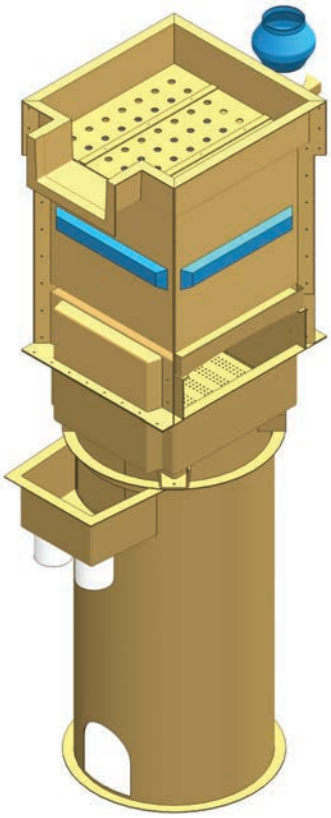
PENTAIR

AQUATIC ECO-SYSTEMS

GAS CONTROL TOWER
(GCT)



INSTALLATION AND OWNER'S MANUAL

IMPORTANT SAFETY INSTRUCTIONS

READ AND FOLLOW ALL INSTRUCTIONS

SAVE THESE INSTRUCTIONS

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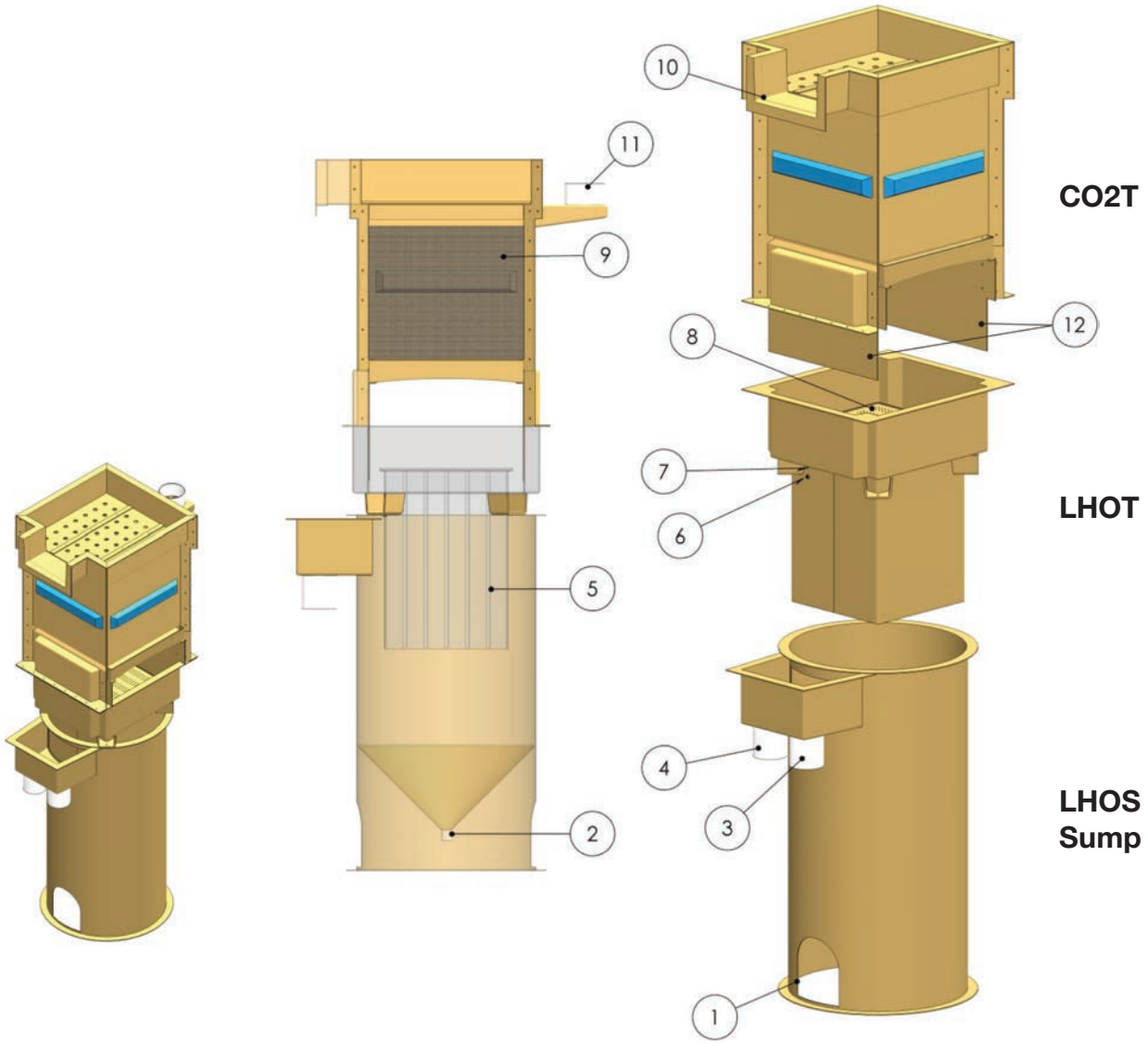
SECTION 1: GENERAL DESCRIPTION OF SYSTEM



(LHOS) LHO Sump		LHOT (Low Head Oxygenator)		CO2T (CO_2 Stripper)	
Mark	Description	Mark	Description	Mark	Description
1	Drain Access	5	LHO Baffle	9	Media
2	Drain	6	Oxygen Connection	10	Inlet
3	Outlet	7	Off-gas Port	11	Fan Connection
4	Overflow	8	LHO Distribution Plate	12	Deflector Sides

Figure 1: Typical GCT

SECTION 2: THEORY OF OPERATION

The Gas Control Tower (GCT) is used to maintain proper balance of dissolved gases in reuse process water. The GCT is comprised of three sections: the CO2 Stripper (CO2T) and the Low Head Oxygenator (LHOT) and the LHO Sump (LHOS).

2.1 CO_2 Stripper (CO2T)

The CO2T maintains equilibrium of CO_2 gas in the process water and the ambient air moving through the unit. The CO2T receives reuse process water into the CO2T Head Chamber (usually from the Bio-Filter). The CO2T can operate in a number of manners. Three of them are:

2.1.1 Naturally Aspirated: the falling water through the unit creates a natural vacuum to pull air. g/l is lower.

2.1.2 Co-current: air moves from top to bottom of the unit induced by a fan or blower.

2.1.3 Counter-current:– air moves from bottom to top of the unit induced by a fan or blower.

** The co-current and counter-current can operate in either a positive or negative pressure state.

2.2 Low Head Oxygenator (LHOT)

The LHOT adds Oxygen back into the process water after the process water goes through the CO2T which drops down into the Head Chamber of the LHOT. The LHOT has an Oxygen/Ozone inlet port and exhaust port along with multiple internal baffles which create chambers in which the gas serpentines through the LHOT.

The multiple holes in the distribution plate allow the falling streams of process water to penetrate the pool of process water in the LHOS. Gas transfer happens during this penetration of the falling stream into the pool of water below.

2.2.1 The burp tube allows for gas back pressure adjustment in the LHOT.

2.3 LHO Sump (LHOS)

The LHOS creates the process water level control for the LHOT. LHOS can also become a head tank for gravity flow of the process water back to the culture tank(s). Depending on LHOS configuration, the cone drain fitting can be used for debris/solids capture.

SECTION 3: GCT INSTALLATION

GCT is provided in multiple sections consisting of the CO_2 Stripper (CO2T), Low Head Oxygenator (LHOT) and LHO Sump (LHOS).

3.1 Installation Requirements

3.1.1 The GCT is to be installed on a level support pad or floor.

3.1.2 Pad or floor to be designed to carry the total operating weight of the GCT including the vessel, water and media along with any other design conditions.

3.1.3 When required for stability, wind load or seismic loads, the GCT shall have adequate hold down anchors installed.

3.1.4 Support surface to be smooth and free of any debris or occlusions that may damage the bottom of the GCT.

3.2 Setting the LHO Sump (LHOS)

3.2.1 Use lifting eye bolts to lift and set the LHOS Sump on the pad or floor taking care to orient the fittings correctly.

3.2.2 If required, install the anchors.

3.2.3 Always utilize an anchor with a nut and jam nut. Lightly tighten nut and then install jam nut. This will allow for thermal expansion or contraction.

3.2.3.1 It is recommended that all hardware be 316SS

3.2.4 Remove Lifting Eye Bolts.

SECTION 3: GCT INSTALLATION

3.3 Setting the Low Head Oxygenator (LHOT)

3.3.1 Using the lifting eye bolts lift and set the LHOT on LHOS Sump and ensure correct orientation.

3.3.2 Adjust to make LHOT Support Lugs symmetrical on Top Flange of LHOS Sump.

3.3.3 Match drill through LHOT Support Lugs into Top Flange of LHOS Sump. Each LHOT Support Lug to have two sets of bolt holes.

3.3.4 Install bolts with a flat washer and a nut with a flat washer in each bolt hole.

3.3.5 Tighten all bolts and nuts to a torque of 27.116 N·m (20 ft-lbs).

3.3.6 Remove Lifting Eye Bolts.

3.4 Setting the CO_2 Stripper (CO2T)

3.4.1 Using the lifting eye bolts lift and set the CO2T on LHOT at the correct orientation.

3.4.2 Use four of the flange bolts with flat washers to align the sections.

3.4.3 Install, on the bottom of the bolts, a flat washer and nut.

3.4.4 Lift section and install four 0.635 cm (¼") temporary spacers equally spaced.

3.4.5 Around the perimeter inside of the mating flanges, inject a 0.635 cm (¼") to 0.9525 cm (⅜") bead of sealant (Sikaflex 221, BASF NP1 or 3M 540 are recommended sealants).

3.4.5.1 307.56 ml (10.4 oz) tube yields approx 3.048 m (10') of bead.

3.4.6 Remove spacers to let upper section flange drop onto lower section flange.

3.4.7 Install remaining bolts, flat washers and nut. Bolt holes on the mating flanges between the CO2T and LHOT may require match drilling.

3.4.8 Tighten all bolts and nuts to a torque of 27.116 N·m (20 ft-lbs).

3.4.9 Attach Deflector Sides to CO2T side panel opening with a 0.635 cm (¼") to 0.9525 cm (⅜") bead of sealant labeled #12 in the drawing in Section 1.

3.4.10 Slide Deflector Pan(s) onto Deflector Sides.

3.4.11 Install the supplied Fan(s) / Blower(s) as required.

3.4.11.1 The Fan Housing port located on the CO2T has several set screws used for securing the blower to the GCT

3.4.11.1.1 A piece of ribbon or string can be attached to the blower/fan airstream for a visual indicator to determine if the blower is operating

3.4.11.2 If required a demister can be installed to the Fan Housing port

3.4.11.3 All electrical work shall be done by a licensed or certified electrician or qualified service professional in accordance with the National Electrical Code and all applicable local codes and ordinances. Improper installation will create an electrical hazard which could result in death or serious injury to users, installers or others due to electrical shock and may also cause damage to property.

3.5 Pipe Connections

3.5.1 All valves and piping to be supported independently.

3.5.2 The Influent water shall be plumbed into the top fittings of the CO2T labeled #10 (Inlet) in the drawing in Section 1.

3.5.2.1 Installing a bypass around the unit is not necessary but would allow for maintenance of the unit without having to shut down the system.

3.5.3 Optional influent trough installation

3.5.3.1 The influent trough is design to be installed to the Pentair Aquatic Eco-Systems Cyclonic BioReactor (CBR). When the CBR and GCT are sold together they will both have matching trough dimensions.

3.5.3.2 The CBR and GCT shall be installed such that the troughs are lined up flush, plumb and level.

3.5.3.3 Use four flange bolts with flat washers to align the sections.

SECTION 3: GCT INSTALLATION

3.5.3.4 Install a flat washer and nut on the threaded side of the bolt.

3.5.3.5 Use two temporary 0.635 cm (¼") spacers between the flanges on the troughs. The spacers shall be located on the outer periphery of the flanges such that they are between the flange bolt holes and outer perimeter of the flanges.

3.5.3.6 Inject a 0.635 cm (¼") to 0.9525 cm (⅜") bead of sealant around the inside perimeter of the flange between the bolt holes and inner perimeter.

3.5.3.7 Remove spacers, install remaining bolts, flat washers and nuts.

3.5.3.8 If there is a slight bolt hole misalignment between some of the holes on the flanges correct the situation by match drilling the holes.

3.5.3.9 Tighten all bolts and nuts to a torque of 27.116 N·m (20 ft-lbs).

3.5.4 The effluent flow from the GCT shall be plumbed from the fitting labeled #3 (Outlet) on the LHOS Sump in the drawing in Section 1.

3.5.4.1 Note: The GCT is a non-pressurized vessel and as such the effluent will flow out of the GCT unit by gravity only.

3.5.5 The GCT LHOS Sump has an overflow port (See drawing in Section 1, fitting labeled #4 (Overflow)) used for regulating the water height in the LHOS Sump and secondly to act as a safety feature to prevent water from overflowing the sump onto the floor. Consequently, the overflow fitting will need to be plumbed such that it allows the overflow water to flow by gravity back to the pump sump or whichever location determined by the system designer.

3.5.5.1 The overflow outlet port is a glassed in coupling located on the bottom of the LHOS Sump over flow box. This fitting allows the user to insert a standpipe to regulate the water height inside the LHOS Sump. Do NOT glue the standpipe to the coupling fitting on the inside of the LHOS Sump over flow box.

3.5.6 The oxygen supply line shall be connected to the LHOT at the inlet port labeled #6 Oxygen Connection) in the drawing in Section 1. Only oxygen safe/compatible materials shall be used for connecting the oxygen supply line to the LHOT. A check valve on the oxygen line is recommended in an effort to prevent any system water from backing up the oxygen line towards the oxygen source during shutdown. A rotameter shall be installed between the oxygen source and check valve in order to control and regulate the amount of oxygen flow into the LHOT.

3.5.7 The Off-Gas outlet port (labeled #7 in the drawing in Section 1) is the location the gas stream exits the LHOT vessel. This Port requires back pressure to create a slight positive pressure within the LHOT vessel. The off-gas port shall use oxygen safe/compatible materials. The off-gas outlet port shall have a union attached directly to the outlet on one side and a 90° elbow on the opposite side. The elbow shall be installed such that one side is flush to the union and the opposite side has a length of pipe facing downward towards the LHOS Sump. The pipe shall be cut to a length such that it is submerged 15 cm (6") below the operating water level of the LHOS Sump.

3.5.8 The drain port labeled #2 (Drain) in the drawing in Section 1 shall have a ball valve used for purging any debris in the LHOS Sump. This line shall be plumbed to waste. It is recommended to use a small section, 30 cm (12"), of clear PVC pipe so the operator can visually inspect the amount of debris purged from the LHOS Sump.

SECTION 4: MEDIA & DISTRIBUTION PLATE INSTALLATION

4.1 CO_2 Stripper (CO2T)

4.1.1 Media Installation (if required)

4.1.2 Structured Media

4.1.2.1 Structured Media will be precut to the proper size.

4.1.2.1.1 Be sure the openings of the Media are in the vertical position.

4.1.2.2 Set 0.6 m (2') tall media on support ledges first.

4.1.2.3 Add any additional media as required

4.1.3 Random Packed Media

4.1.3.1 Install Media Support.

4.1.3.2 Pour Random Packed Media on to Media Support to required depth.

4.1.4 Distribution Plate(s) (DP)

4.1.4.1 Orientate DP as per drawing in Section

4.1.4.2 Install Crown Nozzles (if required) in the distribution plate

4.1.4.2.1 Install bottom section (with diffuser) of Crown Nozzle into 4.45 cm (1 ¾") hole in DP.

4.1.4.2.2 Install upper section of Crown Nozzle into bottom section of Crown Nozzle.

4.1.4.2.3 Be sure colored insert is installed into upper section of Crown Nozzle.

4.2 Low Head Oxygenator (LHOT)

4.2.1 Distribution Plate(s) (DP)

4.2.1.1 Orientate DP and insert it on the top of the LHO as per drawing.

4.2.1.2 Install set screws and hand tighten

SECTION 5: GCT STARTUP

5.1 Start the pump to initiate the water flow to the inlet of the CO2T. Slowly increase the flow rate until the required flow to the GCT has been met.

5.2 Insert a standpipe in the overflow side box to obtain the proper water level in the LHOS Sump (do not glue)

5.2.1 Some water shall overflow into the overflow side box standpipe such that a constant water level within the LHOS Sump will be maintained.

5.3 Start the fan(s) / blower(s) on the CO2T.

5.4 Start flow of oxygen to the LHOT. Use the oxygen rotameter to dial in the anticipated flow rate.

5.4.1 Loosen the off-gas outlet union and swivel the outlet pipe such at only a 1.25 cm (½") of pipe is below the LHOS Sump water level. Hand tighten the union

5.4.2 Watch the submerged outlet pipe for continuous bubbling of off-gas. This may take 10 mins or more.

5.4.3 Once continuous bubbling has occurred check the water height above the LHOT distribution plate (see drawing in Section 1 label 8 (LHOT Distribution Plate). A height of 10 cm (4") above the distribution plate is desired. As long as the water flow and oxygen flow rates are kept at a constant the water height above the LHOT distribution plate will be regulated by changing the submerged depth of the off-gas outlet pipe. The deeper the pipe is submerged in the LHOS Sump the greater the backpressure in the LHOT vessel thus an increase of water height above the distribution plate.

5.4.4 Repeat steps 5.4.1-5.4.2 until a water height of 10 cm (4") is obtained above the distribution plate. Note: the deeper the off-gas outlet pipe is submerged the higher the water height will be above the LHOT distribution plate and vice versa. It may take 10 mins or more for equilibrium to occur which will be noted by continuous bubbling of off-gas through the submerged pipe.

5.4.5 If the water flow rate or oxygen flow rate is changed the off-gas outlet pipe will need to be readjusted to dial in the 10 cm (4") of water depth about the LHOT distribution plate.

5.5 During initial start, recirculate water in the water treatment system only. This will allow capture of any debris.

5.6 Observe and Label Operating Levels

5.6.1 Mark the designed operating liquid level of each section determined by operational characteristics.

SECTION 6: NORMAL OPERATION

6.1 Under normal operation check that the liquid levels are constant.

6.2 Maintain process water flowrate through the GCT

6.3 Method to Increase Oxygen Concentration

6.3.1 Increase the oxygen flowrate to the LHOT

6.3.1.1 Adjust off-gas outlet to maintain 10 cm (4") water depth above LHOT distribution plate (as described in section 5.4)

6.3.2 Process water flowrate through the GCT may need to be increased to increase the amount oxygenated water to the cultural tanks.

6.4 Method to Decrease Oxygen Concentration

6.4.1 Decrease the oxygen flowrate to the LHOT

6.4.1.1 Adjust off-gas outlet to maintain 10 cm (4") water depth above LHOT distribution plate (as described in section 5.4)

6.4.2 Process water flowrate through the GCT may need to be decreased to decrease the amount oxygenated water to the cultural tanks.

6.5 Lower CO_2 Concentration Required

6.5.1 Check to make sure the fan(s)/blower(s) on the CO2T are on and functioning properly.

6.5.2 Check to make sure the media in the CO2T is not clogged with biofouling

6.5.2.1 If the media has excessive biofouling thoroughly clean the media

6.5.3 Process water flowrate through the GCT may need to be increased to increase the amount of CO_2 stripped water to the culture tanks.

SECTION 7: SHUT DOWN

7.1 If gas control is not automatic, turn off gas supply before shutting down system.

⚠CAUTION

GAS IS EXPLOSIVE – USE CAUTION!

7.2 Turnoff fan(s) / blower(s) on the CO_2 stripper.

7.3 Clean Distribution plate(s) (DP) and media if applicable (refer to the Maintenance section).

SECTION 8: MAINTENANCE

8.1 Distribution plate(s) (DP) need to be cleaned with a brush on a regular basis based upon visual requirements.

8.2 CO_2 media may need to be cleaned or flushed out.

8.3 Purge LHOS bottom on a regular basis.

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