED BAC IS NOTIFIED PRIOR TO INSTALLATION.

1 Contact Information

For assistance with your BAC heat rejection unit please contact your local representative or agent.
Additional contact information is also provided below.



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2 Principle of Operation

The TrilliumSeries™ Fluid Cooler system consists of 4 main parts:

- i. Evaporative pre-cooling system (open circuit) including (recirculation pump, water distribution system, water sump and evaporative media).
- ii. Finned-tube heat exchanger (closed circuit).
- iii. Variable speed fans.
- iv. Control panel, which includes PLC, power supply and contactors.

These heat rejection systems extract energy from air by evaporating water running through the evaporative media. Since no external energy is provided for this process, the result is a reduction in the air temperature, which is used to cool the fluid passing through a conventional finned-tube heat exchanger, refer to [Fig1].

The design and operation of the unit is to minimise utility waste and impact on the environment. Legionella risk is reduced to a negligible level through a combination of factors; low precool water temperature, daily water dump and dry-out cycle, and low air velocity over the high efficiency evaporative cooling pads to prevent any moisture carryover.

These features remove the need for water treatment chemicals or services which in turn allow the dump water to be used for other benign downstream purposes such as irrigation.¹

The unit can be configured to operate on water efficiency or power efficiency cycles. Where water efficiency is the prerequisite, the cooling evaporator pads should be run wet only under higher ambient conditions. Where energy efficiency is important, the evaporative precooling can be operated for extended periods of time, thereby reducing the air flow and fan speed to save power as well as reduce chiller power consumption.

The unit is supplied with an integral control panel.² The unit can be monitored and the fans and pre cool operated remotely via an RS485 connection using MODBUS or BACnet protocol.

- 1 You should refer to local environmental regulations to determine the types of reuse that are allowed.
- 2 When operated remotely, it is recommended BAC is consulted to ensure the system operates both within legislated and operational design guidelines.

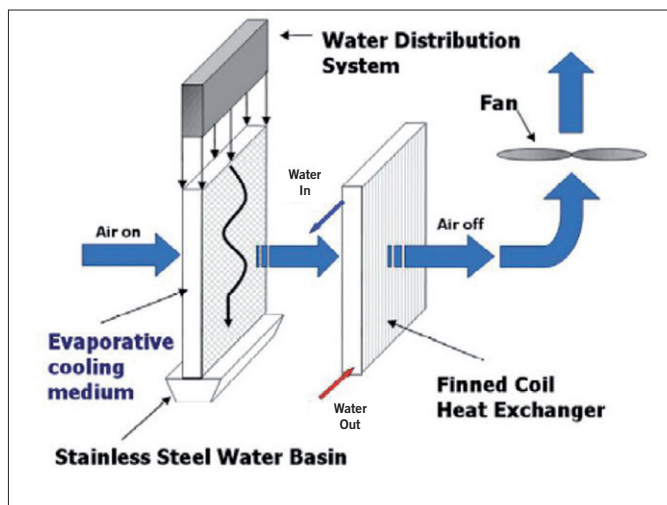


Figure 1

3 Legislation, Codes of Practice and Guidance Notes

When installing and operating your BAC system, consideration needs to be given to compliance with local legislation, codes of practice and bylaws.



Information

Your TrilliumSeries™ Fluid Cooler system is NOT a cooling tower as defined under state or federal legislation and as such will not be subject to protocols designed to minimise the risk of Legionella³ growth and dissemination.

For the purpose of installation guidance, your BAC TrilliumSeries™ Fluid Cooler heat rejection system falls under the definition of “Evaporative air conditioning equipment” as given in Australian Standards

AS/NZS 3666.1:2002, Part 1:
Design, Installation and Commissioning.

and

AS/NZS 3666.2:2002, Part 2:
Operation and maintenance.

Note that compliance with this standard is not legislated for in all States. It does however represent the most comprehensive installation and operational guidelines and as such meets the minimum requirements of all States⁴.

The standards provide the following recommendations for evaporative air-conditioning equipment which would also be applicable to a TrilliumSeries™ Fluid Cooler⁴:

Part 1: Installation

- Equipment should comply with *AS2913-2000: Evaporative air-conditioning equipment where applicable.*
- All water supply and drainage systems should comply with *AS3500.1.2: Plumbing and drainage - Water services* and *AS3500.2.2 Plumbing and drainage - Sanitary plumbing and drainage and associated products* should comply with *MP52-2001: Manual of authorisation procedures for plumbing and drainage products.*
- The equipment should be located further than 6 metres from an air intake in accordance with *AS1668.2 The use of ventilation and air conditioning in buildings - Ventilation design for indoor air contaminant control.*

Part 2: Operation & Maintenance

- The following components should be inspected every 3 months while the system is in use:
 - a. Sump – drained and cleaned
 - b. Wetted pads – Cleaned and replaced as necessary
 - c. Water strainer – cleaned when necessary
 - d. Drainage system – flushed with clean fresh water
- The system should be drained when not in use for a period greater than a month. The BAC controller (optional) provides this function where fitted. Where a system is purchased without a BAC supplied controller and is controlled remotely, this functionality should be incorporated into the control algorithm.
- We suggest that this manual is readily accessible at the installation site for easy access by operating, maintenance and regulatory personnel.

3 Legionella is the bacteria which is the cause of Legionnaires disease.

4 It is recommended the standard be obtained for a full discussion of the requirements.



Information

The BAC TrilliumSeries™ Fluid Cooler system is required to be installed by an appropriately qualified technician or appropriately qualified industrial plumber.

4.1 General

4.1.1 Health & Safety

Ensure the following guidelines are observed:

- The electrical supply is suitable for the equipment supplied.
- Water make-up and drainage (storm water) is available.
- The TrilliumSeries™ Fluid Cooler is installed by appropriately qualified electrical / industrial plumbing trades people in accordance with relevant national codes and standards of electrical /refrigeration/plumbing installation practice.

Australian Standard Codes are shown below:

- Occupational Safety & Health Guidelines NOHSC: 7019.
- AS 1345 Identification of Pipe, Conduits & Ducts.
- AS 1657 Fixed Platforms, Stairways and Ladders.
- AS 1674.1 Fire Precautions.
- AS 3000 Wiring Rules.
- AS 3500 National Plumbing & Drainage Code.
- AS/NZS 3666 Air Handling and Water Systems of Buildings – Microbiological Control.

4.1.2 Flammability Risk

The precool pad represents the only potential flammable component of the TrilliumSeries™ Fluid Cooler. The precool pad will only ignite while an external ignition source is applied.

Installers need to identify and manage any potential ignition inception hazards.

As part of the installation procedure it is necessary to ensure all electrical connections are adequately tightened and secured prior to commissioning.

4.1.3 Checks at Delivery

The following items should be checked prior to installation:

- a. Inspect the system for shipping damage. It is a warranty requirement that BAC must be notified immediately of any obvious faults or defects or discrepancies between the item/s delivered against those ordered. All systems are shipped pressurised and it is a requirement that it is verified the system/s were holding pressure upon delivery.
- b. Ensure services to the system (power, fresh water and drainage) are adequate and meet local code requirements. Care should be taken to ensure adequate water is available to replace evaporative water losses, which can be significant during times of high ambient temperature.
- c. For ground level installation, fencing or barriers that totally surround the system are recommended to avoid tampering and interference with the unit.
- d. Ensure noise level requirements will not be exceeded as outlined in AS1055.
- e. Consider access and safety issues (refer to local regulations).

4 Installation Requirements

4.1.4 Location

For optimum performance, the TrilliumSeries™ Fluid Cooler system should be positioned to meet the following criteria: -

- Sufficient space on both air inlet sides of the unit (minimum distance 1.5m) to prevent restrictions to the air flow.
- On multiple system installations, take in account the prevailing wind directions and building layout to prevent short-circuiting of the air flow.
- Air discharge should be free of any restrictions, as this will impair the performance of the system.

4.2 Lifting and Load Bearing Points

Lifting points have been provided on the systems and must be used when lifting or moving the unit into place.

When lifting the unit it is important to ensure that the weight is distributed evenly across all of the lifting lugs.

Lifting should be carried out only by appropriately qualified crane operators (Refer to Occupational Health and Safety Authority guidelines).

Note the presence of bump guards fitted to the base of the systems. These are designed to prevent

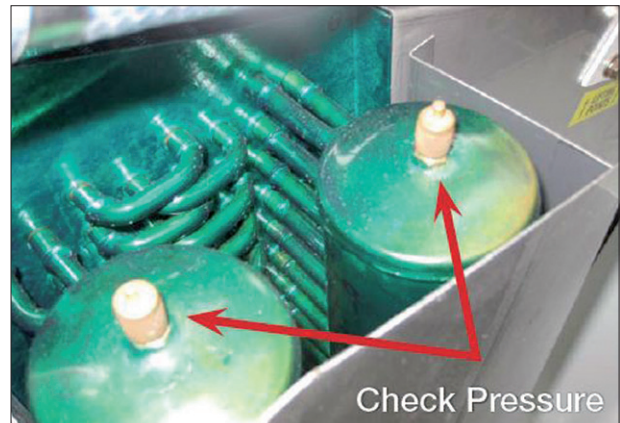


Figure 3
damage while the system is in transit.



Figure 4



Information

Remove and discard the Mild Steel lifting plates and bolts. Fill bolt holes with the supplied Stainless Steel bolts.



Warning

The use of incorrect lifting points may result in excessive stress being placed on the system. Damage to the system in this manner may invalidate the warranty.

The minimum lifting chain length from each lifting point should be 4 metres.

4 Installation Requirements

4.3 Location and Spacing

Location and spacing guidelines for TrilliumSeries™ Fluid Coolers are shown on the drawing below. For details on a specific unit, please contact BAC directly.

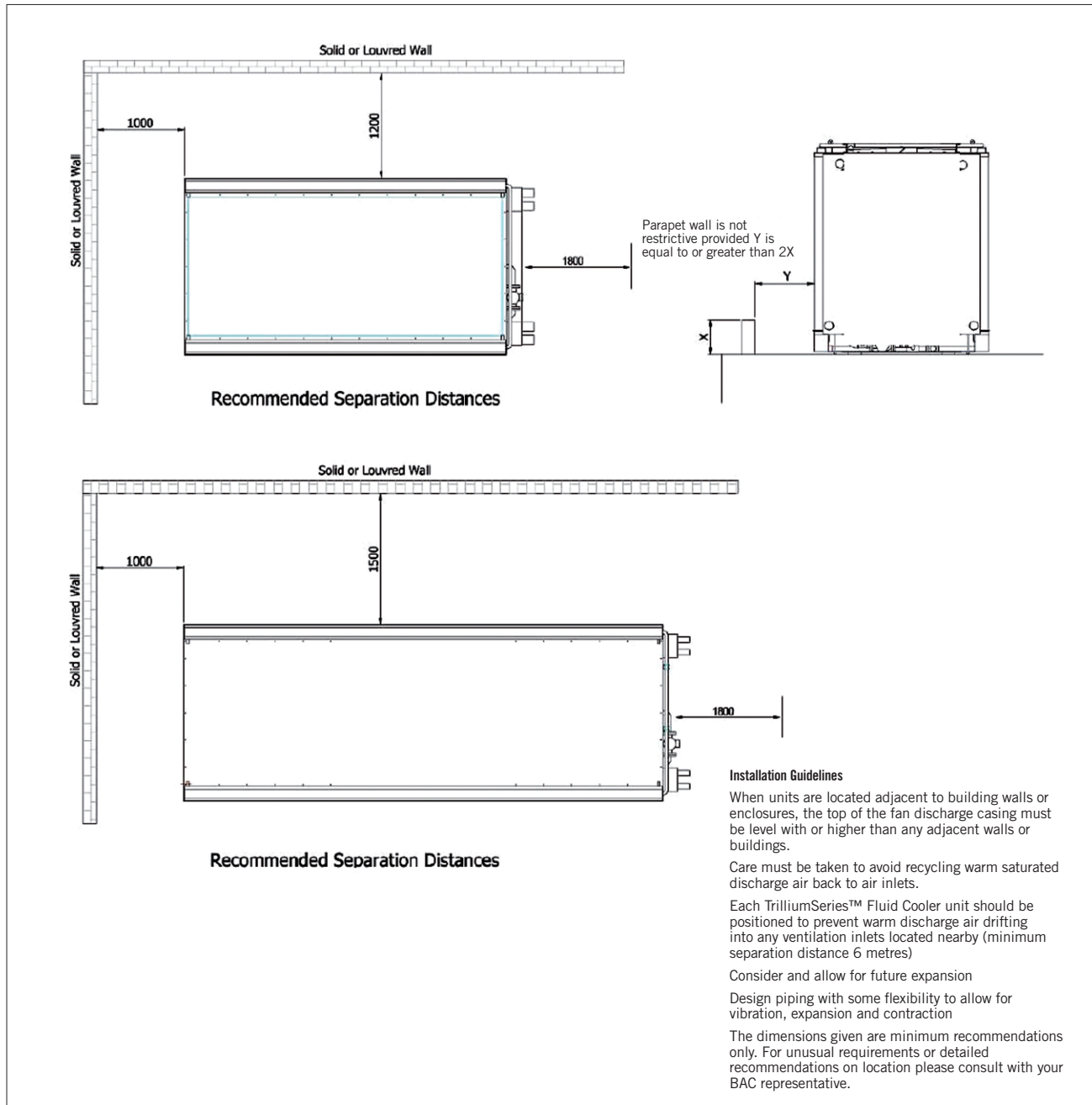


Figure 5

4 Installation Requirements

4.4 General Arrangement

4.4.1 End View



Figure 6

4 Installation Requirements

4.4.2 General Arrangement: Sump/Sump Pump and Controls

Sump and Pumps - 1 strainer removed for Clarity



Water Make-up Solenoid Valve



Figure 7

4 Installation Requirements

4.4.3 General Arrangement: Switch Connections

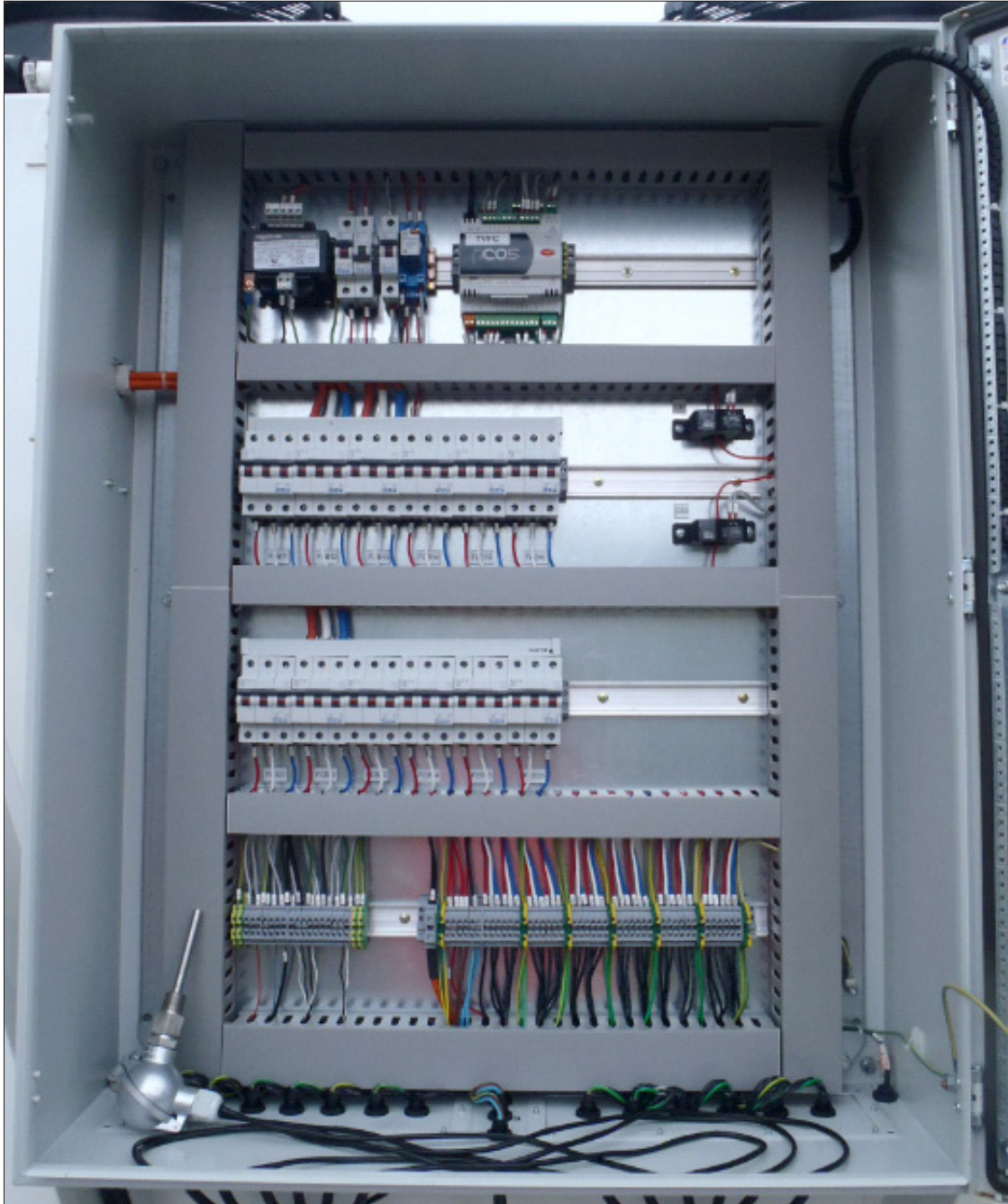


Figure 8

“TrilliumSeries™ Fluid Cooler”

4.5 Specific Instructions

This section details the specific installation requirements for mounting, pipe work and connections, freezing and corrosion protection, electrical connections, motors and sound pressure for TrilliumSeries™ Fluid Cooler systems.

4.5.1 Mounting

All systems must be set up level to ensure free drainage.

4.5.2 Piping and Connections

(a) General

All pipe work and connections must be made in accordance with plumbing industry best practice. All pipe work to be adequately supported so that stresses are not transmitted to the TrilliumSeries™ Fluid Cooler headers.

If TrilliumSeries™ Fluid Cooler systems are connected in parallel then special attention is required to the water pipe work circuit to ensure even water flow and pressure drops through each branch.

Piping should be kept free of all foreign matter.

Care should be taken to minimise the number of elbows, tees and valves since these will decrease the pumping capacity. Valves should be located to facilitate servicing.

Drain connections should be fitted at all low points within the system to permit the complete drainage of liquid from the system when necessary.

A small valve or valves should be installed at the highest point or points in the liquid piping to allow any trapped air to be purged.

All liquid piping should be thoroughly flushed to free it from foreign material before the system is placed into operation. Use care to avoid flushing any foreign material into, or through the system. Any new pipework, particularly where mild steel is used, should be chemically passivated prior to use.



Figure 9. Air Bleed Valve.

4 Installation Requirements

(b) Dump Valve

- Dump valve has been opened manually to prevent damage to pump prior to final site commissioning
- Please unscrew top screw, remove solenoid top of dump valve and manually turn valve to close then reassemble prior to operation.



Figure 10



Figure 11



Figure 12



Figure 13

(c) Condenser Water Circuit

- Connect to TrilliumSeries™ Fluid Cooler with premium grade copper using same diameter as the pipe stubs.
- Fit isolation valves to both flow & return lines.
- With retrofits, the pipework now becomes a closed loop so the following items must be fitted:
 - Adequately sized expansion tank.
 - Pressure relief valve.
 - Water make-up system with anti-back flow device, etc.
- Auto air bleed at highest point of system.

d) Celpad Drainage

- Connect overflow and automatic dump valve to local drainage point
- Install barrel unions where appropriate in drainage system to allow removal of components for servicing.



Figure 14. Evaporative Pad Water Regulating Valve.

(e) Celpad Water Make-up

- Connect main water supply via appropriate isolation valve and anti back flow device to sump water makeup connection.
- Main water pipe size should be at least equivalent diameter to water solenoid to minimise water hammer (normally 25NB).

4.5.3 Freezing and Corrosion Protection

In areas where ambient temperature can fall below freezing point it will be necessary to dose the water in the closed loop with an anti-freeze such as MEG, MPG or brine. To protect metal components against the corrosive effects from the addition of anti-freeze, we recommend a corrosion inhibitor is also added to the condenser water circuit.

Note: Coil damage from a failure to manage the closed loop water circuit is excluded from the initial warranty. We strongly recommend advice be sought from a specialist water treatment provider.

4.5.4 Electrical Connections

All electrical connections must be made in accordance with the local and national standards and in conformance with electrical industry best practice.

The site supply voltage, frequency, accepted power rating and number of phases must comply with the details on the TrilliumSeries™ Fluid Cooler unit technical data sheet included in Section 11 of this manual.

- Connect protected power supply to TrilliumSeries™ Fluid Cooler electrical panel through supplied electrical isolator.

4.5.5 Water Probe

The water probe has been temporarily connected for factory testing.

Please mount probe in the “water out” pipe work, disconnect and extend cable to required length then reconnect using the same terminals.

4.5.6 Motors

The data on the motor size and maximum current ratings can be found in the TrilliumSeries™ Fluid Cooler catalogue.

During commissioning, the fans and pump shall be checked for proper direction.

4.5.7 Sound Pressure

Sound pressure levels shown on the technical data sheets in Section 12 are free-field values in dBA to be used as a guide only for comparative purposes. Actual sound measurements may vary significantly from the documented values due to the location of the unit and the influence of the surrounding features.

5 Key TrilliumSeries™ Fluid Cooler Components

5.1 Water Level Control

The TrilliumSeries™ Fluid Cooler evaporative system's water levels in the Celpad basins are controlled by water float switch.

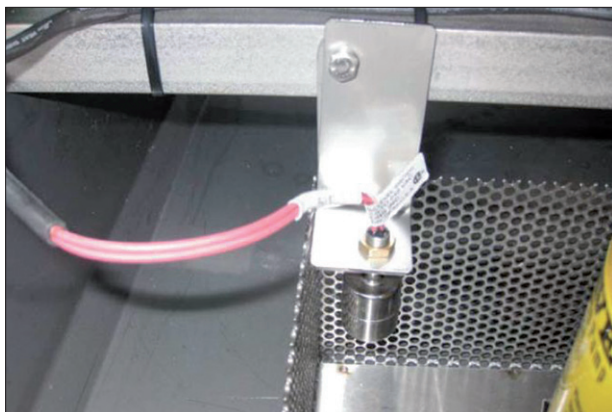


Figure 16. Water Float Switch.

5.2 Water Distribution System

Water is distributed over the evaporative pads from the overhead water distributor.



Figure 17. Water Distribution System

5.3 Water Sump

Water draining off the evaporative pads is captured in a stainless steel sump and recirculated.



Figure 18. .

5.4 Water Pump

Water is recirculated to the distribution system from the sump via a centrifugal pump. Flow rates can be adjusted via the throttling valve.



Figure 19. Evaporative Pad Water Regulating Valve.

6 Water Treatment Considerations

Water used for cooling purposes contains many impurities that can cause serious problems in cooling water systems. These problems include corrosion, scale, fouling and possibly microbiological growth.

The BAC Heat Rejection Systems have been mechanically designed to minimise the potential for water related problems through the use of appropriate materials of construction and fabrication techniques.

The correct operation of your equipment will further help to ensure operational problems are minimised. Best practice would prescribe the supplemental addition of water treatment chemicals be considered to ensure the maximum life expectancy from your equipment.

The following information is provided to offer guidance on assessing the need for water treatment.

Water treatment may need to be considered in the following areas:

The Open Loop Water: The recirculating water used to wet the external evaporation pads, herein called the open loop water.

The Closed Loop Water: The recirculating water running through the BAC TrilliumSeries™ Fluid Cooler radiator block heat exchanger.

6.1 Water Treatment Considerations for the Open Loop Water

6.1.1 Potential for Scale

The novel design of the BAC TrilliumSeries™ Fluid Cooler systems and the use of evaporator pads ensure scale on the heat exchanger is avoided⁵.

Under certain conditions, scale may form on the surface of the evaporator pads. Where deposition is suspected to be interfering with airflow the evaporative pad/s should be cleaned. If cleaning does not improve performance, the pad should be replaced.

6.1.2 Potential for Corrosion

No corrosive materials of construction are used throughout the open loop of the BAC TrilliumSeries™ Fluid Cooler. Additional water treatment is not required.

6.1.3 Potential for Microbial Contamination

The automatic dumping and drying of the evaporator pads and open loop every 24 hours ensures the possible risks of significant microbial contamination within the system are reduced to a negligible level.

The evaporator pads have been treated with an algaecide to minimise the potential build up of algae.

In exposed, cold and wet climates the ability for the system to dump and dry correctly may however be compromised. In such cases where excessive fouling is observed and is suspected to be interfering with air flow, the evaporative pad should be changed.

It is recommended the system be disinfected prior to summer operation. The following procedure is recommended:

- With the fan isolated and the pump circulating water around the system, add 5 millilitres of household bleach (that has 4 per cent available chlorine) per 5 litres of circulating water.
- This will give a concentration of approximately 20 ppm of 'free chlorine'.
- Allow the disinfected water to circulate for at least 30 minutes.
- Dump the water and refill with fresh water.
- Circulate for 5 minutes then dump the water to remove any residual chlorine.
- Repeat the previous step.
- Refill with water and begin normal running.
- Check the equipment is working correctly.

5 It will be noted this is a significant design improvement over conventional Fluid Coolers where water is sprayed directly onto the surface of the heat exchanger causing scale, fouling and reduced heat transfer.

6 Water Treatment Considerations

6.2 Water Treatment Considerations for the Closed Loop Water



Information

Damage to, or failure of the heat exchanger due to inadequate water treatment of the closed loop water system is not covered by the product warranty.

Installation and operational issues should be considered at the time of design and installation.

- Coupling metals of dissimilar galvanic potential should be avoided by material choice or by using appropriate electrical isolation at metal connection boundaries.
- Dead legs and inappropriate water flow velocities should be avoided.

7 Operation and Maintenance

7.1 System Controller

A BAC supplied programmed logic controller has been provided as standard. The PLC is used for capacity control and for regulating the evaporative pre-cooling system. The Control System can be interfaced with a remote BMS system via BACnet, MODBUS or LAN connected. These are additional options not supplied with the original unit.

Functional descriptions and operating instructions of the TrilliumSeries™ Fluid Cooler system can be found in section 11 of this manual.

7.2 Switchboard Maintenance

The switchboard should be periodically checked and cleaned as necessary.

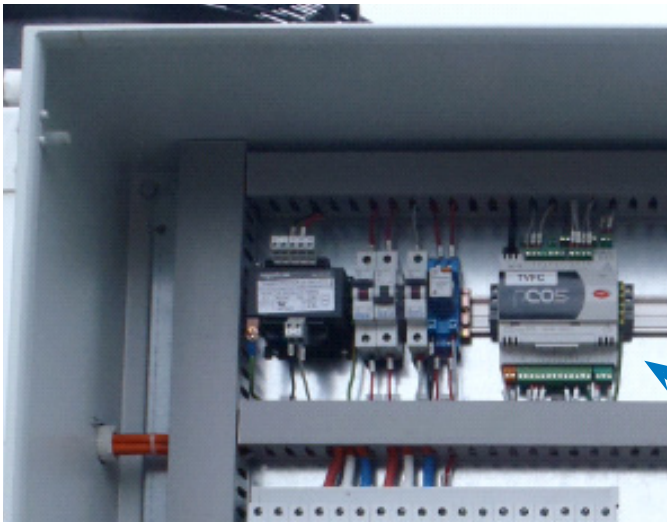


Figure 20.

7 Operation and Maintenance

7.3 Routine Cleaning

The TrilliumSeries™ Fluid Cooler system should be cleaned periodically (say quarterly) depending on operational and environmental factors.



Information

It is a recommendation of AS3666.2 that while operational, the system's evaporative pre-cooler sump is drained, cleaned and flushed quarterly.

Simply do the following:

- Turn off the main isolator.
- Isolate pumps.
- Initiates dump valve to open.
- Remove Celpads then brush and hose the sump until clean.
- If there is a build up of bio-film it is recommended the sump be wiped over with household bleach and then hosed out and allowed to drain.
- Once cleaning is complete, return system to

normal operating conditions.

During cleaning it is advisable to inspect the pre-cooler pumps and associated pipe fittings to ensure all are in a sound operating condition. It is also prudent to check (if pre-cooler is working) water sump levels and water distribution over evaporative pads.

Depending on conditions the Celpad may require cleaning. Visual inspection will indicate if this is required. Celpads can be cleaned with detergent and moderate water pressure.

Any large debris attached to the pads should be removed (such as leaves, plastic bags etc) and the Celpads inspected. Celpads in poor condition should be replaced. Where water strainers are fitted, they should be cleaned and inspected.



Caution

Avoid the use of high-pressure sprays or rigid straw broom on the cooling Celpads. High-pressure sprays may damage or reduce the life expectancy of the Celpads.

7.4 Heat Exchanger Coil

It is recommended that the finned coil be inspected annually. If required the coil can be cleaned using a low-pressure water hose with a mild detergent. Reepoxy coat coil if required.

Avoid hosing directly on to the fan motors or electrical components.



Caution

To avoid damage to Celpads and Coils please rotate Celpads 180 degrees at a minimum of once annually.

7.5 Fans

The fans need to be checked every 3 months after commissioning and thereafter depending on operating conditions.

Ensure complete electrical isolation before removing the fan guards. Inspect the fan blades for evidence of erosion or corrosion. Any residual dirt, impurities or related contamination should be removed at this stage to avoid imbalanced running of the fan.

Also check the fan fastenings and the integrity of the components. Attention should also be given to the fastening screws and balance of the fan blades.

7.6 Lubrication

The fans and water pumps are provided with sealed bearings. Lubrication is not necessary.

7.7 Water Replacement

Water replacement or bleed-off is required to prevent the build up of dissolved solids and impurities. The TrilliumSeries™ Fluid Cooler Control System carries out 'bleed off' automatically. This is determined by BAC at the time of commissioning and servicing. Bleed off should be inspected at cleaning.

Bleed-off: The responsibility is on the owner to regularly check the operation of the bleed-off to ensure free flow of water during the units operation.

Dump Valve: The BAC /TrilliumSeries™ Fluid Cooler system has an electric dump valve that is automatically operated by the TrilliumSeries™ Fluid Cooler controller.

7 Operation and Maintenance

7.8 BAC ANNUAL MAINTENANCE PROGRAM

		ANNUAL	BI-ANNUAL	QUARTERLY
	MOTORS AND IMPELLERS			
1	Check fan impeller operation – noise, vibration, stress cracks etc	X	X	X
2	Check motor operation – electrical connections, bearings, vibration & general condition	X	X	
3	Check fans for guard obstructions	X		
	WATER DISTRIBUTION			
4	Check operation & performance of celdeck pumps & priming	X	X	X
5	Check celdeck pump bleed off rate & adjust	X	X	X
6	Check operation of water dump valve – re-stroke & clean any debris	X	X	
7	Check operation of water make-up solenoid, seat of valve coil & wiring	X	X	
8	Check water distribution system including water flow rate	X	X	
9	Check water level control – Ball float valves & electronic level switches	X		
10	Check and clean strainer baskets	X	X	X
11	Clean all build up of sludge & residue in celdeck basins	X	X	X
12	Clean all build up of sludge in central sump	X	X	X
13	Clean and flushout water headers	X	X	X
14	Remove and clean all celdeck pads	X	X	
15	Check and Clean copper/aluminium heat exchanger coil	X	X	
16	Rotate all celdeck pads 180 degrees	X		
	SWITCHBOARD			
21	Remove and clean switchboard ventilation filters	X	X	
22	Check switchboard electrical connections & tighten etc.	X		
23	Check switchboard for electrical hot spots	X		
24	Check condition & operation of contactors, relays & associated switchgear	X		
25	Check operation of fan variable speed drives	X	X	
26	Upgrade software - where applicable	X		
	OPERATION			
27	Check operation and performance of system under load	X	X	X
28	Check and verify celdeck functionality	X	X	X
29	Check & record controller set points	X	X	
30	Check and record condition of Celpads	X	X	
31	Check and log motor current draw and efficiency	X		
32	Fill out log sheets including any recommendations	X	X	X

a) If the water temperatures returning from the TrilliumSeries™ Fluid Cooler system are higher than normal

- Check to see that the unit is actually running (check PLC display is showing data and not blank).
- Check to see if all fans are indicated as running.
- Check to see ambient temperature is above set point.

If the answer to all of the above is “yes”, the problem will be typically related to the water distribution system.

This can be confirmed if the pre-cooler pads are dry.

If so: check to see

- that the sump is full of water.
- if the pump is running (if the pump is running but not pumping, the problem is likely to be a flow restriction or the pump has not primed).
- Check for blockages or pump air lock. If the problem persists, review the following:
 - Is the pump switched on?
 - Is the water level satisfactory?

If the answer to all of the above is “yes”, please contact BAC Australia Pty Ltd Support Services on 1300.134.622



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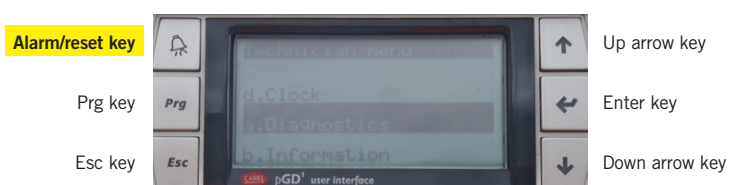
info@baltimoreaircoil.com.au

b) What happens if there is a power “blackout” or “brownout”?

All set points are retained in PLC internal memory so the interruption to power supply does not affect them.

Some power fluctuations may cause the variable speed drives to fault and a manual re-set will be necessary.

Manual Reset requires the opening of all Fan CBs for not less than 30 secs after which the CBs can be closed.



9 Commissioning Report



BAC Adiabatic Equipment Site Commissioning Checklist

E-mail: info@baltimoreaircoil.com.au

Pre - Commissioning Checklist: to be Completed by Customer

Site Name:..... Date.....
Site Address
Site Contractor/Installer.....
Site Contact..... Phone No.....
Unit Model No (s) Serial / Asset Number.....
Unit Application: Condenser ...Y/N **OR** Water Cooler ...Y/N

General Installation – Please confirm

Clearances: RHS.....mm, LHS.....mm, REAR.....mm, FRONT.....mm, TOP.....mm
The base of the unit is level..... Y/N
The Dump valve is connected Y/N Overflow connected..... Y/N
The Bleed lines are connected to drain..... Y/N
The Isolation valves is fitted to the water solenoid valves..... Y/N
Adequate water supply to the unit is available..... Y/N
Anti-backflow is fitted (closed loop & solenoids)..... Y/N
Is installation, operation and maintenance manual on site..... Y/N

Unit Switchboard – Please confirm

The equipment is securely mounted..... Y/N
3 phase power is connected & available at the switchboard..... Y/N
The switchboard/Electrical connections have been checked Y/N
The Ambient Temperature Probe is fitted & connected..... Y/N
After the unit has started confirm the fans are all rotating in the correct direction..... Y/N

For Water Fluid coolers – Please Confirm

The Expansion tank, relief valve, auto air bleed are fitted Y/N
The closed loop is filled with water & the pump circulating..... Y/N
The air has been bled from the closed loop while pump is circulating..... Y/N
A water balance has been performed on the closed loop..... Y/N
Leaving water temp probe is fitted & connected..... Y/N

For Condensers

For Condensers – Pressure Transducer is fitted & connected..... Y/N
Is the unit it a twin circuit Condenser?..... Y/N
If so, is the second transducer fitted & connected?..... Y/N

Additional Items/Special requirements/ Access restrictions

.....
.....
Please Note: If upon the commissioning day the above items are found to cause delays due to non compliance, and BAC are required to attend, the extra time or return travel to site to place the unit into operation will be CHARGABLE.

Please fax (or e-mail) this Pre-Commissioning Checklist back to (02) 4340 1545
(e-mail - info@baltimoreaircoil.com.au)

Customer's Name, Signature:

Date:.....

Carried out on site by installer

1. Confirm mains pressure water is connected to make up solenoid valve.
2. Initiate pre-cooling cycle to begin water make-up
Lower main water temperature/pressure set point to allow fans to start & ramp to 100%.
After celdeck time delay (factory set 90 seconds) make up solenoid valve will open.
3. Check wetting of pads for even distribution. Hand regulated globe valves should start at approx one half of a turn open. Gradually open valves further to provide wetting of full length of celdeck pads. Maximum opening should not exceed 1.5 turns open. Opening amount of valve will vary depending on the site water pressure. Water will begin to flow into sump, when the float switch is activated by the water level for the first time the celdeck pump will start.
4. Make up solenoid will be enabled again when the float switch is de-activated. Allow water level to be maintained back to sump operating level. Then adjust pump water regulating valve to maintain even celdeck distribution. Only adjust valves one eighth of a turn at a time with the maximum opening not greater than 2 turns open.
5. Excessive opening of valves may lead to overflowing of celdeck basins & possibly sump.
6. Power down the controller & power back up, this will change system back to dry mode. Pump & solenoid will be disabled & dump valve will be driven open for sump draining. Reset fan circuit breakers if isolated.



Figure 23. Celdeck pump regulating valve.
This valve may be located in the sump area on some units

11. TVFC Control Switchboard

11.1 Standard Fully Automatic Switchboard

The Control system supplied with the TVFC unit should be fully operational when delivered to site. Connection to a suitable 3 phase and Neutral power supply can be made directly to the isolation switch located on the left side of the switchboard that is mounted on the end of the unit between the coil connections.

Of most importance is the relocation of the Leaving Fluid (Water or Brine) temperature sensor. This sensor is provided inside the switchboard and is connected electrically (2 wire 4-20mA instrument) to the panel as delivered. The unit is fully tested before leaving the factory. The sensor will have to be disconnected from the

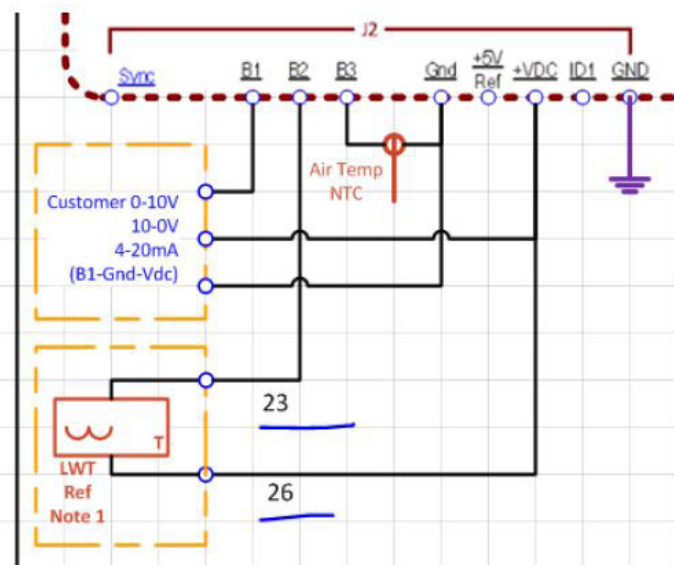
panel to allow fitting to the remote common fluid line. Take note of the wiring connections as the sensor will have to be reconnected afterwards.

The sensor is fitted with a thermowell that can be placed permanently into the common leaving fluid line. The sensor screws out the thermowell.

After turning on all Circuit Breakers on and with mains power connected the unit should run automatically

Note, before turning on the unit completely, please ensure that all electrical and plumbing connections have been securely made and also ensure mains water is turned on.

The Dump Valve should have also been re-orientated to be in the normally closed position. The Dump valve as delivered is in the normally open position to prevent water and contaminants from bulding up in the sump before installation and if the unit is stored for any length of time without power applied.



11.2 Operating sequences

The unit when first turned on will operate in Dry Mode.

This is shown on the LCD screen on the Outside of the Switchboard Panel.

The unit as supplied will operate in a "Default" bias mode which balances energy saving with water savings.

Water bias and energy bias nodes are field selectable.

Set points ex factory for the unit are

- 29.5C leaving fluid temperature. Fan speed will be automatically regulated to maintain this leaving fluid temperature

- 24.0C Ambient temperature

Both these values are field adjustable

The unit will always try and maintain the Leaving fluid temperature at the set point by adjusting the number and speed of the fans operating. Minimum Fan speed is 12% of full speed

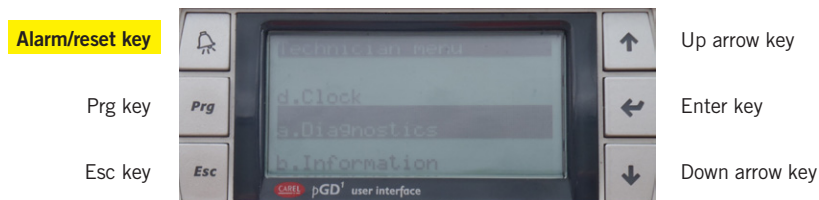
Under High Load and High Ambient the unit will switch from Dry Mode to Pre Cool Mode (Wet Pad Air Cooling).

Pre Cool Mode is called if either of the following occur.

- The ambient temperature setpoint is exceeded for 30 secs.

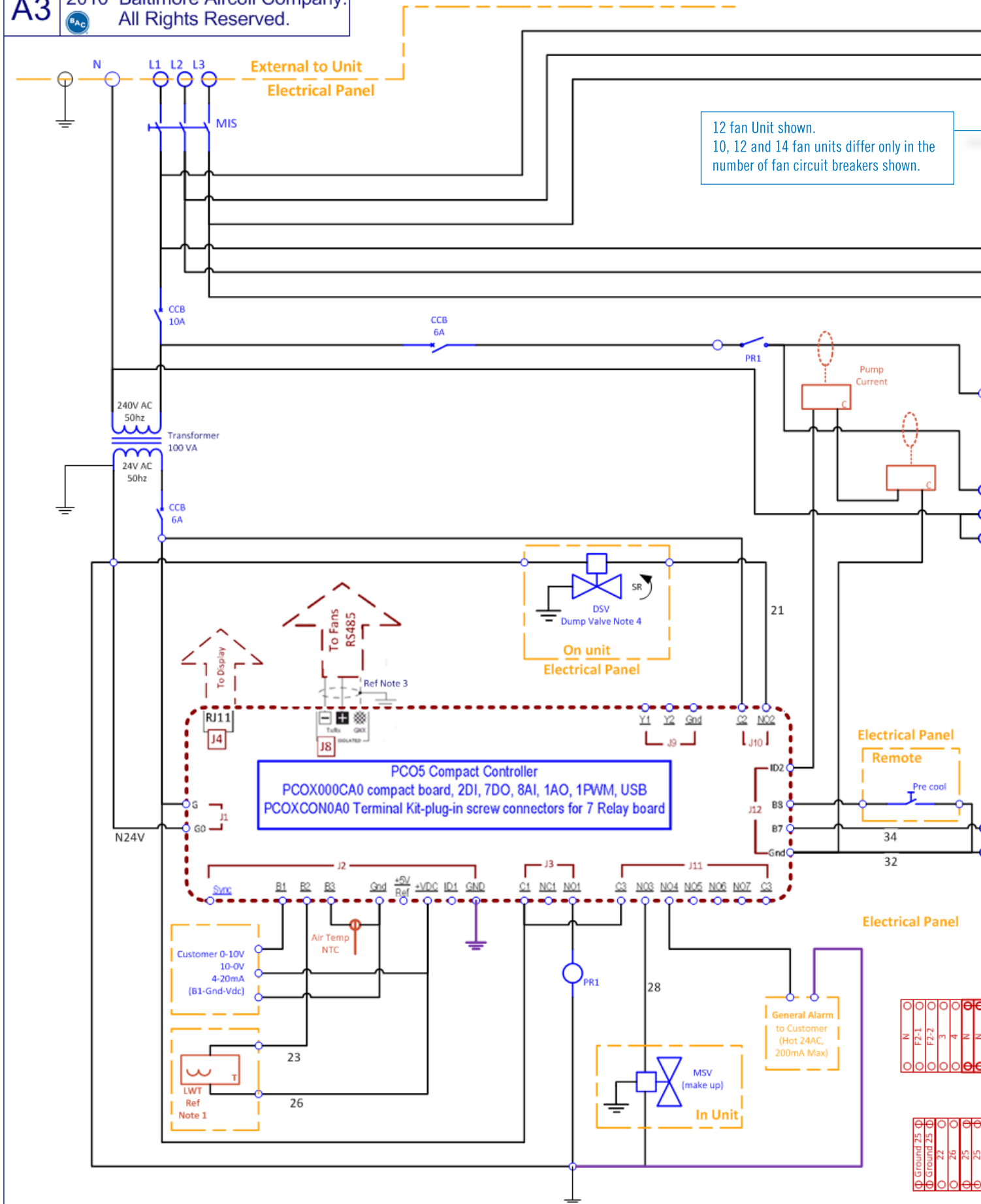
- Fans reach and maintain a speed greater than nn% of full speed for 90 seconds. The value of nn% is dependant on the operating bias selected

If an alarm is detected (fault) by the control system the fans will run at 100% speed until the fault is cleared. To clear the alarm after the fault has been rectified press the alarm button to bring up the alarm screen and then press and hold the alarm key for 3 secs (for each alarm).



11.3 Electrical Schematic Drawing

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No	REVISION DESCRIPTION	DATE	BY

141216A 00e TVFC Electrical Schematic 12 Fan Single Load.vsd

11. TVFC Control Switchboard

11.4 Operating Status Information and Diagnostics

The control system has diagnostic and operating information that is accessible via the LCD screen on the front of the electrical panel.

If a fault occurs in the unit the LCD panel can be used to diagnose and assist in corrective action.

Also Note some faults are regarded as critical and if detected the unit will automatically run all fans at full speed until the fault is corrected and the fault is reset.

The following screens are available for field technician to adjust

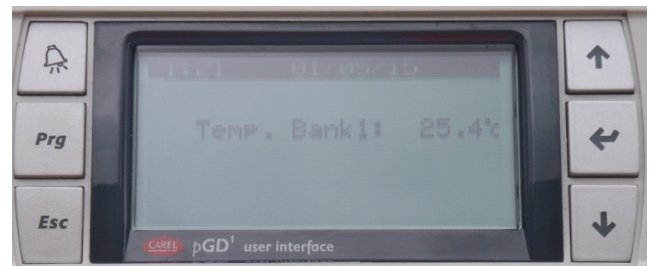
- Setpoints
- Obtain Unit and Fan Power consumptions
- Fan operating speeds
- Change fans and reassign addresses

11.4.1 Information Screen

The information screens are shown by default

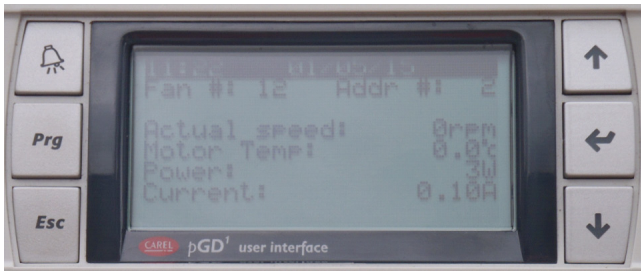


The first screen is shown above and displays Outside Air Temperature, the Fan Speed, and the Dry or Wet mode status. To return to this screen from any other screen, hit the **Esc** key to back out to this screen

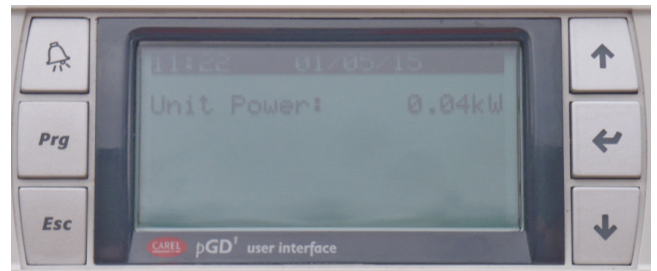


The second screen states the temperature of the fluid leaving the unit. The instrument used is the fluid sensor provided with the unit but mounted remotely in the common liquid line

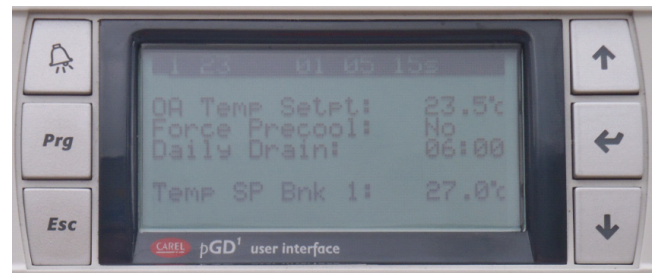
11. TVFC Control Switchboard



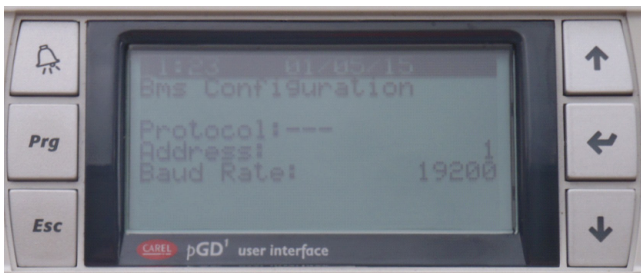
The third screen shows individual fan speed, temperature, power consumption and current. There is one screen for every fan on each unit. This screen shows the Fan Number and the Fan Address. Ref Section 14 for further details.



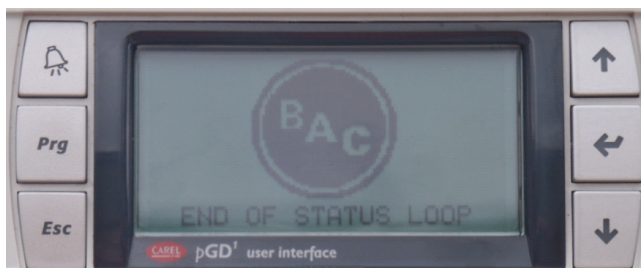
The next screen shows the total unit power consumption



These screens can be used to access and change operating parameters. Press the enter key to scroll through the parameters. Use the up and down keys to change the parameters.

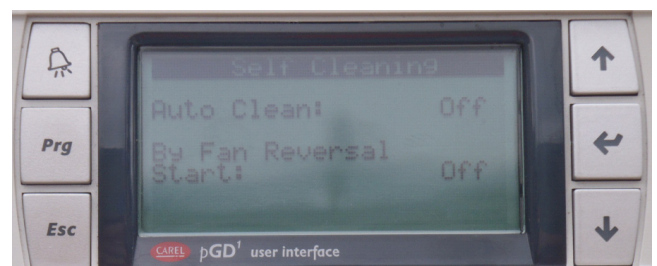


This screen is only used if a communication card has been procured.



Last screen before restart

Note: Hit the down button to go to next screen or up button for previous screen



This is an autoclean mode that reverses the fan to blow contamination off the coils and pads if required.

11. TVFC Control Switchboard

11.4.2 Technician and Diagnostics Menu Screen

For purposes of maintenance, system operation adjustment and troubleshooting the unit control system has a diagnostics menu that can be accessed on the LCD screen on the front door of the electrical panel enclosure.

To access the diagnostics menu

- Ensure the screen is at the top level status screen by pressing the **Esc** key several times.
- Press the **Prg** Key and the main menu will appear.
- Use the up and down arrow keys to scroll the screen until **Technician** is Highlighted.
- Press the enter key and a password screen will appear.

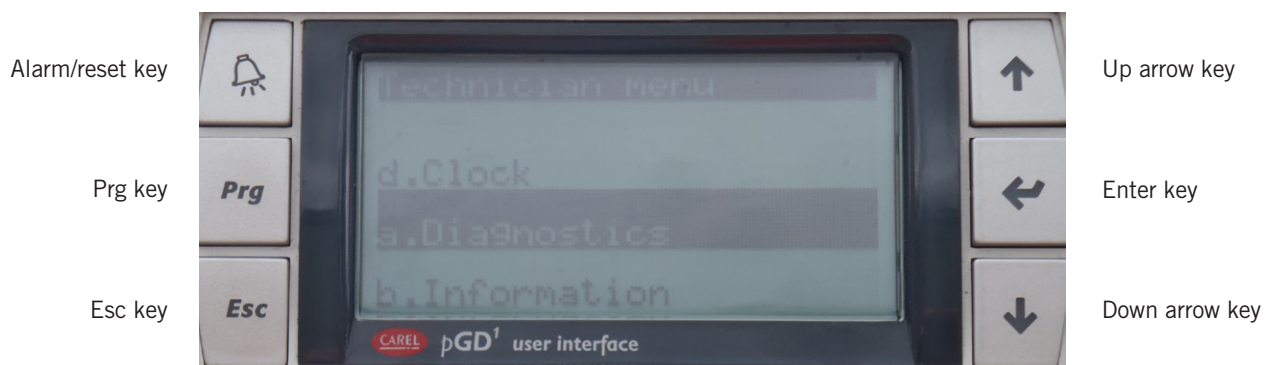
The password for all screens is 4 numeric digits

The Technician password "1703".

Use the up and down arrow keys to change each numeric value and then press the **enter** key.

Pressing the enter key will lock each digit in and move to the next digit.

After the last (4th) digit is entered the **Technician menu** should appear.



The Technician Menu has 4 selections available

- a. Diagnostics
- b. Information
- c. Settings
- d. Clock

The remainder of this section will discuss the Diagnostics sub Menu.

The other sub menus should be self explanatory.

11. TVFC Control Switchboard

11.4.3 Technician and Diagnostics Screens

After Accessing the Technician Menu Highlight the **b.Diagnostic** menu item, press enter to display the following status screen.

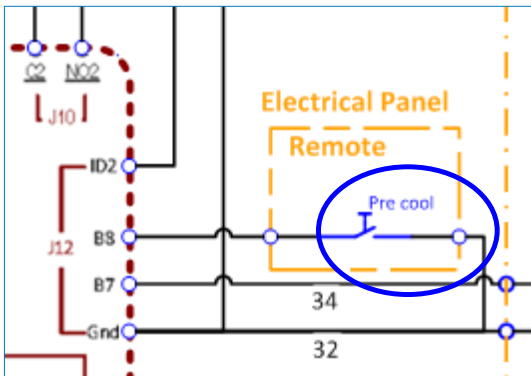
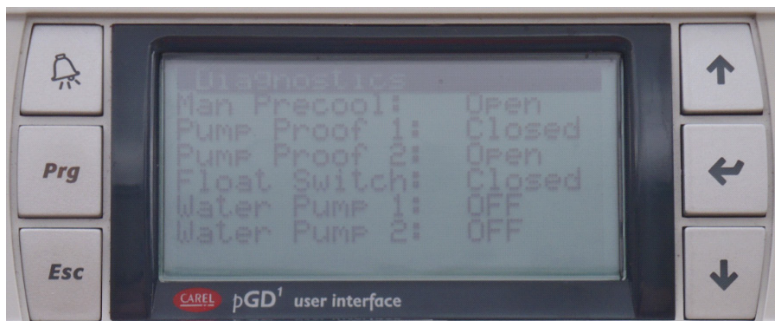
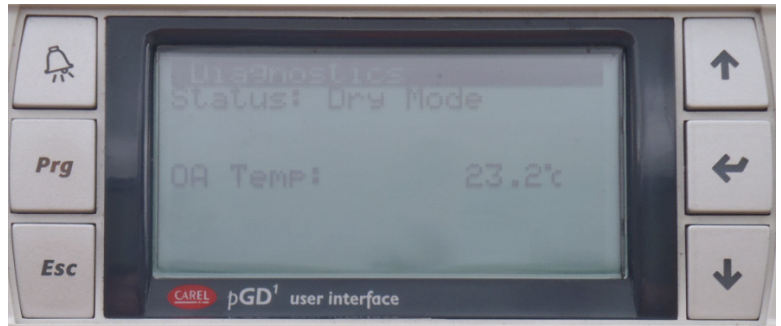
Use the arrow keys to scroll through all available screens as necessary.

Some screens can be entered to change operating parameters via additional sub menus.

The diagnostic screen menus will be described in turn below.

The screen to the right is a status screen and shows general component status.

Man Precool is the status of the input to the PLC that controls the manual pre cool mode. This can be remotely connected and controlled by the end user.



Pump Proof 1 and **Pump Proof 2** are inputs to the PLC that describe the health of the Pumps. **Pump Proof 2** is redundant if the unit operates as 1 bank (default).

Float switch is the input to the PLC from the sump float switch.

Water Pump 1 and **Water Pump 2** are the outputs from the PLC that drive the relays that control the water pumps.

Water Pump 2 is redundant if the unit operates as 1 bank (default) or where only 1 pump is used (3 and 6 fan units only).

The Screen to the right is a status screen that shows the leaving fluid temperature from the unit.

Temp Bank 1 is Leaving Fluid temperature



11. TVFC Control Switchboard

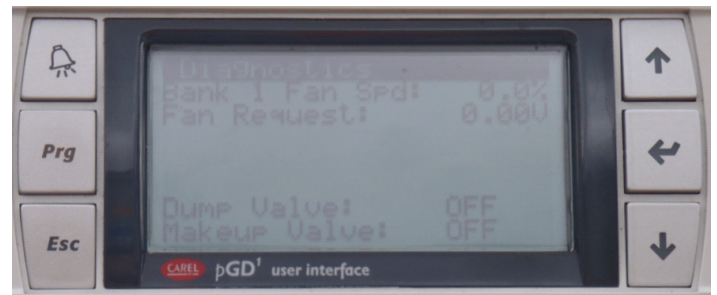
The screen to the right is a status screen

Bank 1 Fan Speed (0 - 100 %) is the speed of the fans on the unit.

Fan Request is the value of a remote if remote fan speed control is enabled (not used)

Dump Valve is the status of that valve

Makeup Valve is the status of that valve



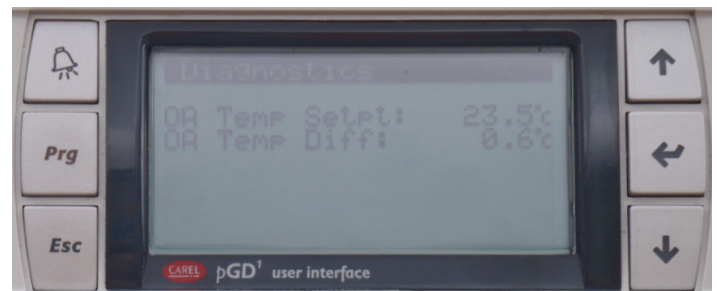
The screen to the right can be accessed to adjust the Ambient setpoint and differential.

If the ambient exceeds the **OA Temp Setpt** is exceeded, pre cool mode is mandatory called.

If the ambient falls below the **OA Temp Setpt** minus the **OA Temp Diff**, the unit is allowed to return to dry mode.

Both these values are field adjustable at this screen.

To adjust these values, press **enter** and use the up and down arrows to adjust.



The screen to right is a status screen but also allows the end user to change timing parameters for the sump dump cycle.

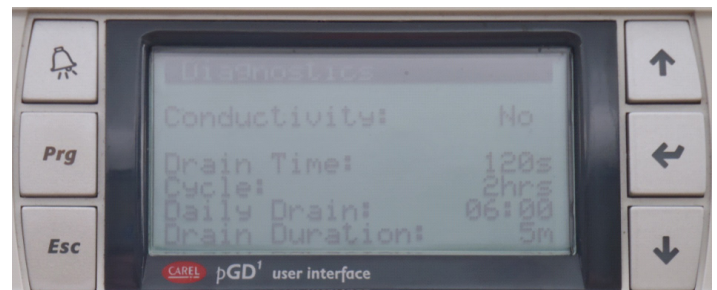
Conductivity is a status only and confirms whether the sump is being monitored for electrolytes. Default is no and additional hardware is required to enable this function.

Drain Time is the time the dump valve is open when a sump purge is entered.

Cycle Time is the cycle time between sump purges if the unit runs continuously in pre cool mode.

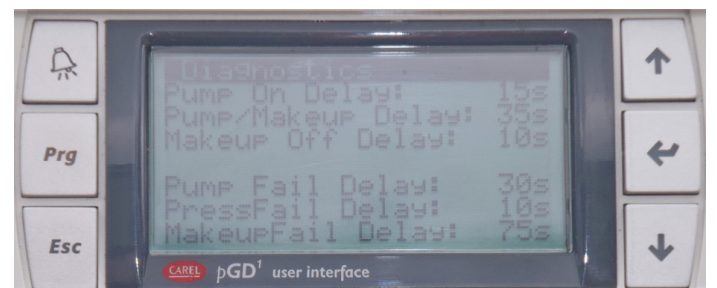
Daily Drain is the time of day when a sump purge occurs automatically.

Drain Duration is the maximum time between the start of the the sump purge and normal operation.



The screen to the right shows the parameters for operation and fault detection on unit components.

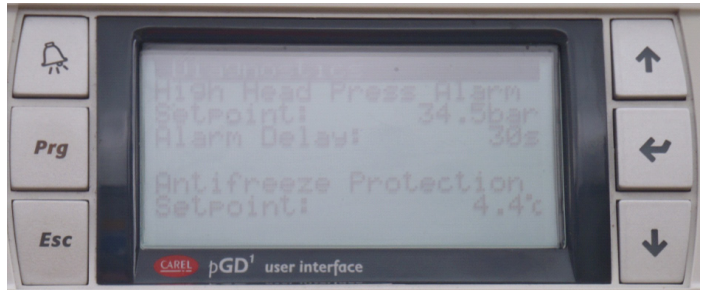
The values contained here should not be adjusted with prior consultation with BACA HO.



11. TVFC Control Switchboard

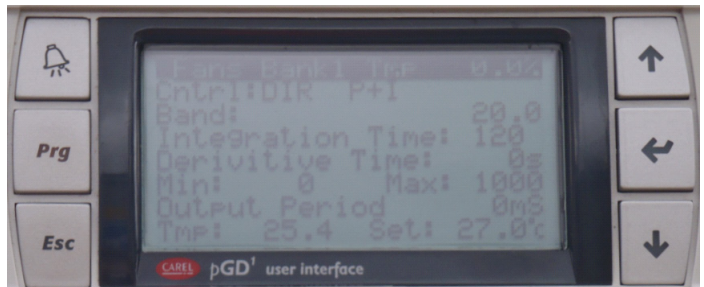
The first part of the screen (top half) to the right shows parameters set for the unit operating as a condenser. These values are redundant for a fluid cooler.

The lower half of the screen shows the Anti Freeze Setpoint protection for the unit. Below this value the unit will not be allowed to enter pre cool mode and the sump will remain purged without water in it.



The screen to the right shows the parameters for control temperature feedback.

The values contained here should not be adjusted with prior consultation with BACA HO.



The screen to the right shows status information about each fan on the unit.

There is one of these screens for every fan.

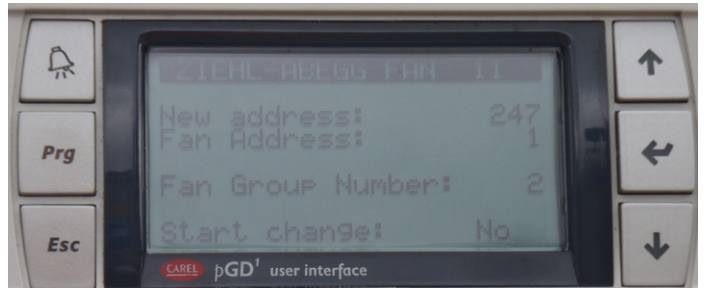
A 12 fan unit will display one of these screens for every fan. The up and down arrows can be used to cycle through these screens.



This screen is only used when replacing fans in the field.

Every fan has one of these screens showing the fan number, its Modbus address and the fan group it belongs to.

If a fan needs to be replaced a full instruction sheet will be provided with the replacement fan if procured from BACA.

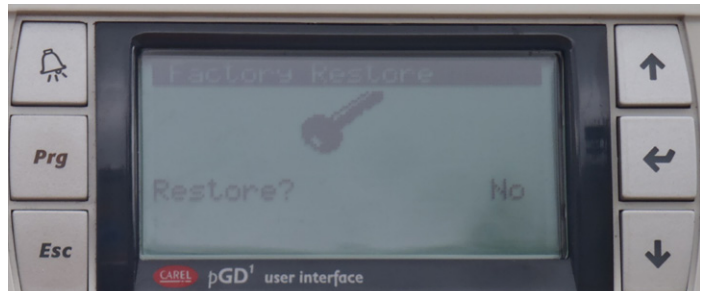


This is the last screen in the Technician Diagnostic Menu.

Please discuss with BACA Head Office before restoring Defaults.

Restoring Defaults may require additional parameter changes to bring the control system back to the delivered configuration.

Please quote the serial number of the unit.



12. Rigging

Lifting Points

All units are fitted with approved lifting ears as shown in the Fig 32.

Units with 8 fans or less use 4 lifting ears only. Units with 10 fans or more use 8 lifting ears.

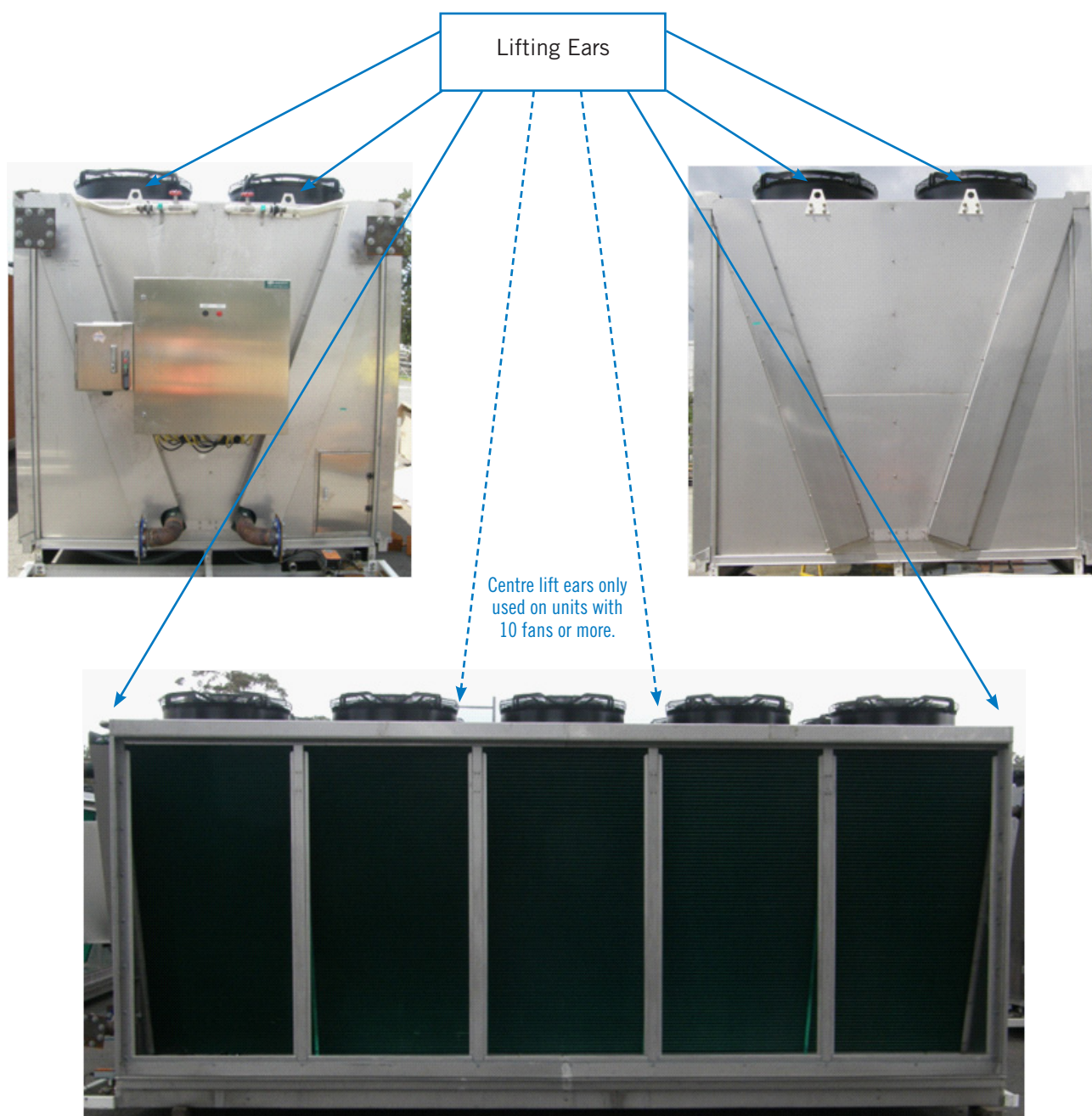


Figure 32

Rigging

For shipping weights refer to unit submittal drawing.

Slings are to be set at a hook height not less than 1.5 m (1500mm) above lifting ear.

As per side elevation view, slings should be vertical.

The unit can be placed safely down on hard flat ground

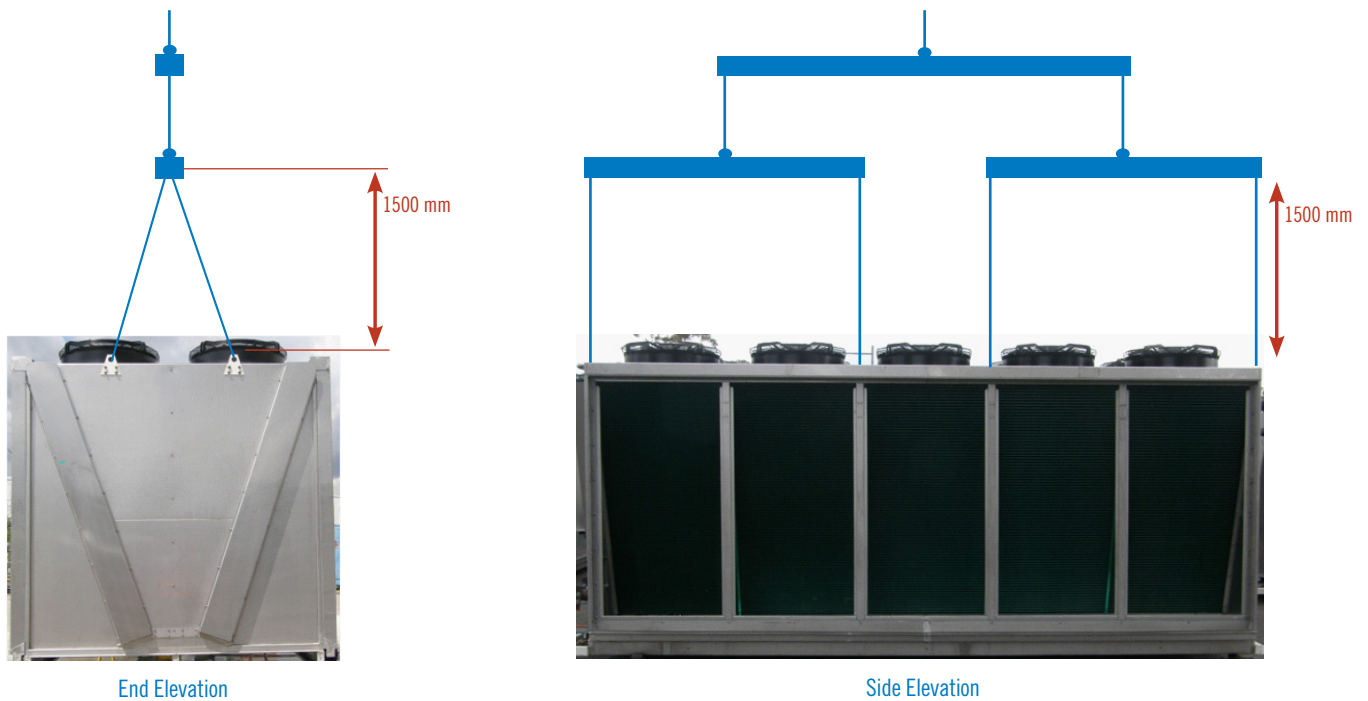


Figure 33

13. Fan Numbering, Addressing, Grouping

The TVFC units have multiple fans

For purposes of maintenance, diagnostics and fan replacement the following information has been provided.

The TVFC fans are uniquely numbered for discrimination at the circuit breakers and on the electrical schematic.

This unique **Fan Number** is based on the position in the unit.

For all units with 6 fans or greater there are two banks, one on the left (bank 1) and one on the right (bank 2) looking from the electrical panel end.

The fans are also in paired rows.

The fan number makes reference to the bank and row (from the electrical panel) the fan is located in. eg Fan 23 is in the 2nd bank (right side) at the 3rd fan from the electrical panel (refer picture below).

For the software to interrogate and control each of the fans, there is a unique **Fan address** for each fan. The **Fan Address** and the **Fan Number** are different and their relationship changes between units with different numbers of fans.

The Fans are also divided into two **Groups** for an energy saving option. This option is a special mode that must be selected at time of order. The standard unit is not supplied with group mode available. The first group of fans always comes on first.

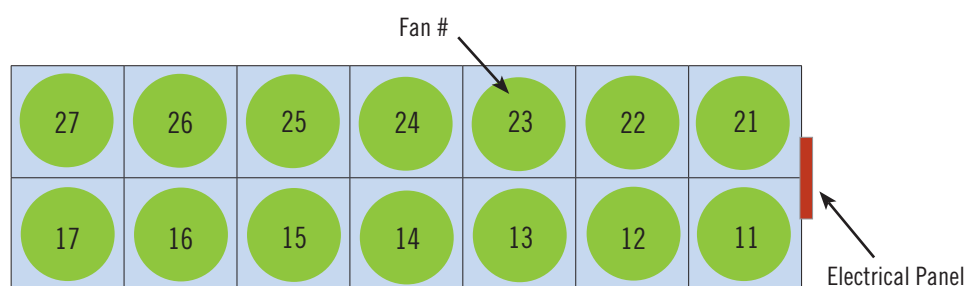
As the load increases the second group also comes on.

Refer to the following pictures to confirm the relationship between the Fan Number, the Fan Address and the group number.

14. Fan Configuration Control

14 Fan Address & Group Assignment

BANK 1			BANK 2		
FAN #	FAN ADDRESS	GROUP	FAN #	FAN ADDRESS	GROUP
Fan 11	001	2	Fan 21	008	2
Fan 12	002	1	Fan 22	009	1
Fan 13	003	2	Fan 23	010	2
Fan 14	004	2	Fan 24	011	2
Fan 15	005	2	Fan 25	012	2
Fan 16	006	1	Fan 26	013	1
Fan 17	007	2	Fan 27	014	2



12 Fan Address & Group Assignment

BANK 1			BANK 2		
FAN #	FAN ADDRESS	GROUP	FAN #	FAN ADDRESS	GROUP
Fan 11	001	2	Fan 21	007	2
Fan 12	002	1	Fan 22	008	1
Fan 13	003	2	Fan 23	009	2
Fan 14	004	2	Fan 24	010	2
Fan 15	005	1	Fan 25	011	1
Fan 16	006	2	Fan 26	012	2



14. Fan Configuration Control

10 Fan Address & Group Assignment

BANK 1			BANK 2		
FAN #	FAN ADDRESS	GROUP	FAN #	FAN ADDRESS	GROUP
Fan 11	001	2	Fan 21	006	2
Fan 12	002	1	Fan 22	007	1
Fan 13	003	2	Fan 23	008	2
Fan 14	004	1	Fan 24	009	1
Fan 15	005	2	Fan 25	010	2



8 Fan Address & Group Assignment

BANK 1			BANK 2		
FAN #	FAN ADDRESS	GROUP	FAN #	FAN ADDRESS	GROUP
Fan 11	001	2	Fan 21	005	2
Fan 12	002	1	Fan 22	006	1
Fan 13	003	1	Fan 23	007	1
Fan 14	004	2	Fan 24	008	2



14. Fan Configuration Control

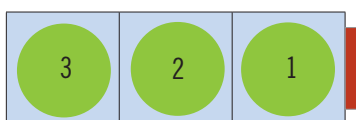
6 Fan Address & Group Assignment

BANK 1			BANK 2		
FAN #	FAN ADDRESS	GROUP	FAN #	FAN ADDRESS	GROUP
Fan 11	001	2	Fan 21	004	2
Fan 12	002	1	Fan 22	005	1
Fan 13	003	2	Fan 23	006	2



3 Fan Address & Group Assignment

BANK 1		
FAN #	FAN ADDRESS	GROUP
Fan 1	001	1
Fan 2	002	1
Fan 3	003	1



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