



BacComber

(Non-Chemical Condenser Water Treatment System)

Operations & Maintenance Manual

**Ecospec NovelTech Pte Ltd
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1. Introduction

The newly developed BacComber System is designed to be economical, simple to install and effective in treating water in cooling towers. Using the ULF (Ultra Low Frequency) wave technology, it is effective in controlling scaling and corrosion, preventing algae and bacteria growth in the water without any chemicals or additives.

Scale Control

Scale formation is prevented by increasing the solubility of Calcium ions in the water and encouraging precipitation as harmless Aragonite as opposed to the scale forming calcite. This protects the condenser and other heat surfaces from scale and removes the need for chemical addition.

Biological Control

The ULF also inhibits the growth of bacteria and algae by interfering with the cell division process. This effectively prevents colonization of the cooling system, as well as 'killing' existing bacteria and algae colonies. Again this is achieved with no chemical addition.

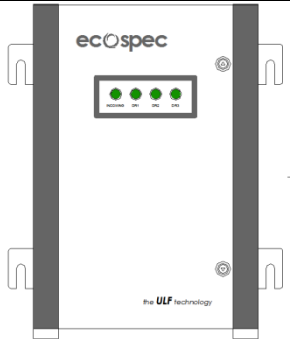
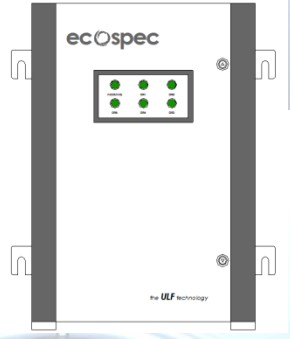
Corrosion Control

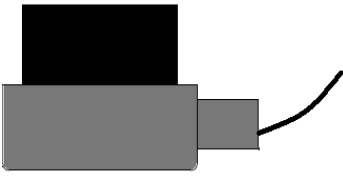
ULF treatment encourages the formation of Magnetite on bare steel surfaces. Magnetite is stable and once formed protects the underlying steel surface from further corrosion. Magnetite can also form under existing red rust (Hematite) corrosion, preventing further loss of steel. Painting and coating is not required.

This manual includes product information and installation instructions. Users are advised to adhere to the instructions provided in order to obtain OPTIMAL BacComber performance.

2. Product Specification

The BacComber system comes with an enclosure and emitters.

 <p>Size: 450 x 650 x 300mm</p>	Enclosure Material	IP65 Steel Enclosure
	Voltage Input	85~264VAC; 50~60Hz
 <p>Size: 550 x 780 x 300mm</p>	Maximum output	OP1: 0.2kW OP2: 0.5kW OP3: 0.67kW OP4: 0.85kW OP5: 1.05kW OP6: 1.4kW
	Dimension (W x H x D)/ Weight	OP1 & OP2: 450 x 650 x 300mm/ 33kg OP3, OP4, OP5 & OP6: 550 x 780 x 300 mm/ 43kg

 <p>G. Emitter</p>	Emitter Material	Graphite / PVC
	Cable	2.5mm ² XLPE single cable 10m long
	Diameter	95mm
	Height	73mm
	Weight	1kg

3. Installation and Operation

The BacComber has very minimal spare parts so that it is easy for installation. The power unit in the enclosure wire connected with emitters. The varying field energy generated by power unit will be emitted into water through the emitters placed in the cooling tower sump. The schematic layout of the system is shown in the below figure.

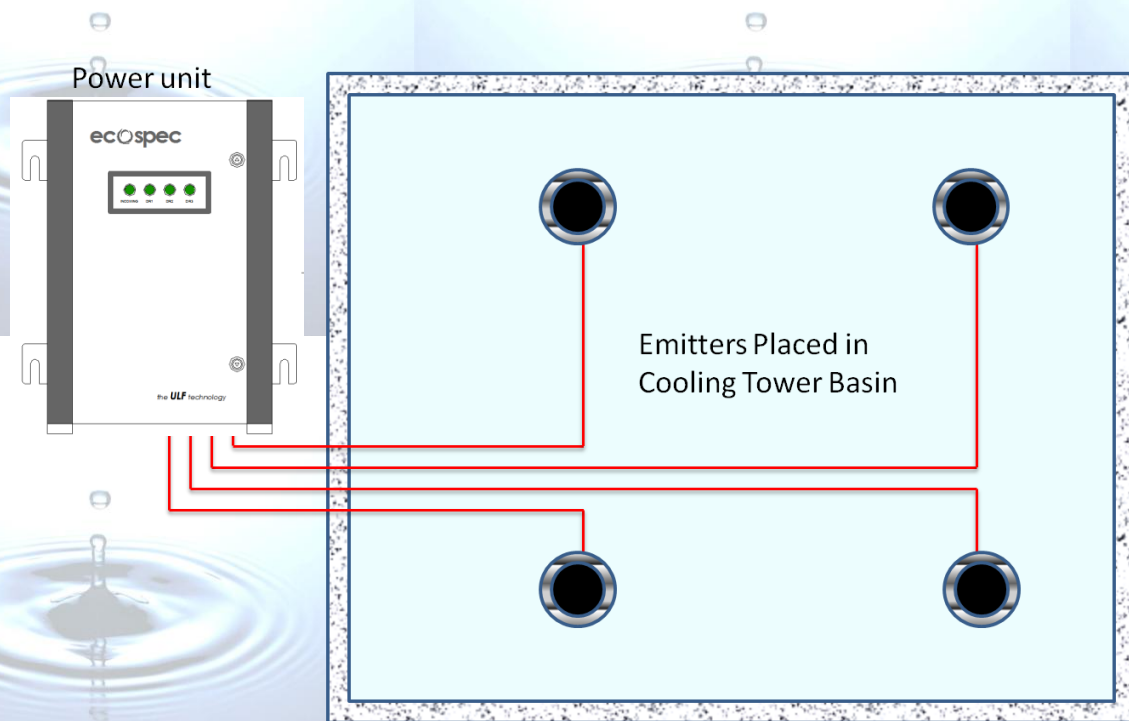


Figure 1: BacComber Schematic Diagram

4. Installation of Emitters

The emitters can be installed in both box type and bell shaped cooling tower.

In order for the system to perform effectively, users have to ensure the following are carried out:

- It is advised that the cooling tower basin is fully cleaned prior to installation to ensure that a sound base is prepared for the emitter mounting structure and cables.
- Cables need to be run through protective conduit to avoid damage both inside and external to the cooling tower basin.
- Emitters must be fully submerged in the water.
- Emitters have to be placed apart at an optimized distance as shown in the following diagrams.
- PVC pipes are recommended to secure and maintain the fixed optimized distance. It can also be used to run cable so as to ensure tidiness in the cooling tower basin.
- The polarity (negative/positive) of the emitters has to be the same as shown in the following diagrams.

4.1 Box Type Cooling Tower

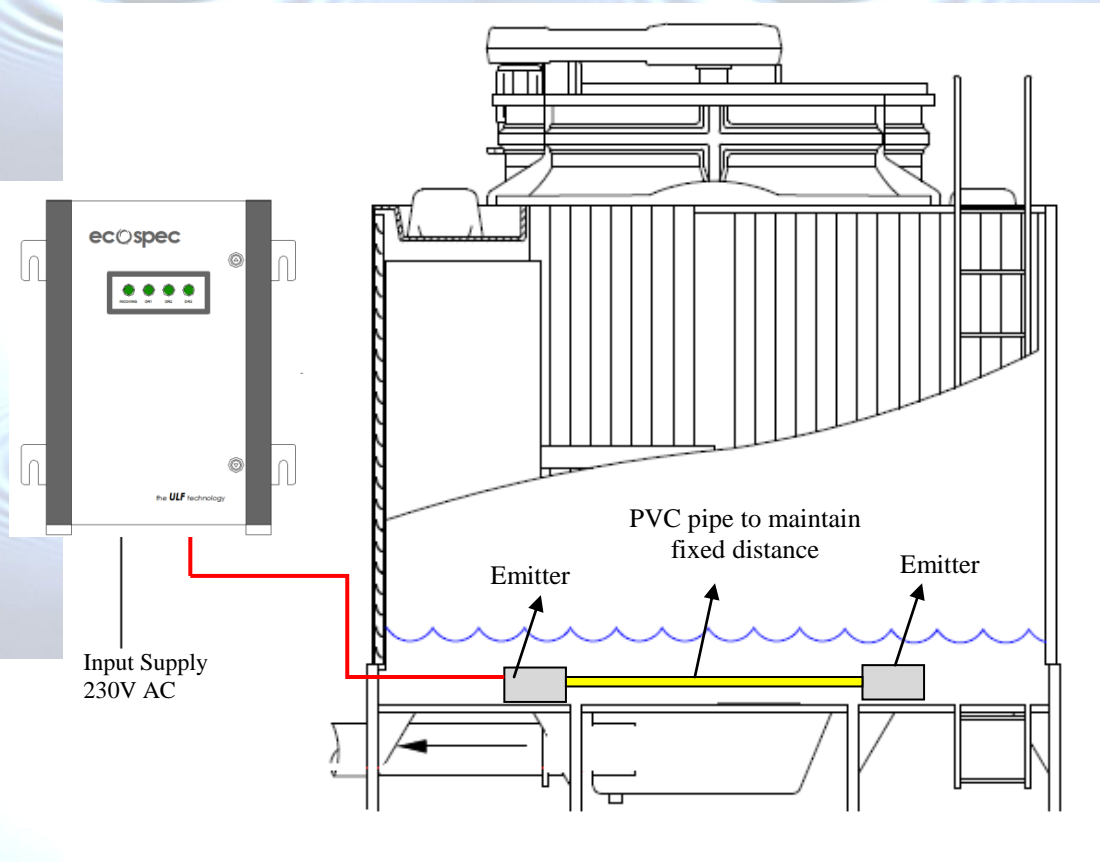


Figure 2: Installation on Box Type Cooling Tower

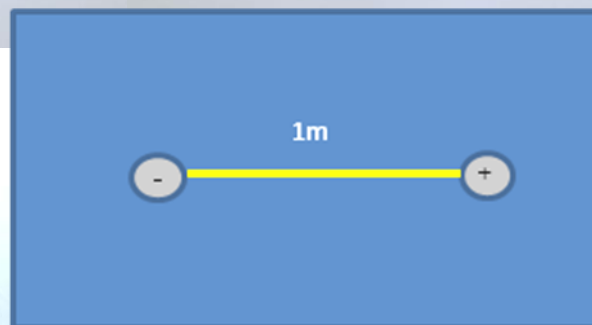


Figure 3: Installation Type 1 Layout

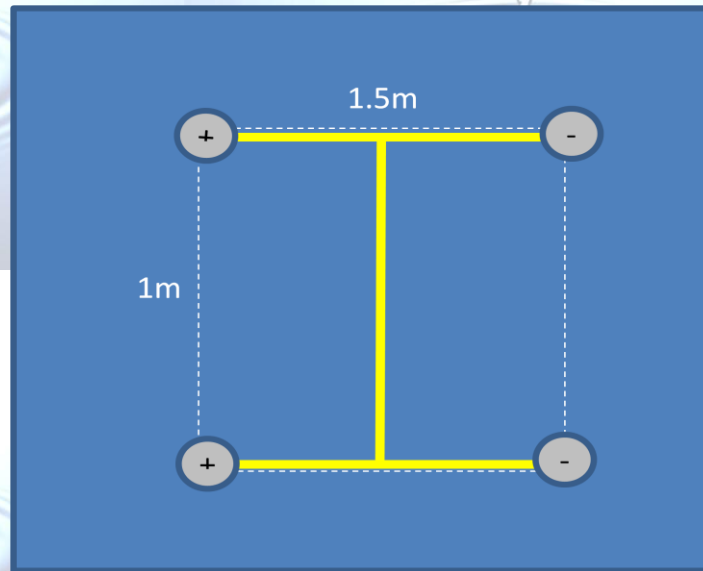


Figure 4: Installation Type 2 Layout

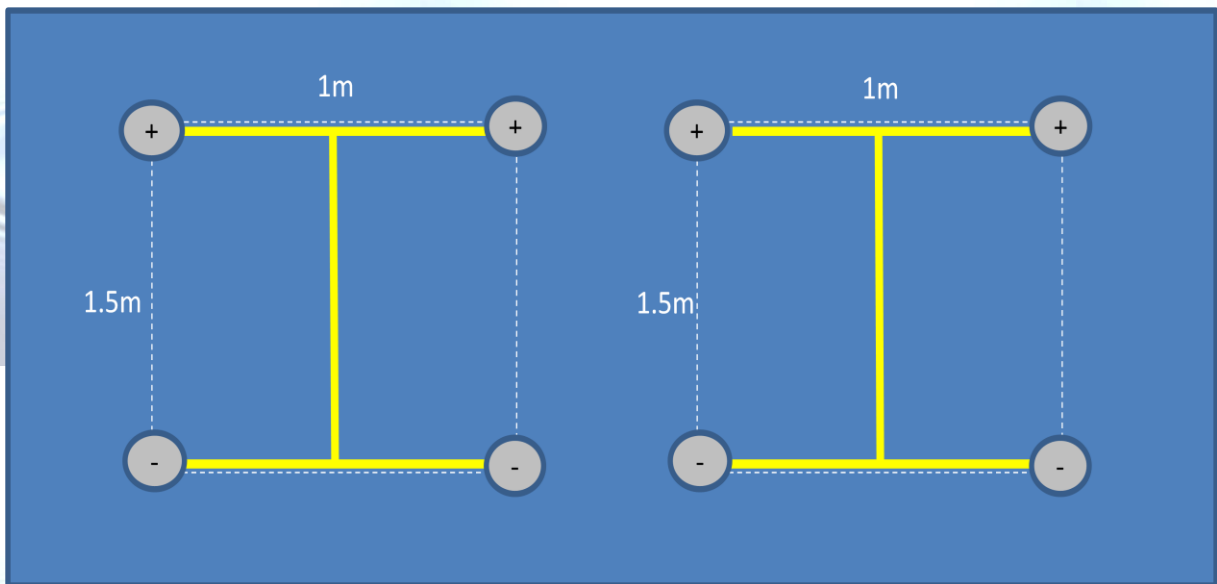


Figure 5: Installation Type 3 Layout

4.2 Bell Shape Cooling Tower

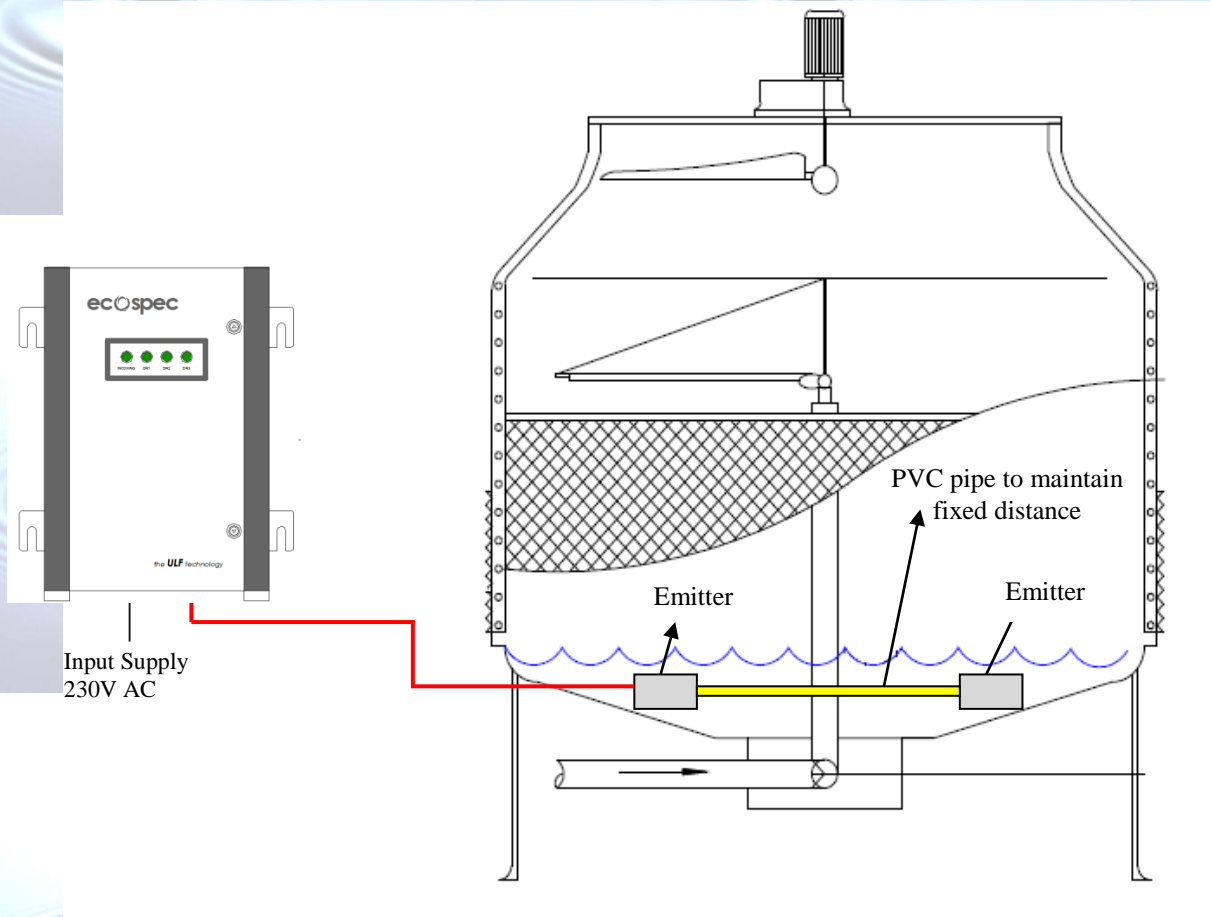


Figure 6: Installation on Bell Shaped Cooling Tower

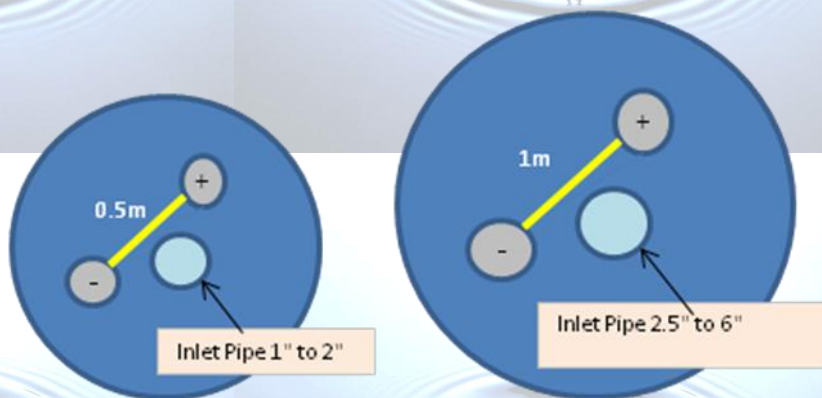


Figure 7: Installation Type 1 Layout

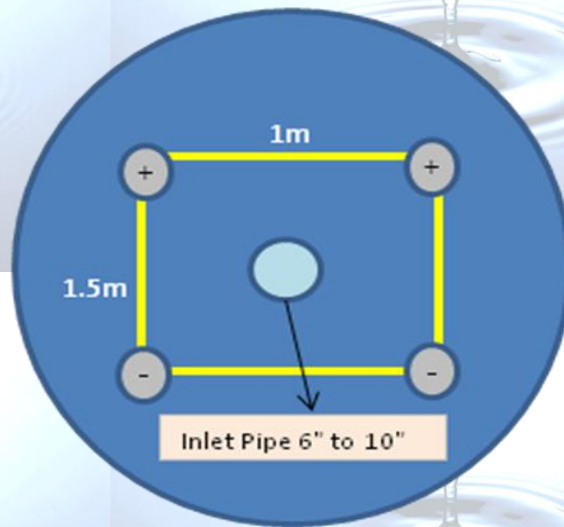


Figure 8: Installation Type 2 Layout

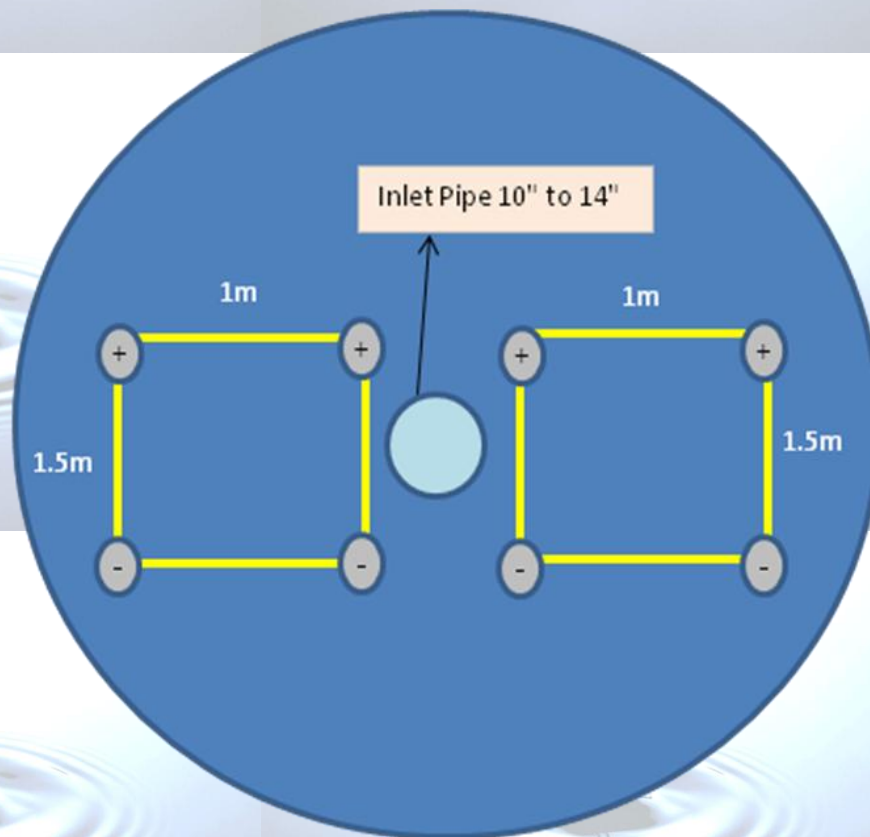


Figure 9: Installation Type 3 Layout

5. Mounting of the Control Panel

5.1 Location of Enclosure

- The enclosure assembly is to be placed at location outside of the cooling tower, but as close as possible to the cooling tower.
- The control panel although designed to be waterproof should be mounted in an area protected from rain, dust and direct sunlight. Note the panel is not resistant to power washing or high pressure hosing.
- It may be located against a wall, or below or beside the cooling tower where power supply is available.

One of the possible enclosure locations



Figure 10: Typical Location of Enclosure

6. Interfacing Connection

The cables attached to the emitters are to be connected to the enclosure in the following manner:

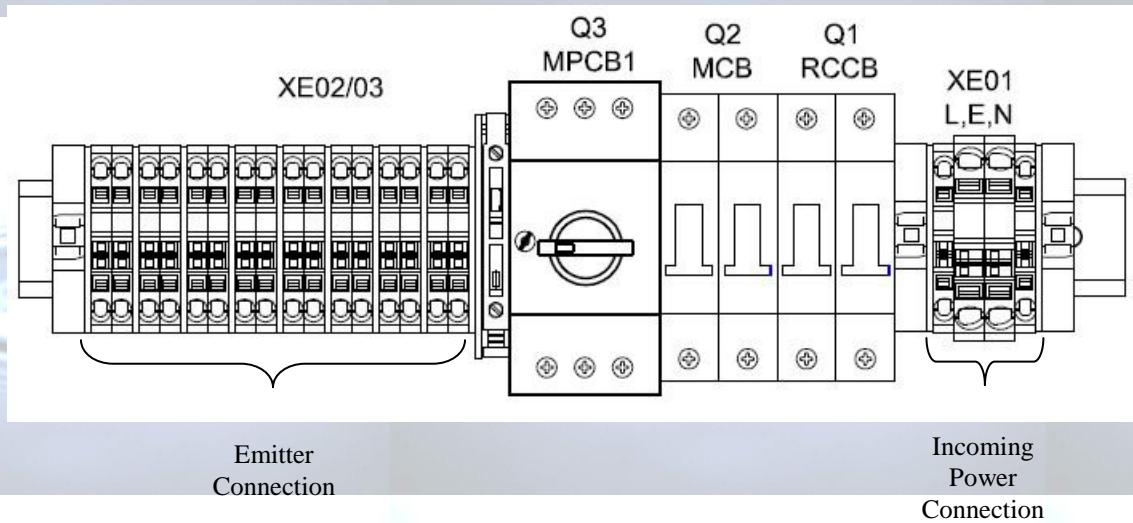


Figure 11: Cable Termination Point

7. Troubleshooting

- If the green LED does not light up, check to see if there is incoming power supply. If the main power supply is off, simply switch it on.
- If the green LED does not light up and there is incoming power supply, tong the wire going to the terminal of the BacComber Power Unit. If there is no current, the fuse in the BacComber Power Unit may be burnt. Replace with a new fuse and switch on the system.
- If green LED lights up but has no output current, the cable lugs might have come loose. Fasten the cable lugs by screwing tightly the positive and negative terminal.
- If you face other problems with the system, please contact Ecospec Global.

Troubleshooting Tips:

- When testing the control panel, emitters should be connected (unless otherwise noted). If either end is not connected, the results may be inaccurate.
- Always keep a small jumper wire or small test-pen in your toolbox for troubleshooting.
- Unless otherwise noted, **ALWAYS** remove power from the machine before testing any wires to avoid electrical shock.
- If you require assistance in troubleshooting, please have the serial number and a description of the problem available before calling.

8. Startup Recommendations

8.1 Understand the Treatment

BacComber is a non-chemical water treatment system. Unlike the chemical water treatment, BacComber has a unique descaling function which is removing the existing scale and deposits from the cooling water system. The longer the BacComber treatment is in place, the cleaner the cooling system will be. If the cooling water system was treated by chemical treatment before, you may expect a **transition period** of few months to one year depends on how much chemical in the cooling water system. The longer the chemical treatment, the more scale and deposit (especially the chemicals) have been cumulated in the cooling system.

In this transition period, the chemical scale and deposit in the cooling system will be slowly cleaned from cooling water piping system and enter the main flow stream. In some cases, you may expect to see more sediment and sludge present in the cooling water. These sediment and sludge BacComber removed from chemical treated cooling water are the nutrient for algae and even bacterial. It may promote the algae and bacterial to grow. Besides, the sludge may slowly settle down at the condenser tube surface. It may cause the increase in approach temperature or sometime compressor overloading.

8.2 Recommendations in Transition Period

In order to speed up the transition period, we recommend:

- Blow down more frequently and in greater quantities to reduce chemical concentration and to flush out the sludge and sediments. Control the cooling water conductivity not above 1500us/cm.
- If it is possible, install a side stream filtration system to filter off these chemical sludge and sediments continuously, and without shutting down the cooling system.
- Control the cooling water pH below 8 by dosing the acid.

We also recommend taking photos of cooling water system before the installation of BacComber. The areas of photos include cooling tower, piping system, condenser tube, etc. These photos can be used as the comparison of before and after BacComber treatment.

9. Operation and Maintenance Schedule

9.1 Maintenance Instructions

Minimal maintenance is required for BacComber water treatment system. Nonetheless, to ensure the proper functioning of the system, following maintenance routine should be carried out periodically as such:

- BacComber system should be kept on at all time to ensure effective water treatment
- Ensure that all LEDs on the power unit have its green indication light constantly on
- During system intervals, check the current reading against what was recorded at the beginning of operation. Ensure that the current readings have no extreme deviation.
- Check any damages or corrosion on the electrical components inside the power unit.
- Wipe clean the emitter surface with a wet cloth during monthly cleaning to maintain its effectiveness in transmitting ULF energy.
- Regulate blow down of the cooling tower water to ensure the water parameters are within control limits (see table below) and perform within the capability of the system.

9.2 BacComber Water Treatment System (Cooling Tower Water) Control Limits

Cooling Water	Controls Criteria	Remarks
pH	6.5-9	Typically, the water should become more alkaline i.e. pH >8 for effective treatment.
Conductivity	< 1500 $\mu\text{S}/\text{cm}$	To control the cycle of concentration (COC). Do not go below 1000 $\mu\text{S}/\text{cm}$ for effective algae control
Total Dissolved Solid	< 750 ppm	Conversion factor of 0.5
Iron (Fe) ions	< 1 ppm	Corrosion control
Total Hardness as CaCO_3	<300ppm	Scaling control
Silica Level	<100ppm	Scaling control and to prevent potential co-precipitation with calcium scale.
Chloride	<150ppm	If lower grade 304SST material is used – Corrosion
Total Suspended Solid	<150ppm	Sedimentation control

9.3 Characteristic of Emitter System

- i) BacComber water treatment system comprises one or more pairs of emitters placed in the sump of the cooling tower. The emitters ensure that the ULF wave is passed into circulating water system.

- ii) The emitter will not possess any potential threats to the environment and cooling equipment system:
 - No toxic and metallic material used
 - Low voltage safe to use during the operation
 - Low in electrical consumption

- iii) The emitter is not a consumable item that requires regular replacement and maintenance.
- iv) The emitter treatment system shall be able to treat the water in the cooling water basin even the cooling tower is in the standby mode.
- v) The installation and operation of emitter system will not interfere with the main cooling tower operation.

9.4 Spare Parts List (Key Components Only)

S/N	Parts Description
1	ULF driver card
2	G-Emitter
3	Server A



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