BALTIMORE
AIRCOIL AUSTRALIA

3C Heat Rejection Series
V12 SERIES

RIGGING, OPERATION & MAINTENANCE MANUAL

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HEAT REJECTION SYSTEMS - V12 SERIES

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.

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 3C/Dricon 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 (optional), 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].

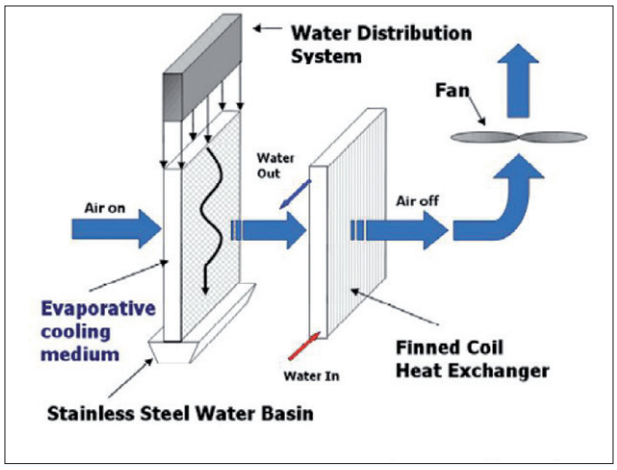


Figure 1

In process-cooling applications, the fluid being cooled is usually water or glycol. In retrofit applications, the fluid would be water that used to run through the pre-existent cooling tower [Fig 2]. Where heat rejection is required for a chiller unit, greater efficiency can be achieved by condensing the refrigerant in the heat exchanger.[1]

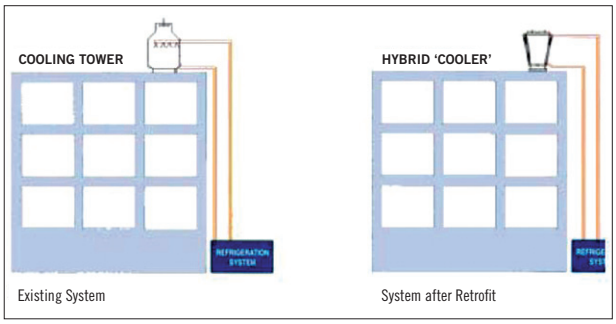


Figure 2

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.[2]

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 normally supplied with an integral control panel (recommended) or can be operated remotely using a suitable control management system.[3]

1 See BAC product documentation for the various cost analysis of these scenarios

2 You should refer to local environmental regulations to determine the types of reuse that are allowed.

3 When operated remotely, it is recommended BAC is consulted to ensure the system operates both within legislated and operational design guidelines.

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 3C 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 Legionella[4] growth and dissemination.

For the purpose of installation guidance, your BAC 3C 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 States[5].

The standards provide the following recommendations for evaporative air-conditioning equipment which would also be applicable to a 3C cooler[6]:

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.

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

5 As understood at the time of writing. BAC is also able to provide a more detailed discussion document upon request.

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

Information

The BAC 3C 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 3C 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 precooler pad represents the only potential flammable component of the 3C cooler. The precooler 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).

4.1.4 Location

For optimum performance, the 3C/Dricon system should be positioned to meet the following criteria: -

a. Sufficient space on both air inlet sides of the unit (minimum distance 1.5m) to prevent restrictions to the air flow.

b. On multiple system installations, take in account the prevailing wind directions and building layout to prevent short-circuiting of the air flow.

c. Air discharge should be free of any restrictions, as this will impair the performance of the system.

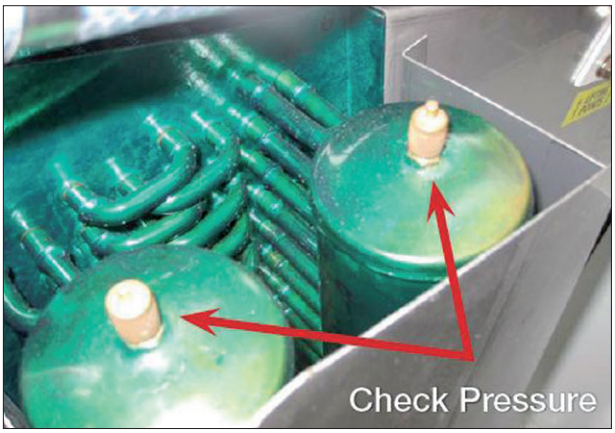


Figure 3

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 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.

4.3 Location and Spacing

Location and spacing guidelines for 3C Coolers and Dricon units are typically shown on the drawing below. For details on a specific unit, please contact BAC directly.

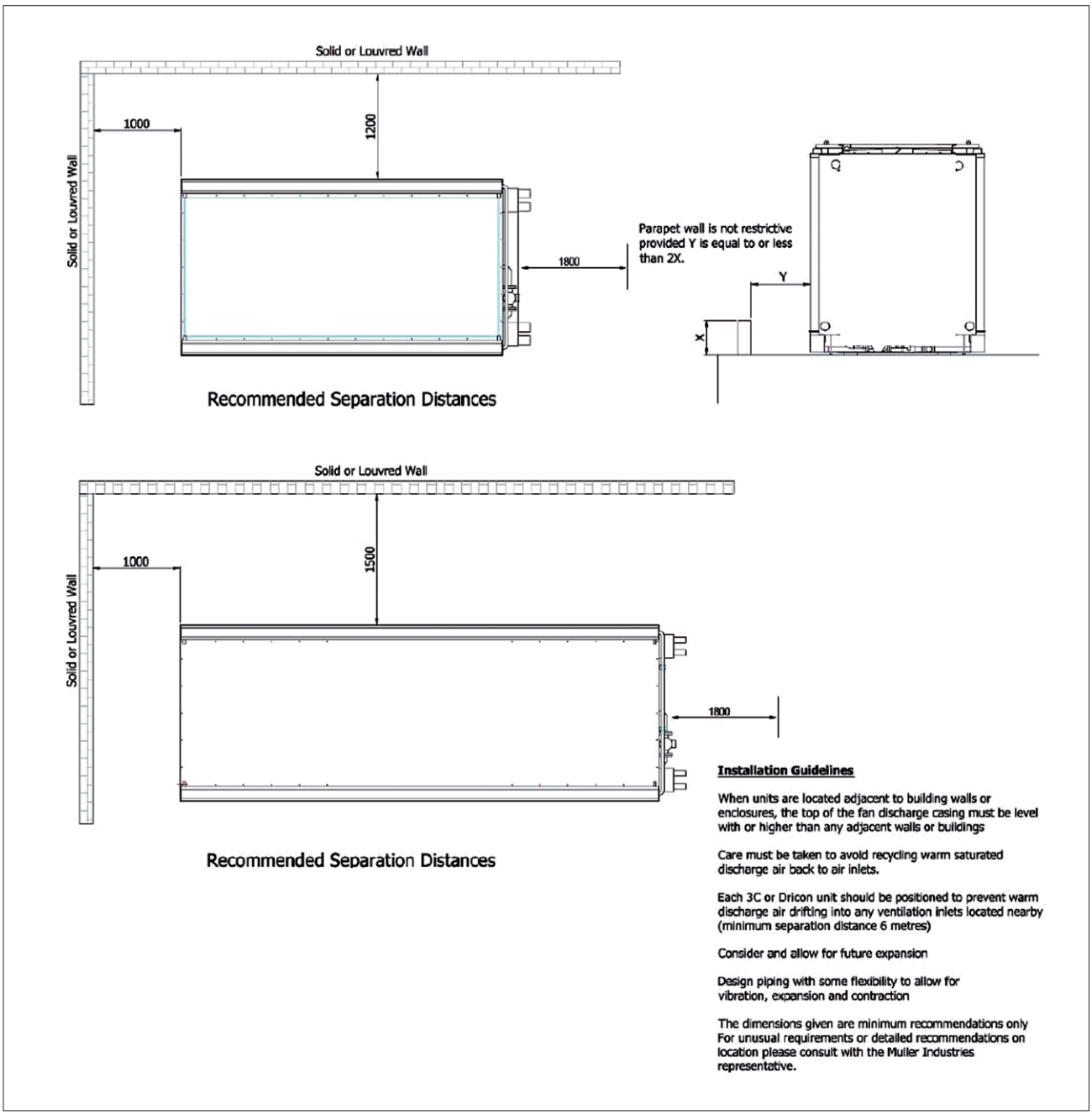


Figure 5

4.4 General Arrangement

4.4.1 End View

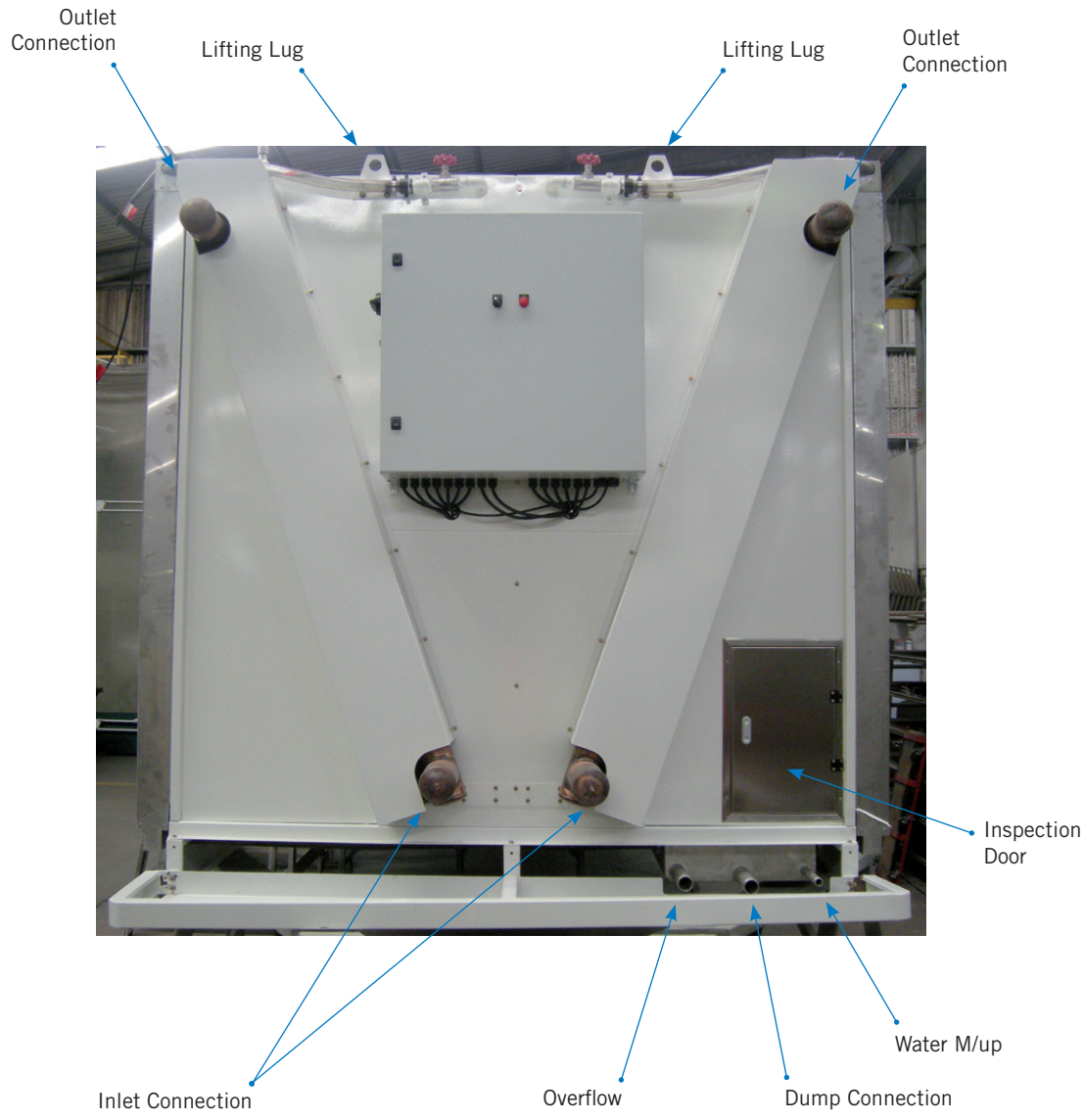


Figure 6

4.4.2 General Arrangement: Sump/Sump Pump and Controls

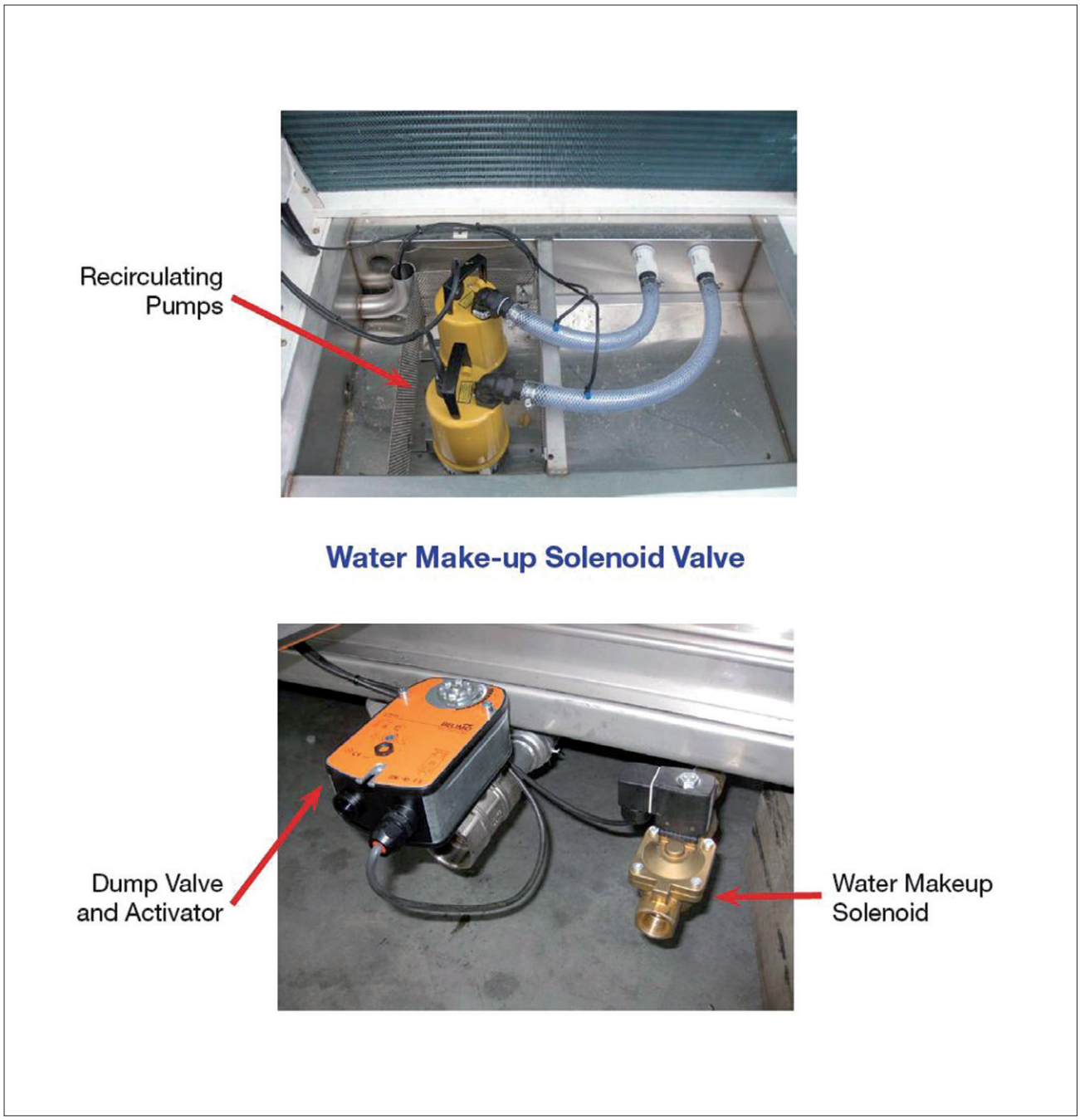


Figure 7

4.4.3 General Arrangement: Switch Connections

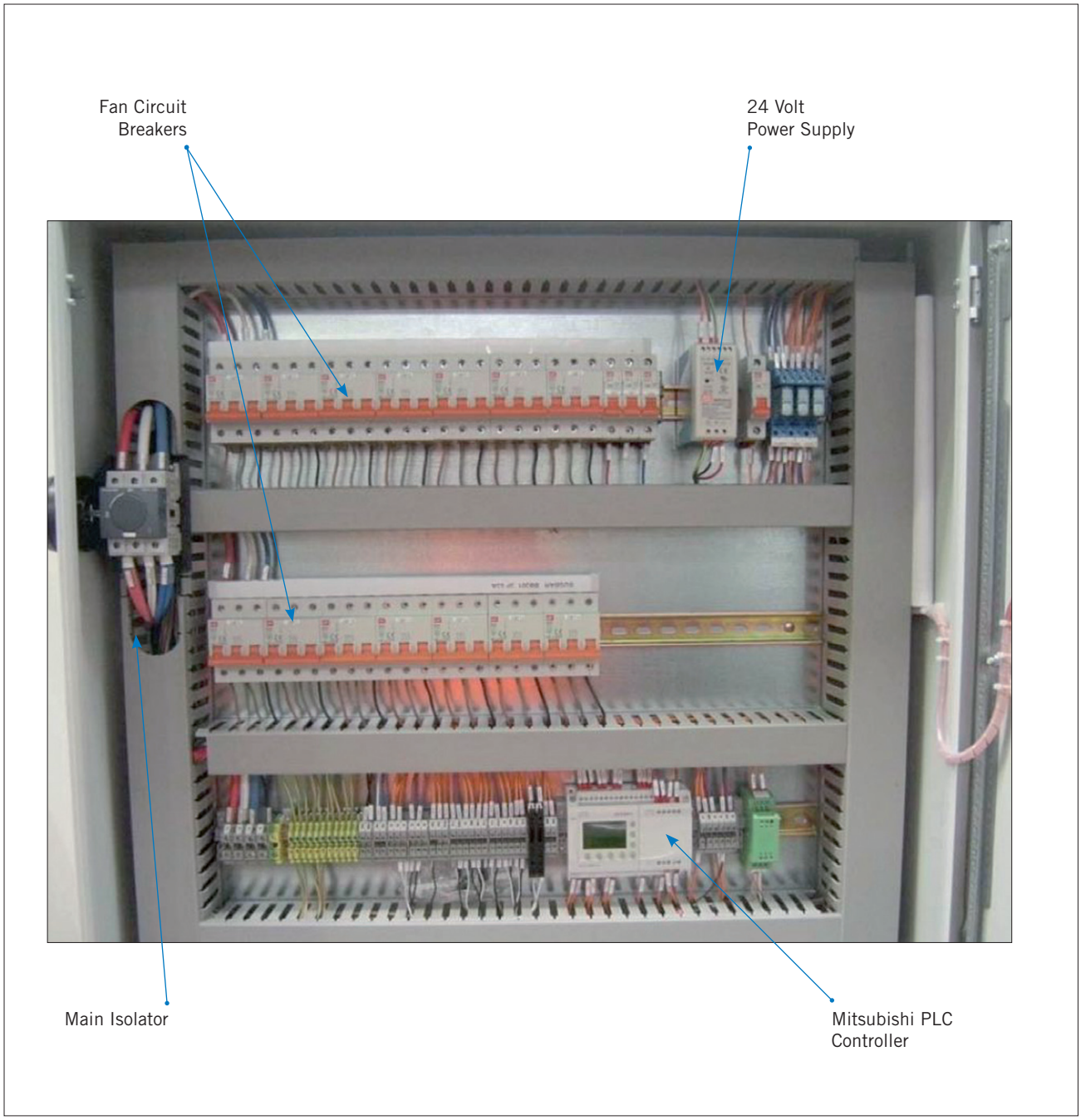


Figure 8

"3C 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 3C systems.

4.5.1 Mounting

All systems must be set up level. Information about size and weights is given in the Technical Data Sheets (refer to Section 11).

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 3C Cooler headers.

If 3C 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.

Connection sizes are given in the Technical Data Sheets (refer to Section 11).

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.

Figure 9. Air Bleed Valve.

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.

(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

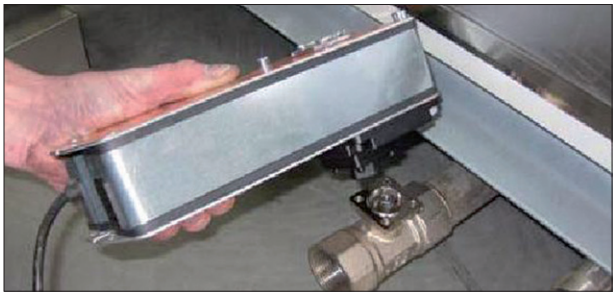


Figure 12

Figure 13

(c) Condenser Water Circuit

- Connect to 3C 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 value.
- 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.

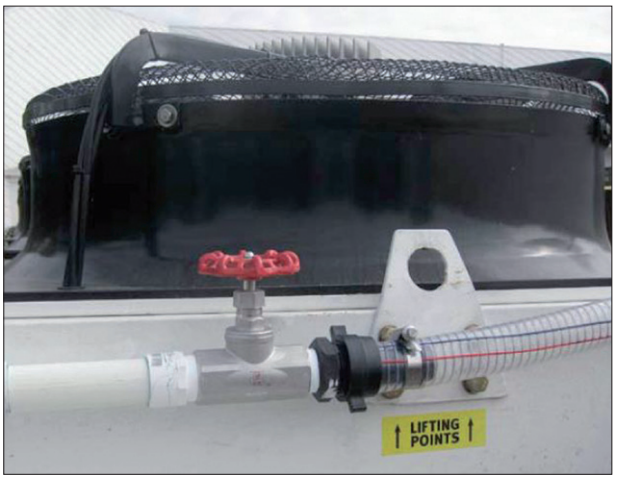


Figure 14. Evaporative Pad Water Regulating Valve.

(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) RPZ Valve Assembly (anti back flow device).

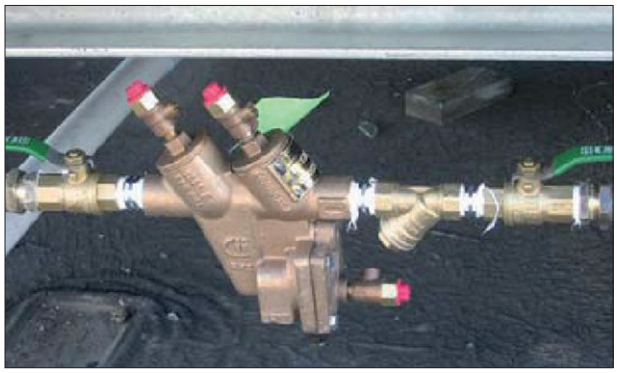


Figure 15. RPZ Valve Assembly (anti-back flow device).

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 3C Cooler unit technical data sheet included in Section 11 of this manual.

- Connect protected power supply to 3C 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 on the 3C Cooler technical data sheet (refer to Section 11).

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 3C Components

5.1 Water Level Control

The 3C evaporative system's water levels in the Celpad basins are controlled by water float switch.

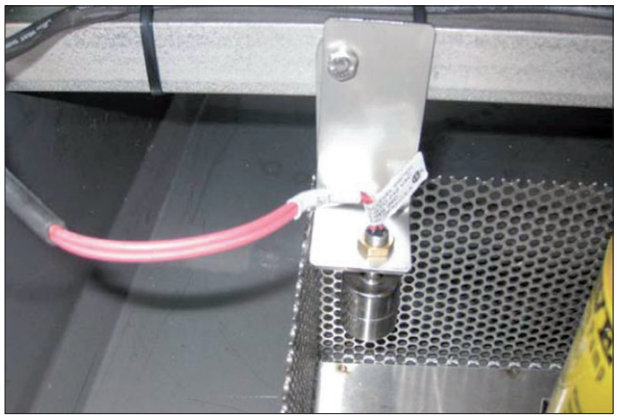


Figure 16. Water Float Switch.

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. Stainless Steel Sump.

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.

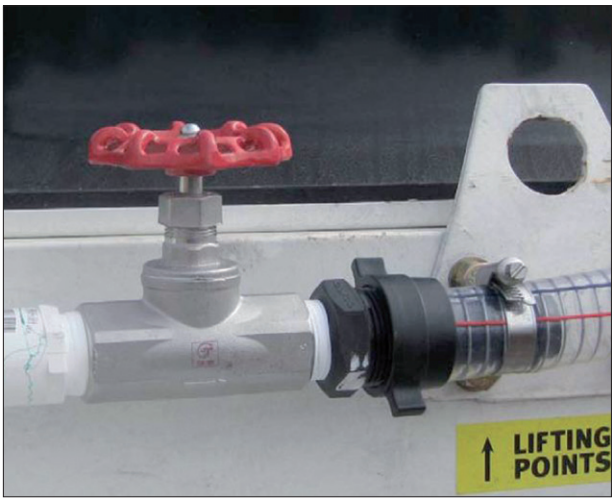


Figure 19. Evaporative Pad Water Regulating Valve.

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 3C radiator block heat exchanger[7].

6.1 Water Treatment Considerations for the Open Loop Water

6.1.1 Potential for Scale

The novel design of the BAC 3C systems and the use of evaporator pads ensure scale on the heat exchanger is avoided[8].

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 3C systems. 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.

7 A closed loop is not present in the BAC Dricon unit. Refrigerant is passed through the heat exchanger block on these devices.

8 It will be noted this is a significant design improvement over conventional 3C and Dricon coolers where water is sprayed directly onto the surface of the heat exchanger causing scale, fouling and reduced heat transfer.

6.2 Water Treatment Considerations for the Closed Loop Water[9]

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.

9 Further information is available in the following technical note from BAC; "TECHNICAL NOTE: Water Treatment for the Cooling Water Loop"

7.1 System Controller

A BAC supplied programmed logic controller can be provided as standard. The PLC is used for capacity control and for regulating the evaporative pre-cooling system. Where the 3C system is controlled from a remote PLC or BMS system, control logic must be programmed into the control system.

Functional descriptions and operating instructions of the 3C 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. Unit Controller attached to Cooler

7.3 Routine Cleaning

The 3C 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.

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.

Figure 21.
Typical pump on a 3C/Dricon unit. Pumps should be periodically cleaned. 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 3C/Dricon 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 /3C/Dricon system has an electric dump valve that is automatically operated by the 3C/Dricon controller.

⚠ Caution

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

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 3C/ Dricon system are higher than normal

- Check to see that the unit is actually running (check PLC display is lit up).
- 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

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.

BALTIMORE
AIRCOIL AUSTRALIA

www.BaltimoreAircoil.com.au

120 Wisemans Ferry Road, Somersby NSW 2250
Telephone (Australia): 1300.134.622
Telephone (New Zealand): 0800.225.842
info@baltimoreaircoil.com.au

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:.....

10 Celdeck Commissioning Procedure

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%(Fans can be isolated at circuit breakers during this procedure).

   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 22. Access panel to sump pump.

Figure 23. Celdeck pump regulating valve.

11. V12 Control Switchboard

11.1 Standard Fully Automatic Switchboard

11.1.1 Functional Description

Customer Electrical Conections

For the standard control panel, electrical connections are made to the bottom of the main isolator inside the electrical panel. Connections are 3ph neutral and earth. Refer to Figure 24 page 29.

For the standard panel there is no need to make any other electrical connection for the unit to operate. All controls are automatic including fans speed, pre cool mode, make up solenoid valve, pump operation, and dump cycle. However, some additional interfaces are available including the connection of a remote enable no voltage switch and alarm relay (refer below).

Control Method and Additional Interfaces

As stated above the V12 unit is provided as standard with a control system that is fully automatic and needs no outside controls to be fully functional. The following additional interfaces are available if the customer requires.

A remote enable connection is available between terminals 1010 & 1010A. The panel, as supplied, has a bridge between these terminals. Connection of a no voltage relay will allow the unit to be remotely enabled.

A fault light is located on the door of the electrical panel. This fault alarm signal can be remotely monitored from terminals 24 and 25. A 24V signal will be present if a fault is detected by the control system in the unit.

Pre - Cooling operation:

The BAC factory fitted control panel is pre-wired for control of all pre-cooling components. (pump, solenoid valve, dump valve & float switch).

Pre cooling mode (adiabatic wet pads) is controlled from the water temperature leaving the unit. This set point is user adjustable through the PLC screen interface. Default value is 29oC.
The unit always starts in dry mode. As the temperature of the leaving water rises and approaches the set point the fans will speed up to increase the unit heat rejection. If the fan speed rises above 80% for more than 20 minutes, pre cool mode will be enabled. Once pre cool mode is enabled it will stay in that mode for 60 minutes. If after 60 minutes the fan speed has dropped below 40% for more than 20 minutes the unit will revert to dry mode operation.

The controller time clock is pre-set to stop the pre-cool cycle (Dump mode) between 5am & 5:15am to confirm water is drained from the sump after an adiabatic precool mode has been entered during the day. The dump mode will be activated during this time period regardless of the ambient temperature & the position of the customer relay.

Controller set point adjustments

To adjust the water leaving set point or the dump mode time:

- Push the down arrow key until the desired set point screen is displayed.
- Push the OK key and the set point value will begin to flash.
- Use the + & - keys to adjust the value
- Push the OK key
- The new set point value has been entered
- A password may be required to change this value.

11.1.2 Electrical Drawings and Circuit Diagrams

14 Fan Unit Shown (Others Similar)

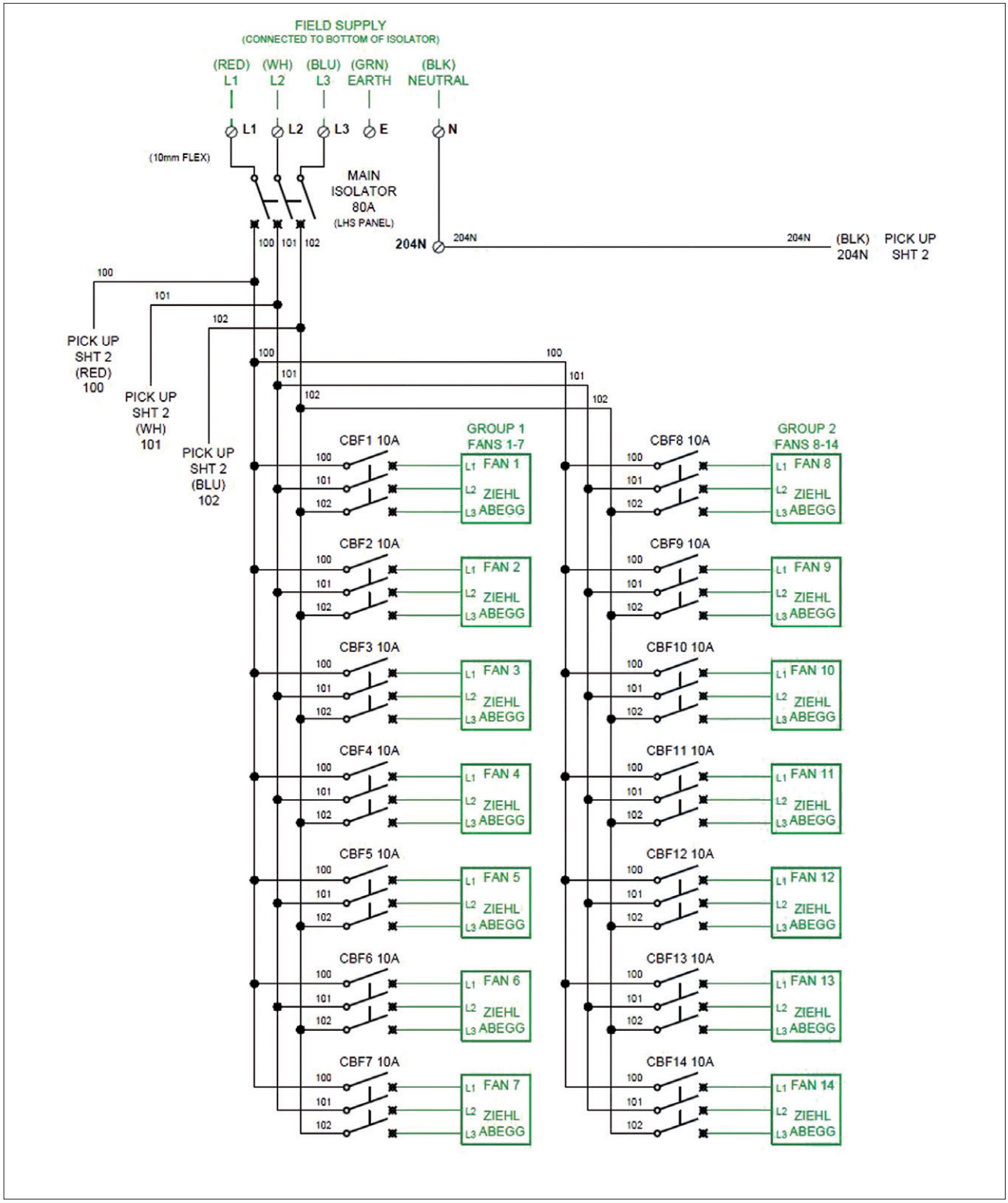


Figure 24

11. V12 Control Switchboard

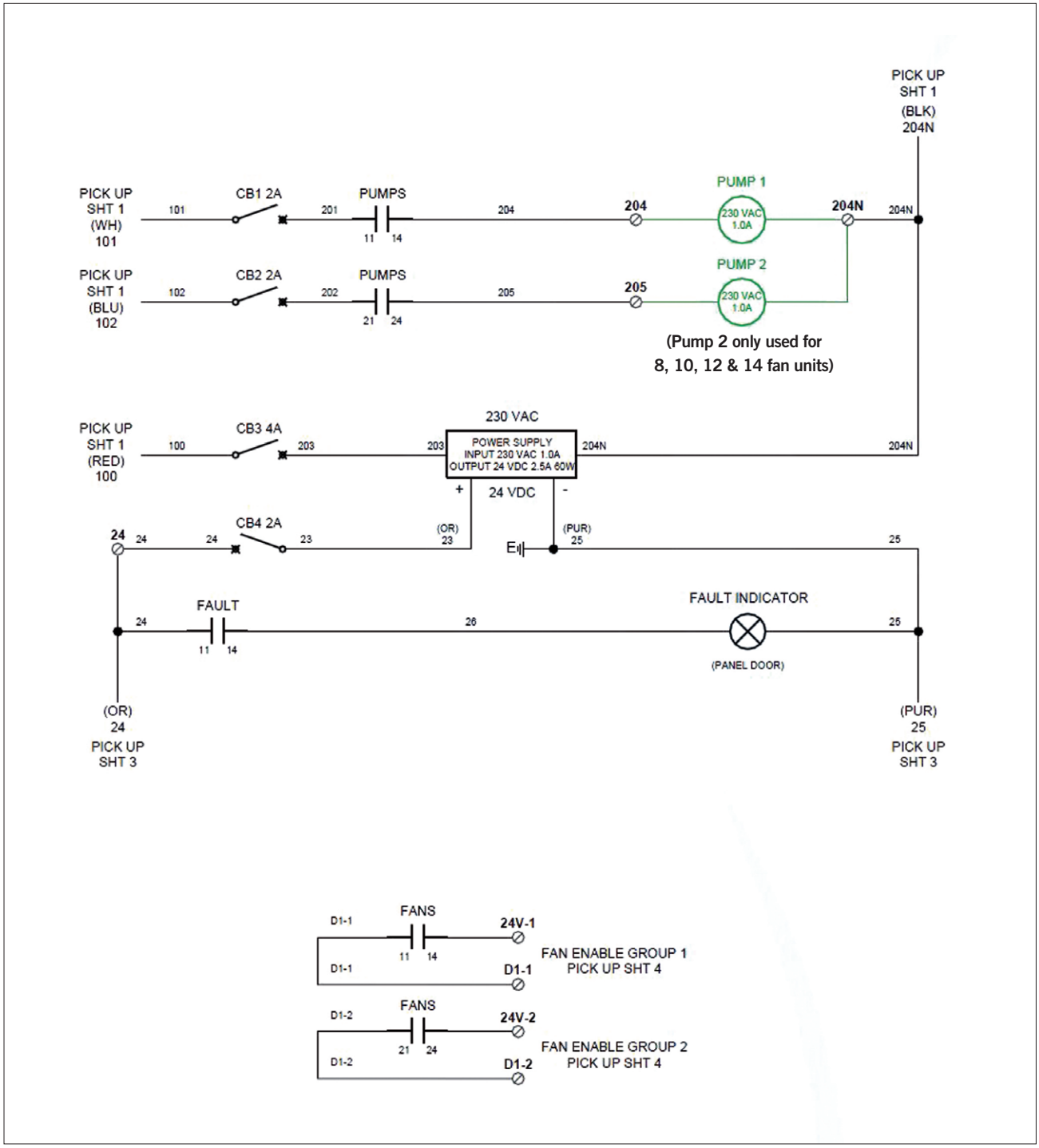


Figure 25

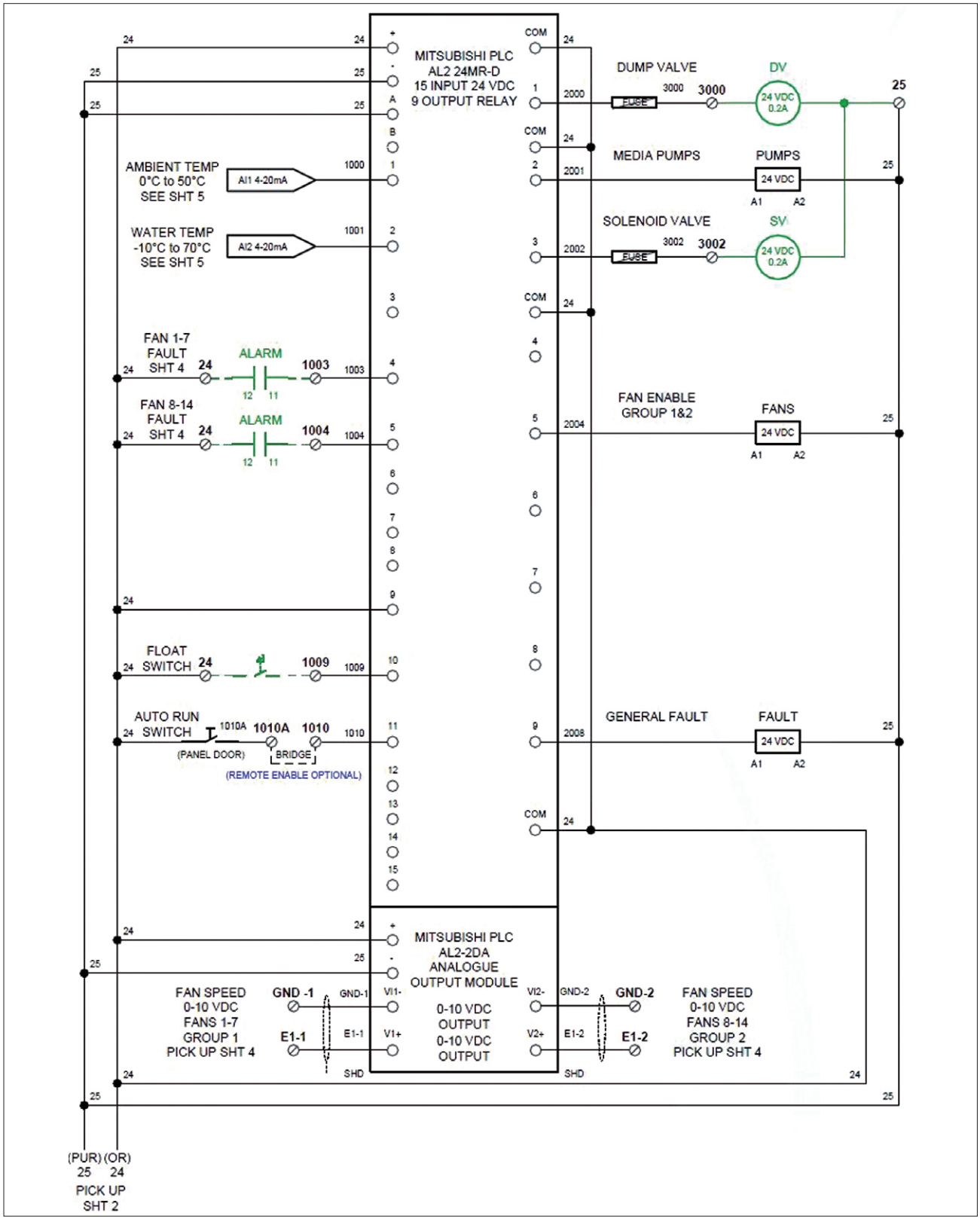

MITSUBISHI PLC
AL2 24MR-D
15 INPUT 24 VDC
9 OUTPUT RELAY
DUMP VALVE
DV
24 VDC 0.2A
MEDIA PUMPS
PUMPS
24 VDC
SOLENOID VALVE
SV
AMBIENT TEMP
0°C to 50°C
SEE SHT 5
AI1 4-20mA
WATER TEMP
-10°C to 70°C
SEE SHT 5
AI2 4-20mA
FAN 1-7
FAULT
SHT 4
ALARM
FAN 8-14
FAULT
SHT 4
ALARM
FAN ENABLE
GROUP 1&2
FANS
FLOAT
SWITCH
AUTO RUN
SWITCH
(PANEL DOOR)
BRIDGE
(REMOTE ENABLE OPTIONAL)
GENERAL FAULT
FAULT
MITSUBISHI PLC
AL2-2DA
ANALOGUE
OUTPUT MODULE
0-10 VDC
OUTPUT
0-10 VDC
OUTPUT
FAN SPEED
0-10 VDC
FANS 1-7
GROUP 1
PICK UP SHT 4
FAN SPEED
0-10 VDC
FANS 8-14
GROUP 2
PICK UP SHT 4
(PUR) 25
(OR) 24
PICK UP
SHT 2

Figure 26

11. V12 Control Switchboard

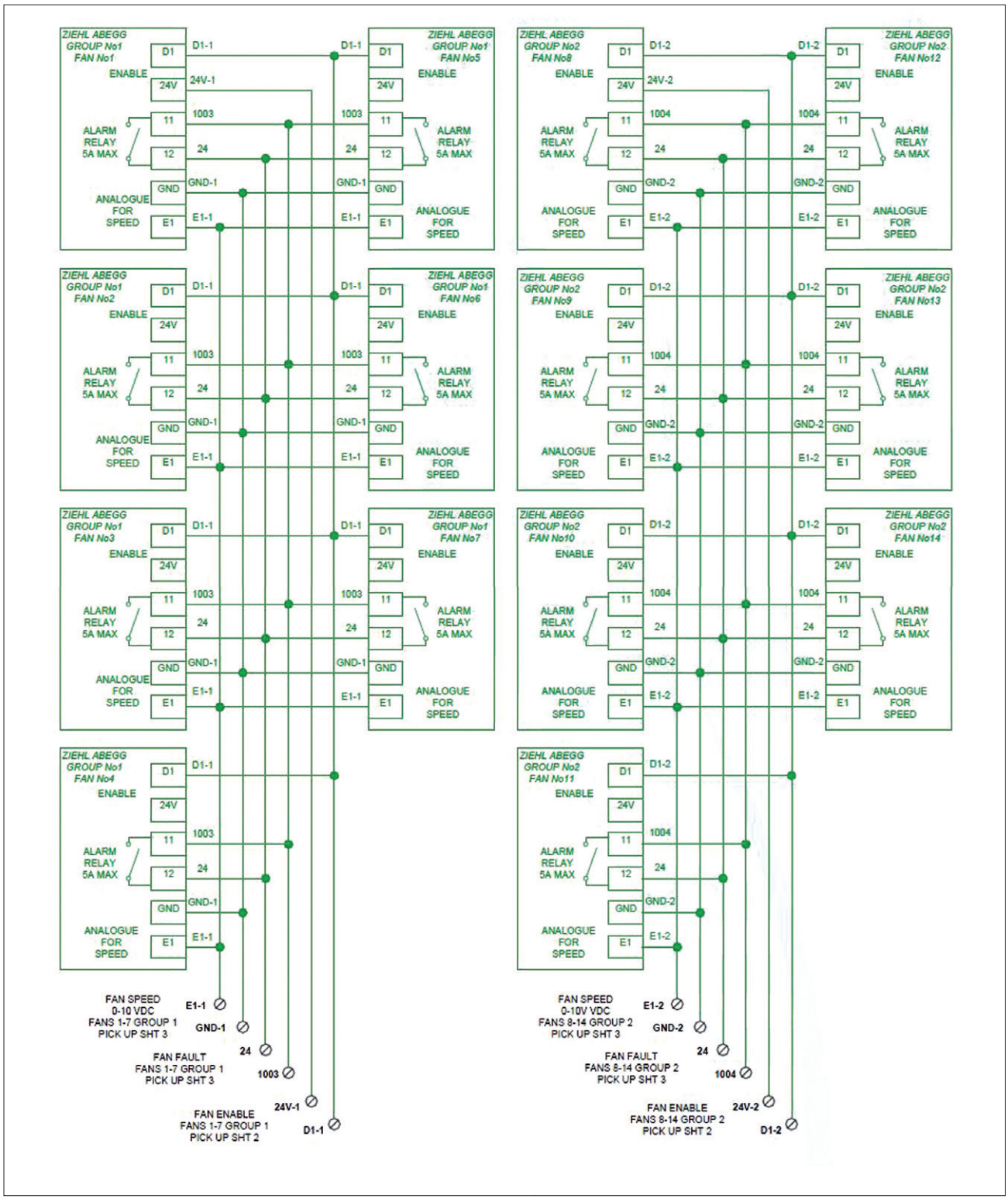


Figure 27

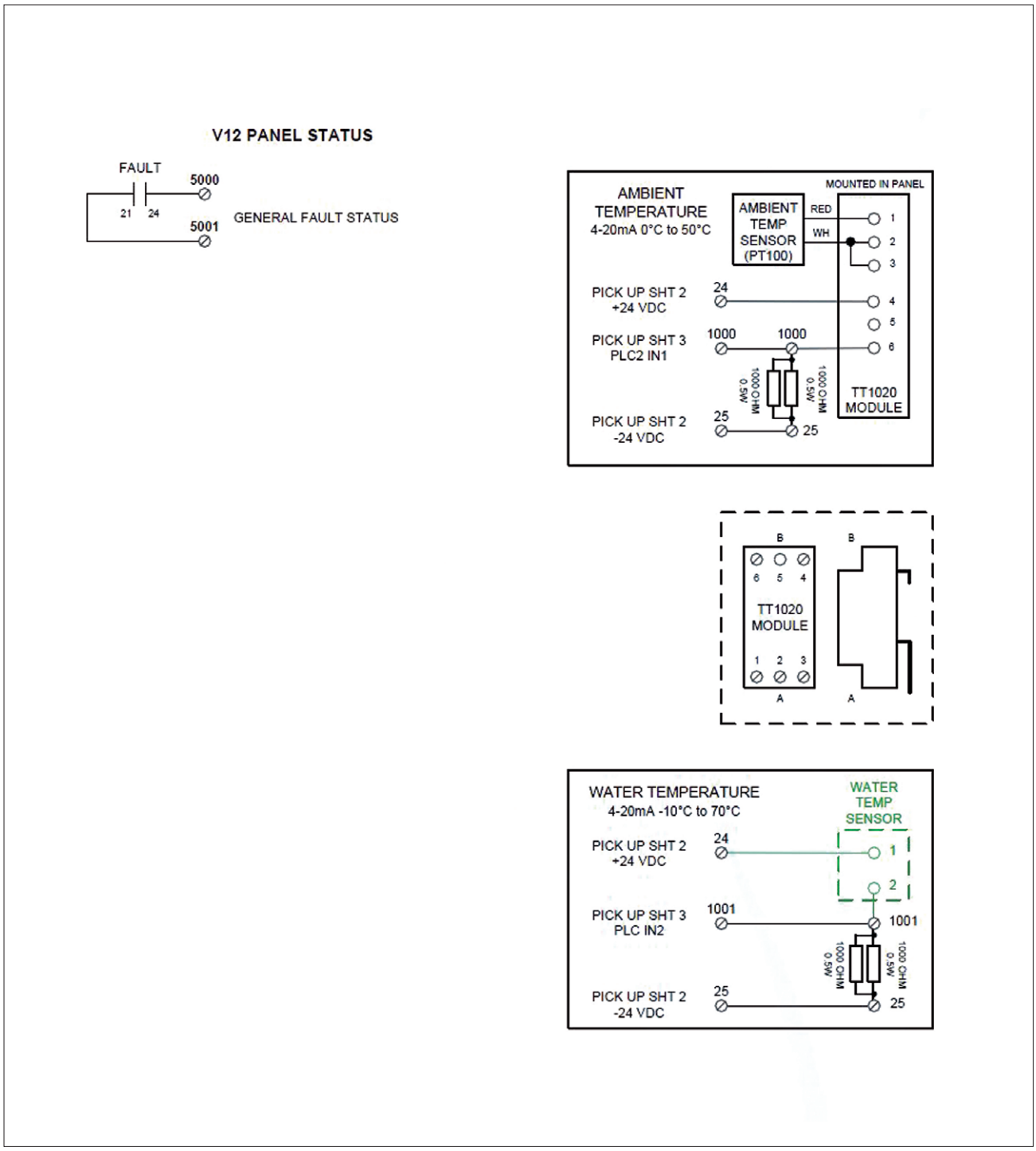

V12 PANEL STATUS
FAULT
5000
21
24
5001
GENERAL FAULT STATUS
AMBIENT TEMPERATURE
4-20mA 0°C to 50°C
AMBIENT TEMP SENSOR (PT100)
RED
WH
MOUNTED IN PANEL
PICK UP SHT 2
+24 VDC
PICK UP SHT 3
PLC2 IN1
PICK UP SHT 2
-24 VDC
1000
1000 OHM 0.5W
TT1020 MODULE
B
A
WATER TEMPERATURE
4-20mA -10°C to 70°C
WATER TEMP SENSOR
1001

Figure 28

11. V12 Control Switchboard

11.2 Optional BMS Enabled Switchboard

11.2.1 Functional Description

Customer Electrical Conections

Customer connections of 3 phase power, neutral & earth/ground is within the isolator/disconnect.

The fan variable speed control is to be connected & controlled by the customer using a 0-10Vdc signal connected in the control panel to terminals E1 & GND for each group (bank) of fans.

The standard B.A.C. control panel is factory fitted with a controller that will activate & control the pre cool system according to an ambient temperature set point.

The connection of above items will allow your B.A.C. cooler to operate, please see the following details for further information

Control Method

The B.A.C. factory fitted control panel has the fan control wires connected at the terminal strip for control by customer.

Only a 0-10Vdc speed signal is required (E1 & GND) to give a speed reference to all fans.

The control enable signal is factory bridged (24V to D1). This can be switched remotely. However, the fans will respond according to the 0-10Vdc speed signal described above. Therefore, when the analogue signal is at 0Vdc the fans will be stopped.

An alarm relay contact from each bank of fans is available for monitoring (24 to 1003 & 1004). This is a no voltage contact & is rated for 5 amp max.

Pre - Cooling operation:

The B.A.C. factory fitted control panel is pre-wired for control of all pre cooling components. (pump, solenoid valve, dump valve & float switch)

The pre cooling mode is activated by the controller according to the ambient temperature. The default ambient setting is 25oC.(User adjustable)

Option - The pre cooling mode can be activated by the customer relay at any time regardless of the ambient temperature, as per wiring schematic terminal no. 4000 & 2000 (24Vdc). This option has been included for customers who chose to control the pre cool cycle from the ‘external’ control system.

The controller time clock is pre-set to stop the pre cool cycle (Dump mode) between 5am & 5:15am to confirm water is drained from the sump. The dump mode will be activated during this time period regardless of the ambient temperature & the position of the customer relay.

Controller Pre Cool activation on ambient air temperature

- The controller activates the pre cool mode when the ambient temperature is greater than the default set point of 25ºC. This set point is user adjustable.
- On activation of the pre cool mode, the dump valve (DV) is energized to close with 24Vac between terminals 3001 & 4001.
- The water make up solenoid valve (SV) is energized to open with 24Vac between terminals 3002 & 4001.
- The sump mounted float switch controls the water level in the sump as a digital input to the controller on terminals 4000 & 1009 (24Vdc).
- The pre cooling pump is energized by the controller when the float switch is made for the first time during the pre cool mode.
- Pre-cool cycle is de-activated once a day with a time clock function at the most desirable time (default 5am to 5.15am dump mode - user adjustable.)

11.2.2 Component Description:

Fan Terminals (Located in control panel)

- **24v & D1** – Control Fan Enable
  - can be remotely switched or bridged (factory bridged)
  - is required to be made for fan to operate
- **Gnd & E1** – Analogue 0-10vdc signal for fan speed reference.

Fan speed; 0v = 0% and 10v = 100%.

Note: Fans require 1.5 to 2vdc before they start.

- **24 to 1003, 1004** – Dry Contact Alarm Relay 5A rated

Pre Cool Connections (Located in control panel)

- **3001 & 4001** – Dump Valve connection
  - o 3001 – Active supply to dump valve (24Vdc+)
  - o 4001 – Negative supply to dump valve (24Vdc-)
- **3002 & 4001** – Water Make up solenoid connection
  - o 3002 – Active supply to solenoid valve (24Vdc+)
  - o 4001 – Negative supply to solenoid valve (24Vdc-)
- **4000 & 1009** – Sump Float Switch
  - o 4000 – Supply to float switch (24Vdc+)
  - o 1009 – Switched value to controller digital input no.4
- **203 & 204N** – Pre Cool Pump
  - o 203 – Active supply to pump (230Vac+)
  - o 204N – Neutral supply to pump (230Vac-)

Controller set point adjustments

To adjust the ambient set point or the dump mode time:

- Push the down arrow key until the desired set point screen is displayed.
- Push the OK key and the set point value will begin to flash.
- Use the + & - keys to adjust the value
- Push the OK key
- The new set point value has been entered.

11.2.3 Electrical Drawings and Circuit Diagrams

6 Fan Unit Shown (Others Similar)

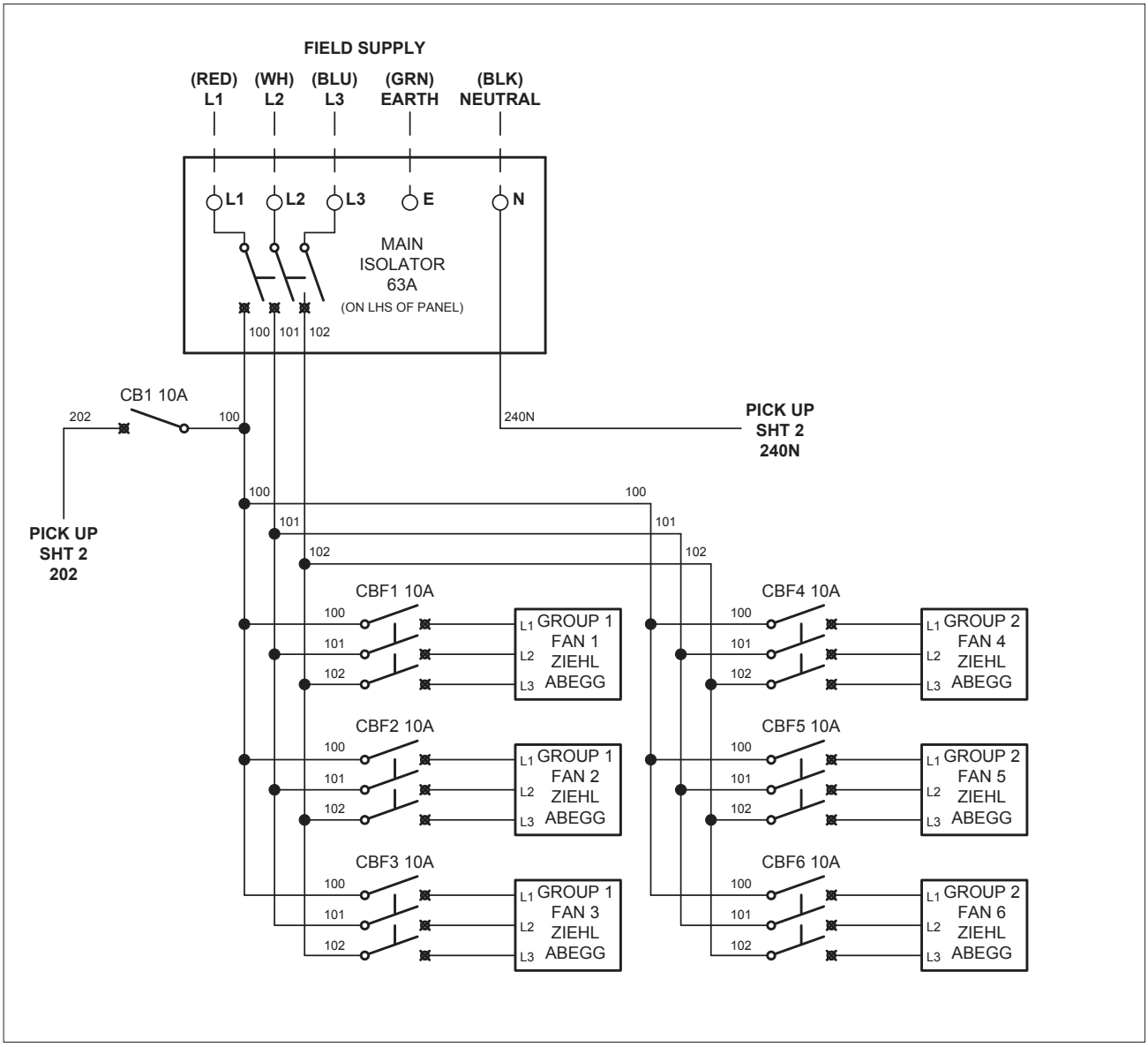


Figure 29

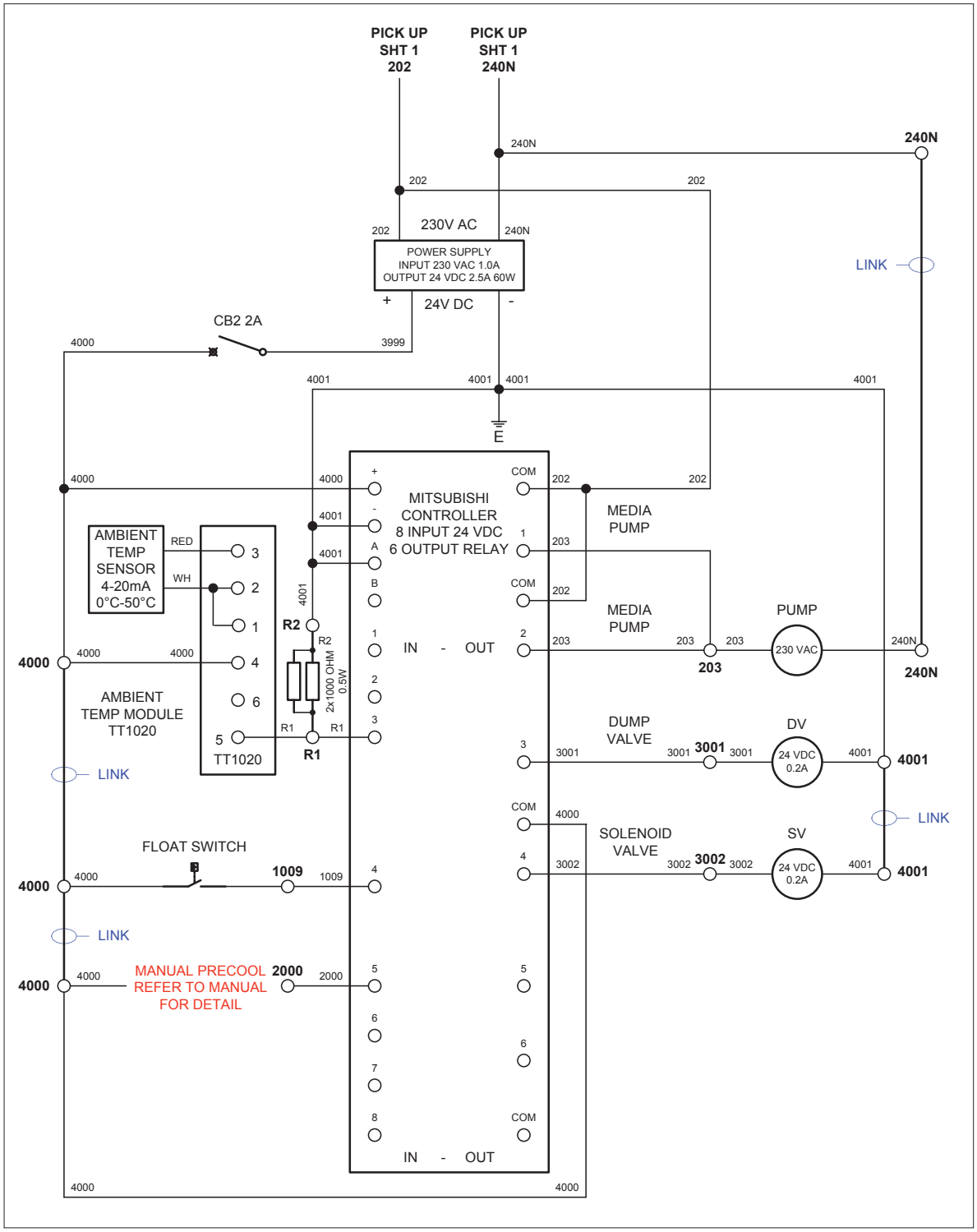

PICK UP
SHT 1
202
PICK UP
SHT 1
240N
240N
202
230V AC
240N
POWER SUPPLY
INPUT 230 VAC 1.0A
OUTPUT 24 VDC 2.5A 60W
+
24V DC
-
CB2 2A
4000
3999
4001
E
LINK
MITSUBISHI
CONTROLLER
8 INPUT 24 VDC
6 OUTPUT RELAY
IN - OUT
COM
MEDIA
PUMP
PUMP
230 VAC
AMBIENT
TEMP
SENSOR
4-20mA
0°C-50°C
RED
WH
AMBIENT
TEMP MODULE
TT1020
TT1020
R1
R2
2x1000 OHM
0.5W
DUMP
VALVE
DV
24 VDC
0.2A
3001
SOLENOID
VALVE
SV
24 VDC
0.2A
3002
FLOAT SWITCH
1009
MANUAL PRECOOL
REFER TO MANUAL
FOR DETAIL
2000
203
4001

Figure 30

11. V12 Control Switchboard

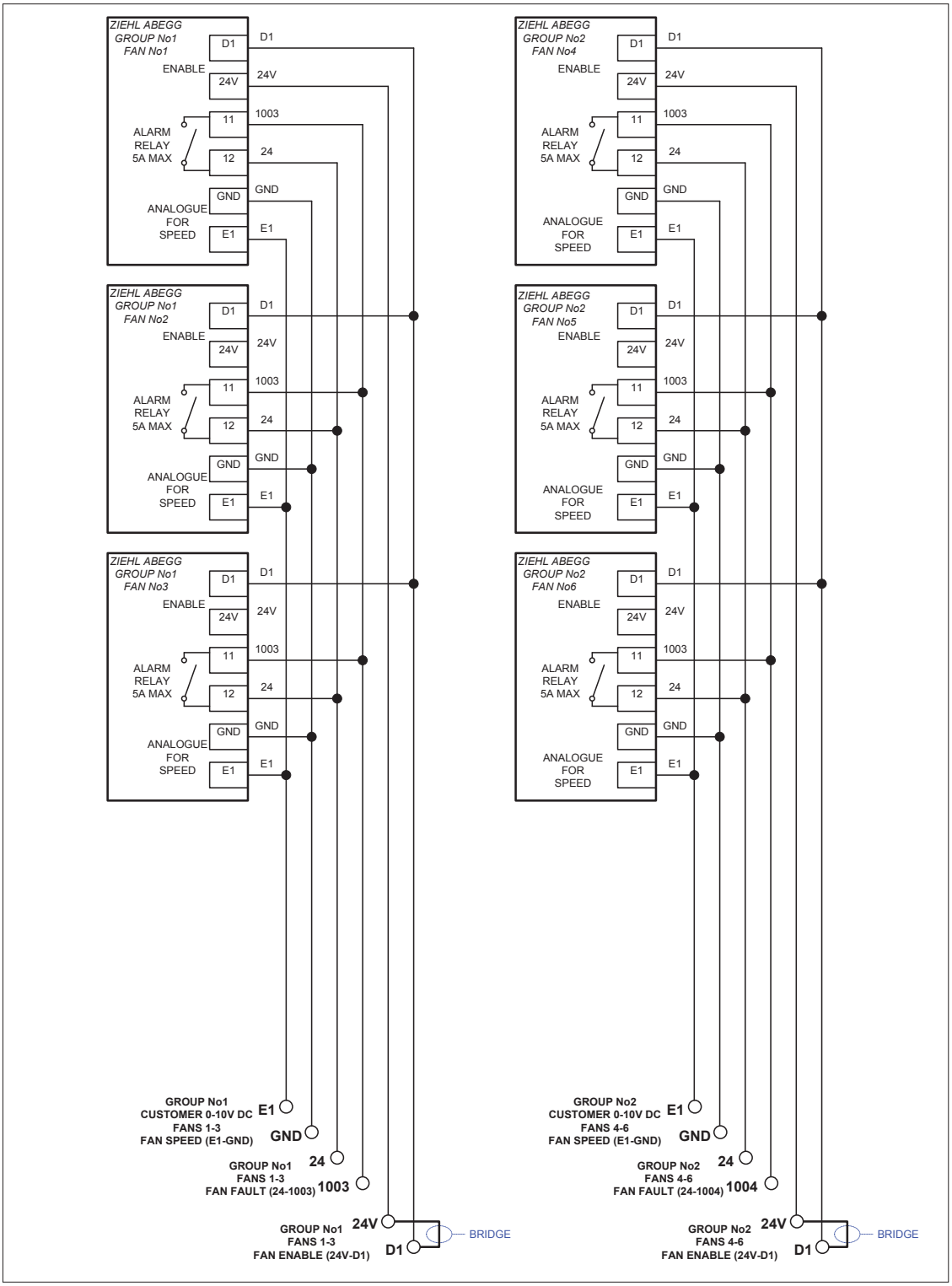


Figure 31

Water Quality Guidelines for 3C Coolers

To ensure long life of 3C evaporative cooling equipment, it is recommended to maintain the circulating water quality within the following limits.

WATER QUALITY MEASURE	
pH	7.0 to 9.0
Hardness (as CaCO3)	30 to 500 mg/l
Alkalinity (as CaCO3)	500 mg/l (max)
Total Dissolved Solids	1000 mg/l (max)
Chlorides	125 mg/l (max)
Sulphates	125 mg/l (max)
Conductivity	1200 µS/cm

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.

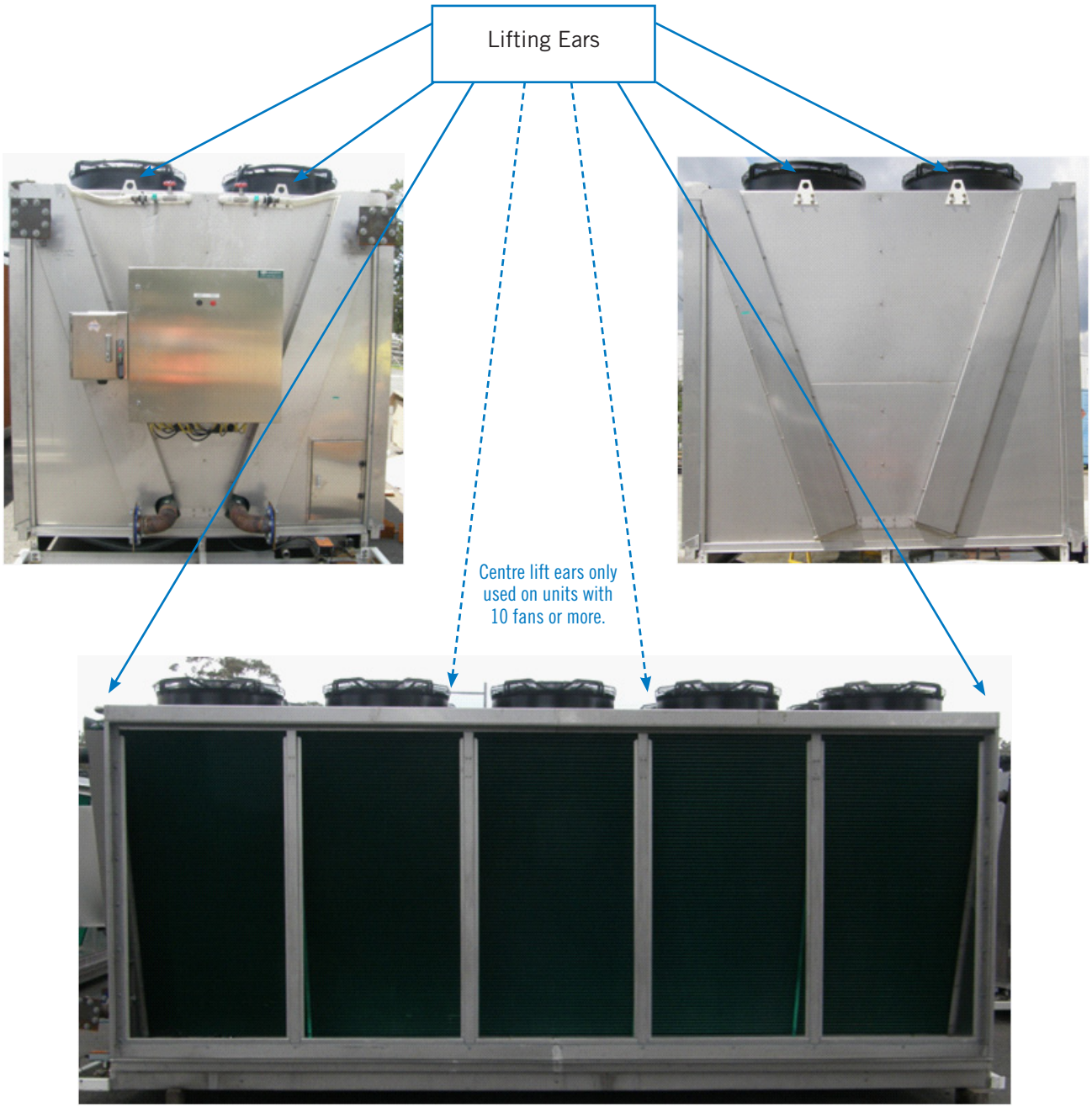


Figure 32

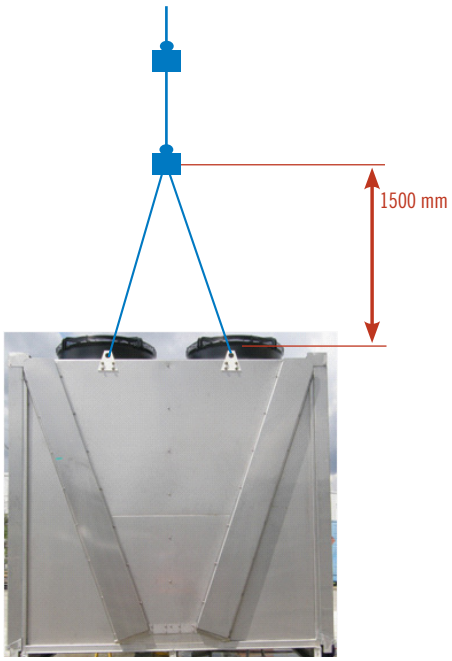
Rigging

For shipping weights refer to unit submittal drawing.

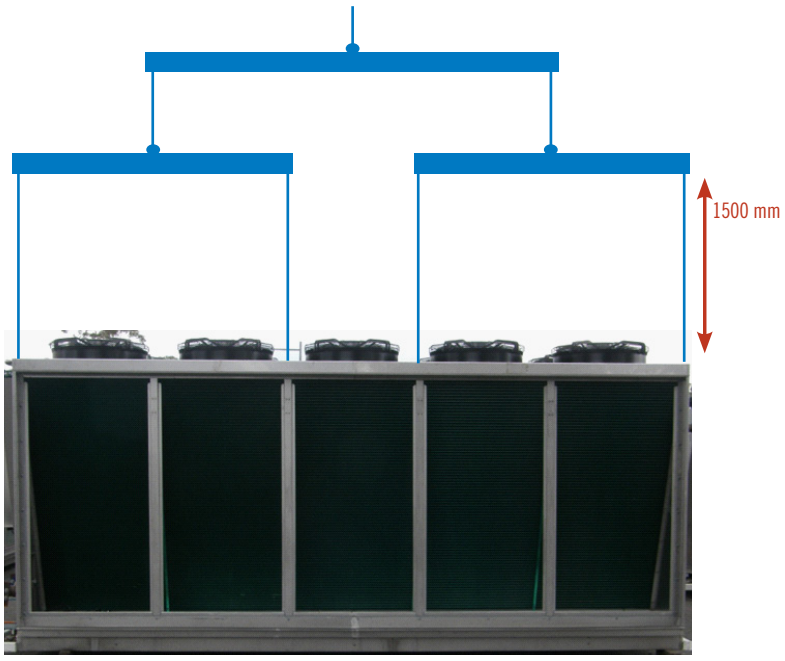
Slings are to be set at a hook height not less than 1.5 m (1500mm) above lifting ear.

As per side elevation view, slings should be vertical.

The unit can be placed safely down on hard flat ground



End Elevation



Side Elevation

Figure 33

COOLING TOWERS

CLOSED CIRCUIT COOLING TOWERS

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