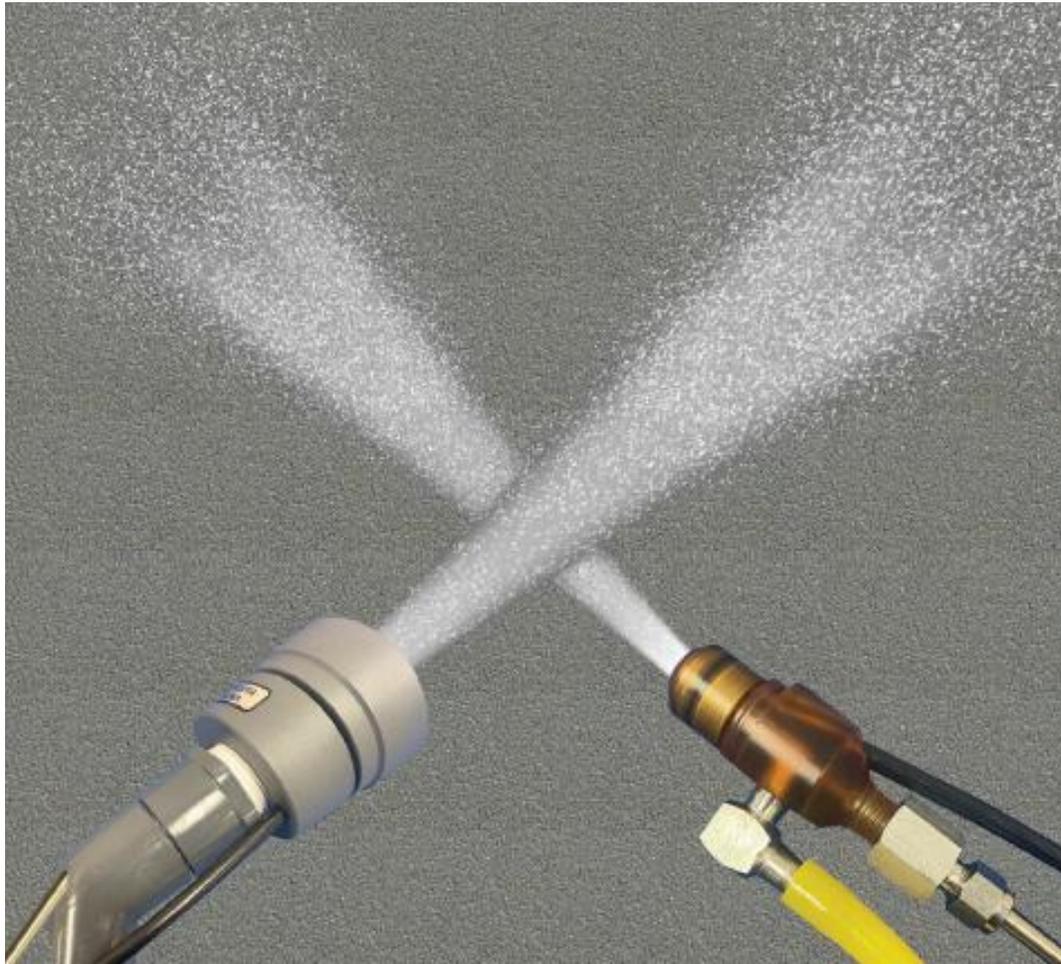




# Radical Oxidizing Technology

## REMEDiate ODOR – FOG – CORROSION



Vapex™ Environmental, LLC  
PICO Installation, Operation and Maintenance Manual

**Prepared For: Folder Name/Sales Force Name**

Equipment Manufactured by:

Vapex™ Environmental, LLC  
2971 Oxbow Circle, Suite B  
Cocoa, FL 32926

<b>Unit:</b>	PICO
<b>Serial No:</b>	VP-#####-US
<b>Sales Rep:</b>	
<b>Contractor:</b>	

Scope of Supply

- **Supplies Provided by Vapex™:**
  - Copy and paste from last budget/firm proposal sent to customer.

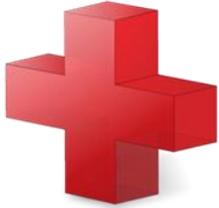
NOTE: Please contact Vapex™ immediately if components are missing or the correct quantity is not received.

- Supplies Provided by Installer:
  - Mounting Hardware
  - 2" tubing conduit
  - Water supply connection
- Utilities/Services Provided by Installer
  - Electrical – 110V, 15A, 60Hz
  - Water – Potable

## General Information



THIS EQUIPMENT SHALL BE OPERATED AND MAINTAINED BY AUTHORIZED PERSONNEL TRAINED IN ITS USE. AUTHORIZED PERSONNEL MUST FOLLOW ANY AND ALL APPLICABLE SAFETY PROCEDURES.



PROLONGED EXPOSURE TO OZONE MAY CAUSE ADVERSE REACTIONS. REPORT ANY PROLONGED EXPOSURE TO YOUR SUPERVISOR IMMEDIATELY AND SEEK APPROPRIATE MEDICAL ATTENTION.



WHEN INSTALLING THIS PRODUCT, ALWAYS MAKE SURE THERE IS A LOCKABLE DISCONNECT WITHIN SIGHT OF THE UNIT.



THE PRODUCT HAS BEEN SUPPLIED WITH WARNING LABELS WITHIN THE UNIT. SHOULD THEY BECOME DAMAGED, REMOVED, OR ILLEGIBLE, PLEASE CONTACT VAPEX™ ENVIRONMENTAL FOR NO COST REPLACEMENTS.

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# 1. START UP & OPERATION

## 1.1 PRE-START UP SYSTEM CHECK

**CAUTION: THE UNIT MUST BE CHECKED BY A CERTIFIED VAPEX™ TECHNICIAN PRIOR TO UNIT START UP.**

1. Remove the Vapex™ PICO control panel cover to access controls and plumbing connections.
2. Remove any packing foam used to protect components during shipping.
3. Ensure the nozzle is securely in place at the treatment area with all access points closed.
4. Check external connections to the system to make sure Water and Power are turned ON at the source and properly connected to the Vapex™ PICO system.

## 1.2 START UP

**NOTE: INITIAL START UP SHALL BE PERFORMED BY A CERTIFIED VAPEX™ TECHNICIAN**

1. Remove the control panel cover
2. Turn the PICO power switch to the **ON** position.
3. Turn the potable water **ON** at the source.
4. Adjust the water flow to the nozzle.
5. Switch the Oxidant **ON** using the rocker switch.
  - a. It may take up to one minute for the oxygen level to rise to operating level before the oxidant will turn **ON**.
6. Adjust the Oxygen Flow to 4 lpm and 7psi.
7. Adjust the oxidant output as needed using the oxidant control dial.

**NOTE: As the Vapex™ PICO runs, the treated space will get “cleaner” and there will be fewer compounds in the well to react with the Hydroxyl Radical Mist. The well may start producing an “oxidant” smell. If this is the case, it will be necessary to turn down the oxidant output. All adjustments made to turn-up or turn-down the oxidant output of Vapex™ PICO are made using the oxidant control dial. Adjusting the oxygen flow or the water flow will NOT vary the oxidant output.**

## 1.3 INDICATOR LIGHT

The **GREEN** Indicator light illuminates when all the operating parameters are met, and the unit is producing oxidant. The indicator lights provide a simple method to indicate the system status and shall **NOT** be used to replace actual system checks of flows and pressures.

## 1.4 LV NOZZLE ASSEMBLY

### 1.4.1 LV NOZZLE COMPONENTS

The LV nozzle is made up of three main parts:

1. Cap – holds the disk in place.
2. Body – receptacle where the three (3) fluids (Water, Air & Oxidant) tubing attach
3. Disk – combines the air, water, and ozone (oxidant) to create the hydroxyl radical fog. The disk is locked inside the cap with a spring clip.

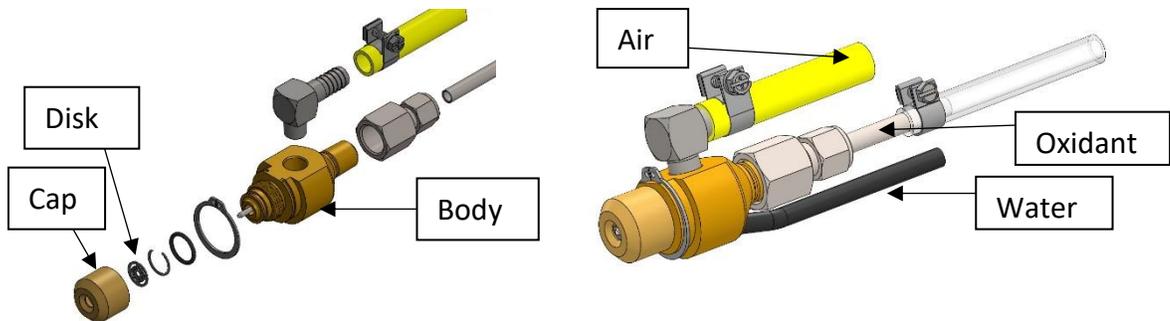


Figure 1: LV Nozzle Components

**IMPORTANT: If the disk is not centered, the cap will not align properly which may result in nozzle damage.**

### 1.4.2 OPERATING THE LV NOZZLE

Assembled correctly, the nozzle will show:

- Four (4) Air Holes
- Four (4) Water Grooves
- One (1) Ozone Tube (located in the center)

It is important that the disk is installed so the water grooves face out towards the direction of the spray, the ozone tube passes through the center hole and the cap is tightened (hand tighten only).

Adjust the water flow using the water flow meter.

## 1.5 WINTERIZING & STORAGE

If the unit will be shut down for an extended time or the unit will be turned **OFF** for the winter months, it is recommended to follow these steps once the system is turned **OFF**:

1. Disconnect the Teflon® tubing and cap the oxidant output tubes.
2. Turn off the water source.
3. Disconnect the steel-braided water inlet hose and water out tubing and drain.
4. Ensure no water is in the unit or the hoses.

**PRO TIP: CONTACT VAPEX™ PRIOR TO WINTERIZATION.**

## 2. ROUTINE MAINTENANCE

### 2.1 VAPEX™ PICO FILTER LOCATIONS

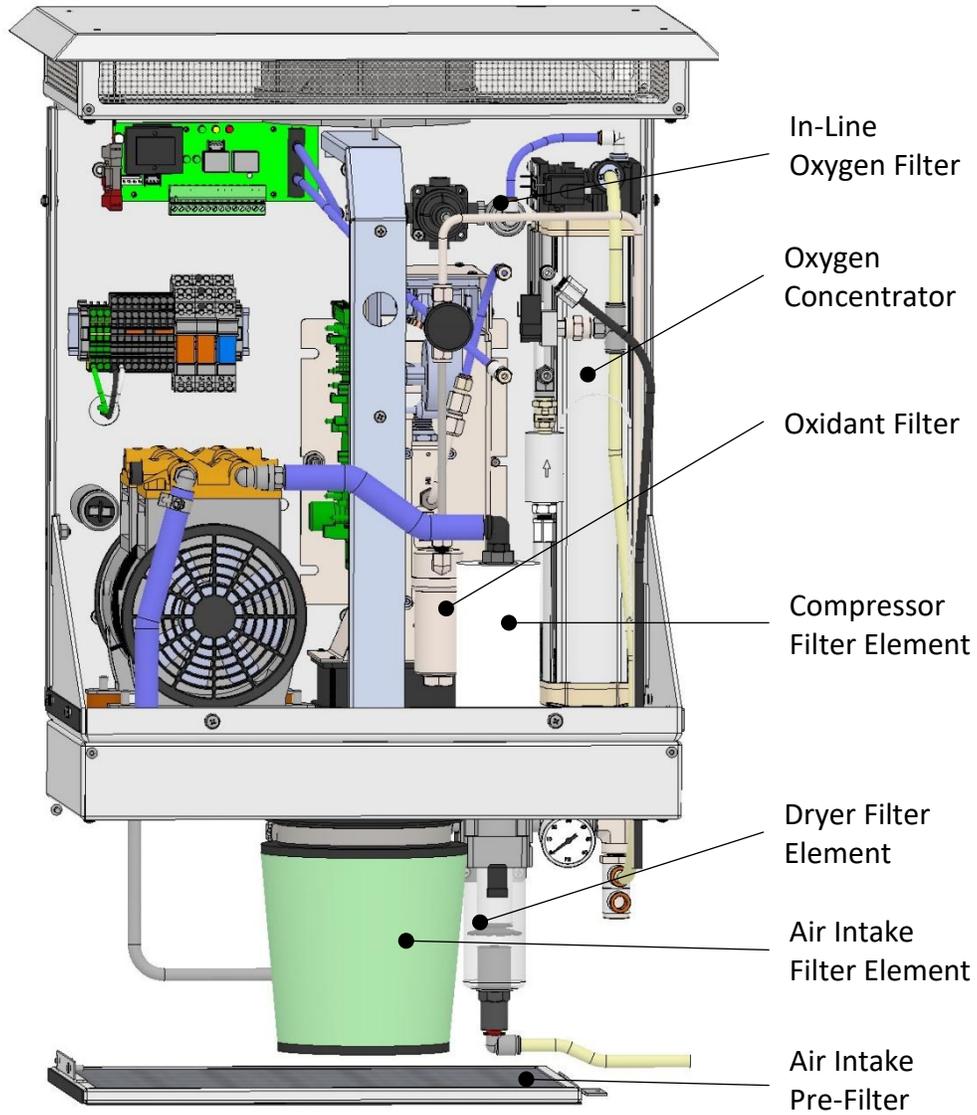


Figure 2: Filter Locations

## 2.2 MAINTENANCE SCHEDULE

Performing preventative maintenance will increase the performance and longevity of the Vapex™ PICO equipment. Not completing the necessary preventative maintenance could void the warranties. Below is a chart that indicates the frequency of the maintenance. The Vapex™ PICO system maintenance checklist and consumable parts order list is included at the end of this chapter.

Frequency	Maintenance
<b>Monthly</b>	Nozzle - Inspect, Clean if needed
	Water Flow Meter - Inspect, Clean if needed
<b>Semi-Annually</b>	Replace Compressor Filter
	Check the Air Intake Pre-Filter - Clean if needed
	Replace Air Intake Filter Element
	Replace Dryer Filter Element & Bowl
	Replace the In-Line Oxygen Filter
	Replace the Oxygen Concentrator
	Replace the Oxidant Filter

Table 1: Maintenance Schedule

## 2.3 LV NOZZLE

Inspect the nozzle weekly and clean as needed. Ensure the face of the nozzle is clean and all tubing is fastened firmly in place. A properly working nozzle will produce water particles completely around the ring without producing large drops.

If the face of the nozzle is visibly dirty or the nozzle still does not spray correctly and/or is producing large drops, follow instructions below for cleaning.

### 2.3.1 CLEANING THE LV NOZZLE

When cleaning the LV nozzle, use only the provided cleaning tools.

- LV nozzle brush
- Channel cleaning tool

Directions to clean the LV nozzle:

1. Switch the oxidant **OFF** using the rocker switch on the control panel.
2. Use the LV nozzle kit to remove any dirt or debris from the nozzle surface.
3. Use the LV nozzle channel cleaning kit to remove any dirt or debris in the holes of the nozzle. Take care not to damage the nozzle openings in the center Nozzle Disk.
4. If excessively dirty, the nozzle cap may be removed for cleaning.
  - a. Unscrew Nozzle cap & use the LV nozzle brush to remove any debris from behind the Nozzle Disk and any inner surfaces.
  - b. Reset the nozzle by reinstalling the cap and hand tightening completely to assure nozzle disk seal.

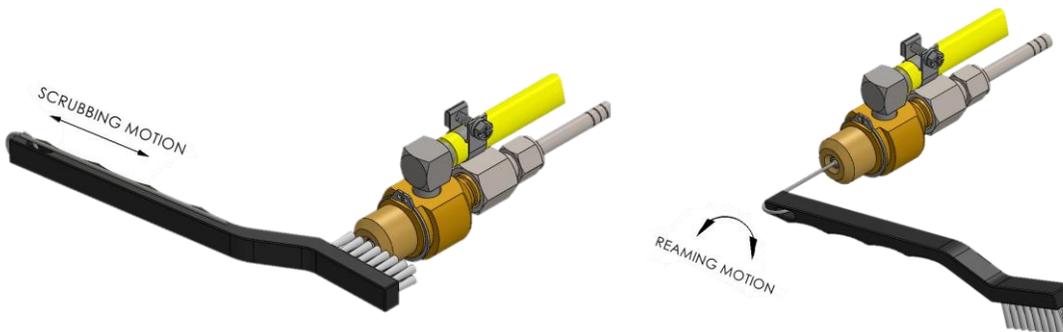


Figure 3: LV Nozzle Brush and Cleaning Tool

## 2.4 CLEANING WATER FLOW METERS & SWITCHES

There are water flow switches located above the water flow meters. These flow switches contain a stainless-steel shuttle that will drop when the water flow is low or off. Check these switches monthly and clean if needed.

1. Turn the water **OFF** using the rocker switch on the control panel and ensure the shuttle drops. If the shuttle does not drop when the water is switched **OFF**, then the switches need to be cleaned.
2. Clean the water flow meters and flow switches using the flow meter cleaning kit.
3. Fill the filter bowl with a “calcium, lime & rust” cleaning liquid (not provided) and attach to the Vapex™ PICO between the water source and the Water IN fitting.
4. Invert the canister and let the equipment operate normally until the cleaner runs through completely, until only water is left in the filter bowl. **Multiple applications may be necessary.**

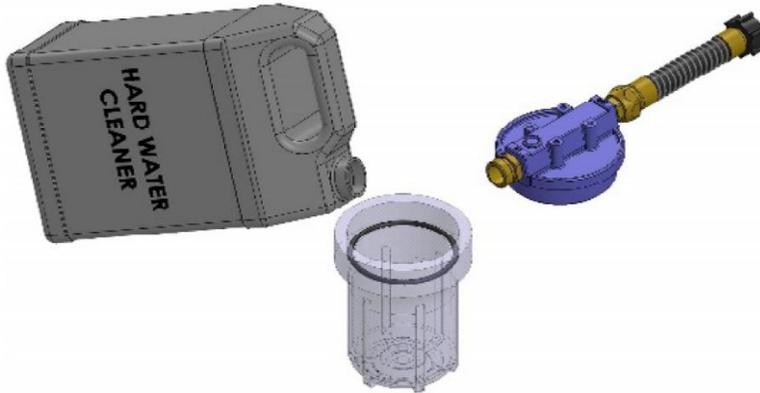


Figure 4: Fill Filter with Hard Water Cleaner

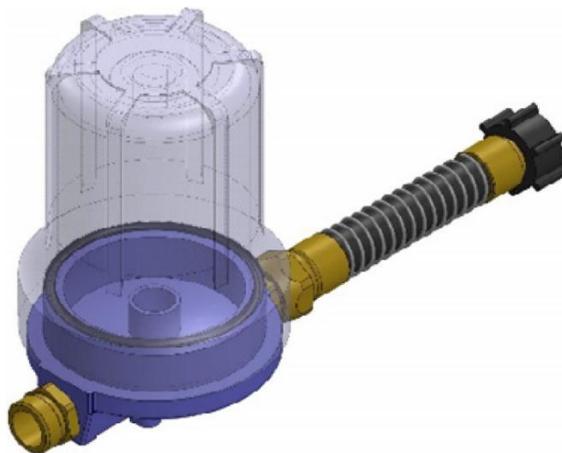


Figure 5: Invert Flow Meter Cleaning Kit Filter Bowl

## 2.5 COMPRESSOR FILTER

An oxygen filter located inside the Vapex™ PICO to filters out any unwanted contaminants in the air. The compressor filter shall be replaced semi-annually.

### 2.5.1 REPLACE THE COMPRESSOR FILTER

1. Remove the control panel cover.
2. Remove the flexible line from the filter element by pulling straight out.
3. Pull the filter element off the rear mount.

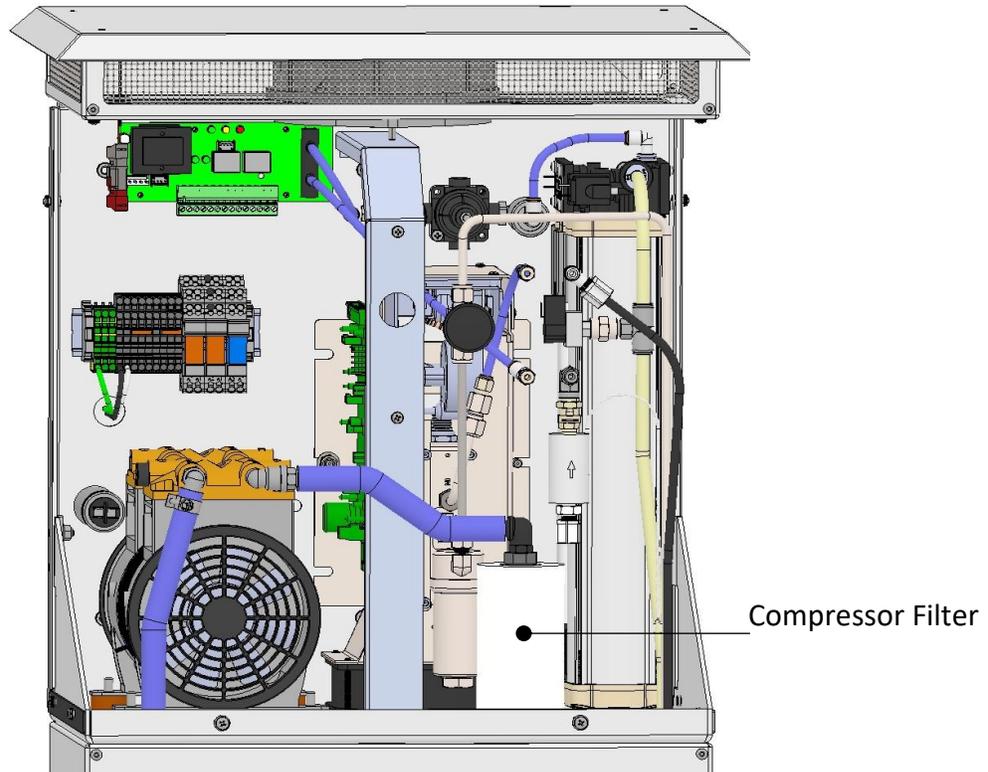


Figure 6: Compressor Filter

## 2.6 AIR INTAKE PRE-FILTER

An Air Intake Pre-Filter on the bottom of the unit keeps large debris and animals out of the unit. This filter may get dirty and can be cleaned periodically.

### 2.6.1 CLEAN THE AIR INTAKE PRE-FILTER

1. Remove the lower cover from the front of the unit.
2. Loosen the Air Intake Pre-Filter bracket thumb screw.
3. Remove the Air intake pre-filter element by pulling straight out.
4. The filter can be cleaned using compressed air or water.
5. Replace the Air intake Pre-Filter element and tighten the bracket thumb screw.
6. Replace the lower cover.

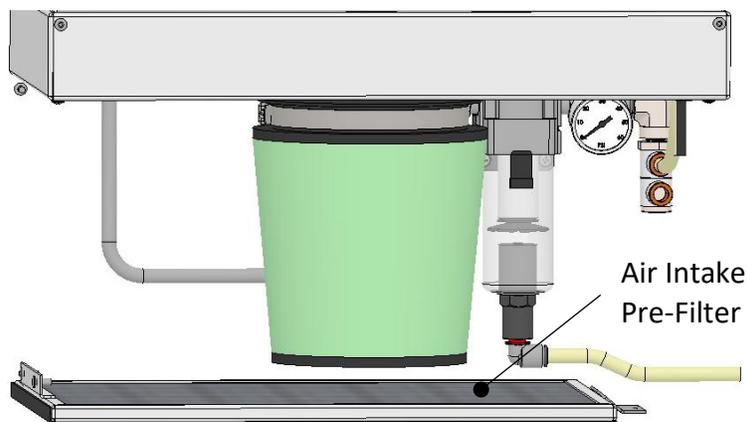


Figure 7: Air Intake Pre-Filter

## 2.7 AIR INTAKE FILTER

All the air used by the Vapex™ PICO in the process and for cooling enters the unit through the air filter. Check the filter monthly and clean if needed. To clean, tap gently to remove heavy debris or compressed air can be used by blowing through the filter from the inside out. The air intake filter shall be replaced semi-annually.

### 2.7.1 REPLACE THE AIR INTAKE FILTER

1. Remove the lower cover.
2. The filter is held in place by a simple hose clamp. Loosen the clamp to remove the filter for cleaning or replacement.
3. Follow these steps in reverse order to install the new Air Filter Element.
4. Replace the lower cover.

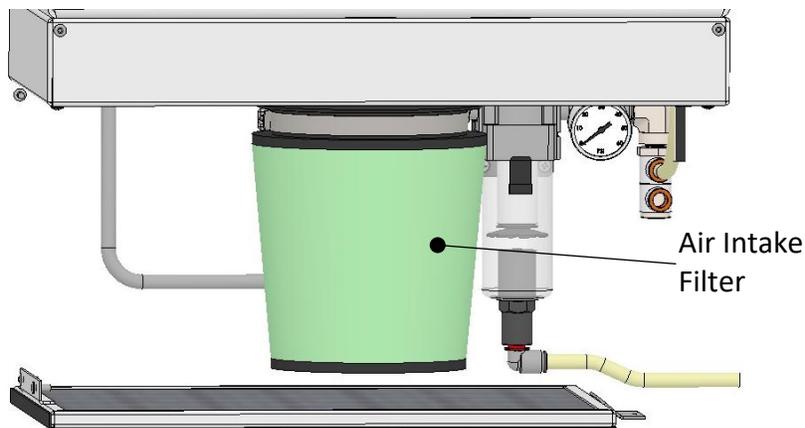


Figure 8: Air Intake Filter

## 2.8 DRYER FILTER

The air from the compressor is moved through a radiator to condense the humidity from the air. A water separator (Dryer) filter is located on the bottom of the unit behind the lower cover and inside this filter is an element that shall be replaced semi-annually.

### 2.8.1 REPLACE THE DRYER FILTER

1. Switch the power **OFF**.
2. Remove the lower cover.
3. Firmly grasp the dryer bowl, push up and twist one quarter of a turn. Pull down on the bowl to remove.
  - a. If the bowl is difficult to push up or twist, apply a small amount of grease to the O-ring to make it easier for the next time.
4. Unthread the old element and discard.
5. Thread on the new element and replace the bowl.
6. Switch the power **ON**.

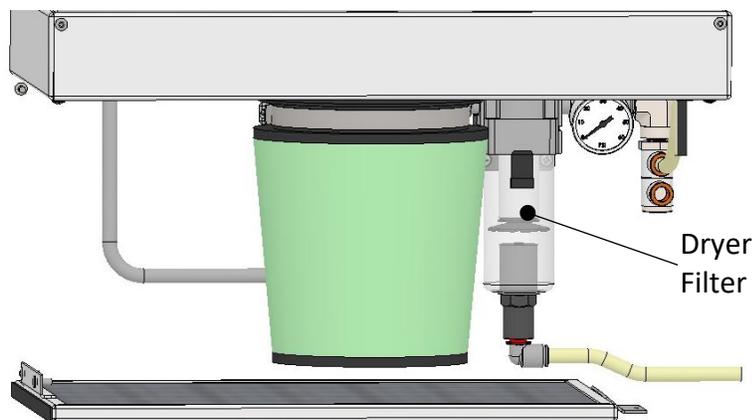


Figure 9: Air Intake Filter

## 2.9 IN-LINE OXYGEN FILTER

The oxygen in the system is filtered before it enters the oxidant generator. This filter shall be replaced semi-annually.

### 2.9.1 REPLACE THE IN-LINE OXYGEN FILTER

1. Switch the unit **OFF**.
2. Remove the control panel cover.
3. Locate & Remove filter element.
  - a. The filters are connected using “Push-to-Connect” (PTC) fittings. Push in and hold the ring around the tube and gently pull the filter.
4. Install the new In-Line Oxidant Filter element by sliding the stems into the PTC fittings. **NOTE: The filter is directional.**

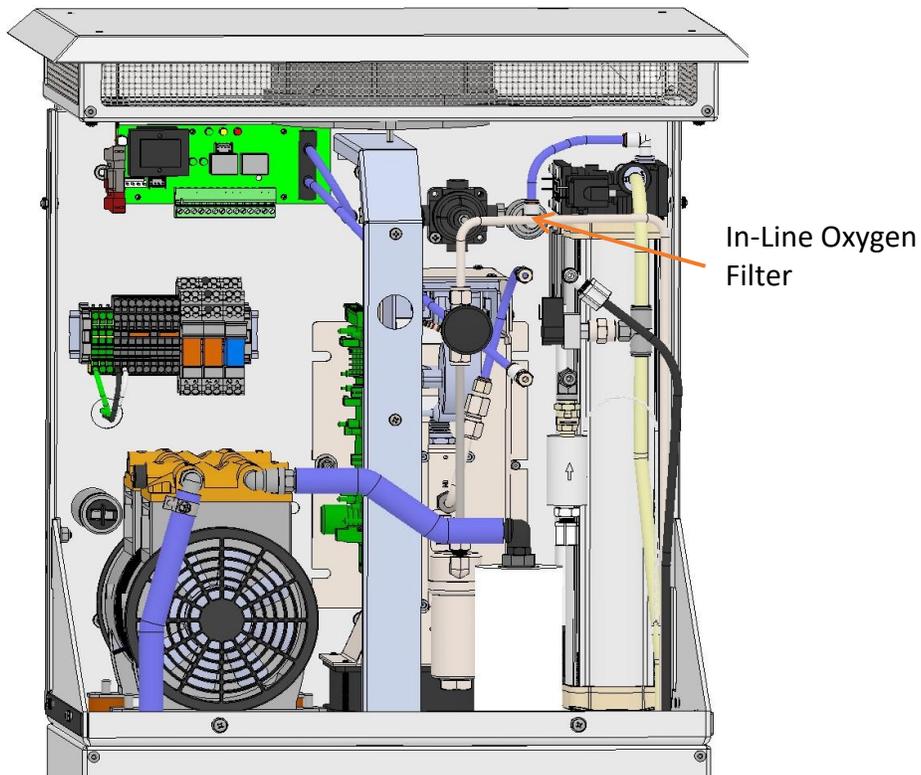


Figure 10: In-Line Oxygen Filter

## 2.10 OXYGEN CONCENTRATOR

To maintain the highest possible oxidant output and efficiency, the oxygen concentrator shall be replaced semi-annually, minimizing the amount of by-product produced during the oxidant generation process that could lead to decreased performance.

### 2.10.1 REPLACE THE OXYGEN CONCENTRATOR

1. Switch the system **OFF**.
2. Remove the control panel cover.
3. Unplug the electrical connections to the concentrator (one pair each, left & right)
4. Disconnect the **BLUE** hose and **CLEAR** hose from the oxygen concentrator.
  - a. These are “Push-to-Connect” (PTC) fittings. Push in and hold the ring around the tube and gently pull the tubing.
5. The concentrator is held in place with large mounting clips. Pull the oxygen concentrator straight out of the clips.
6. Install the new concentrator into the clips.
7. Replace the tubing by sliding it firmly into the PTC fittings. Tug on the tubing to insure complete connection.
8. Reconnect the wires keeping the left and right-side wires on the correct side. There are no polarity concerns on the coil connections.
9. Restart machine and adjust the oxygen pressure and flow rates as needed.

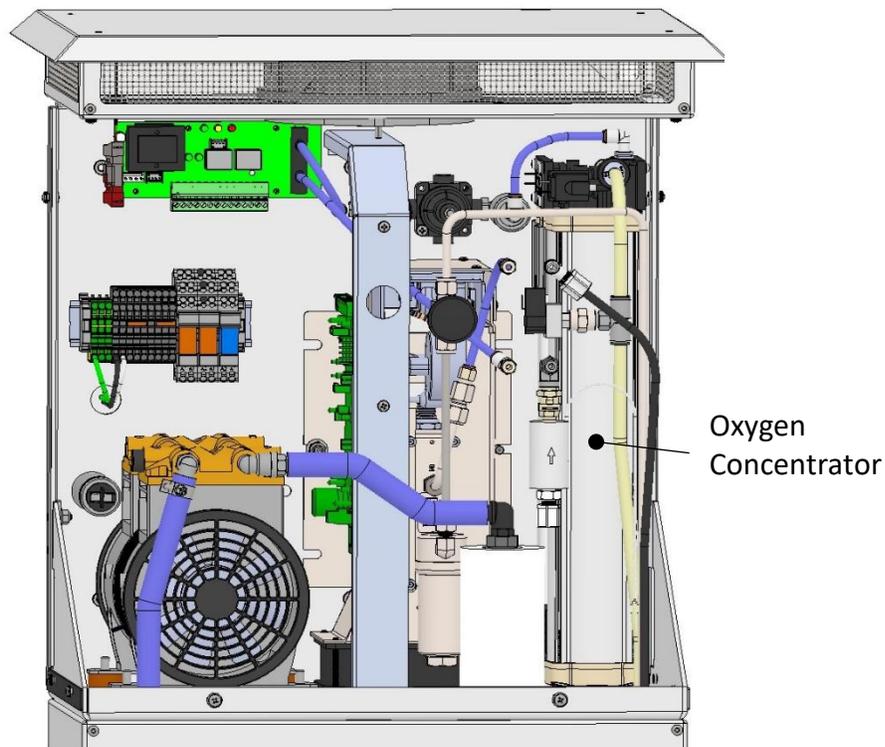


Figure 11: Oxygen Concentrator

## 2.11 OXIDANT FILTER

An oxidant filter is located after the oxidant generator. The oxidant generator filter shall be replaced semi-annually.

### 2.11.1 REPLACE THE OXIDANT FILTER

1. Switch the system **OFF**.
2. Remove the control panel cover.
3. Remove the oxidant filter cover (hex on bottom of bowl)
4. Replace the filter element and replace the filter bowl.
5. Replace the cover and switch the unit on.
6. Check oxidant flow.

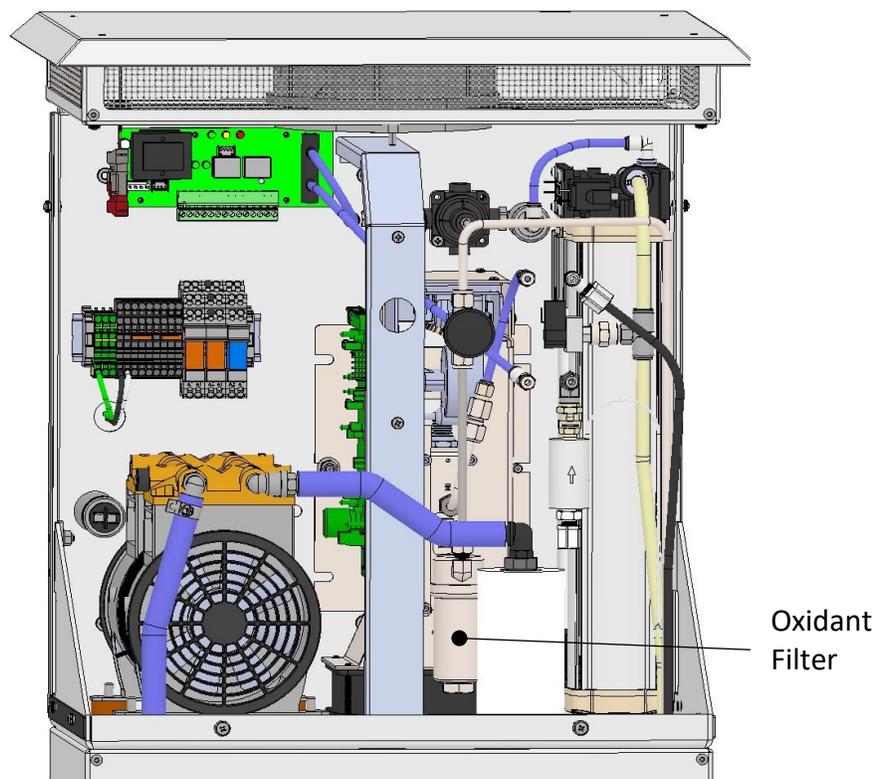


Figure 12: Oxidant Filter

### 3. TROUBLESHOOTING

#### 3.1 OXIDANT ON INDICATOR LIGHT

- The green light indicates the oxidant is **ON**.
- If the light is OFF:
  - A. Confirm the Oxidant is switched **ON**.
  - B. Confirm proper Water Flow to the nozzle.
    1. Adjust as needed using the adjustment knob at the bottom of the Water Flow Meter.
    2. Confirm the Vapex™ PICO is receiving a minimum water pressure of 25-75 psi from the water source.
    3. Confirm the steel braided water hose is intact, unobstructed, and firmly attached to the Vapex™ PICO.
    4. Confirm green light on oxygen sensor board is **ON**.
  - C. Check the oxidant generator for faults.
  - D. Verify system air pressure is between 20-40 psi.
  - E. Inspect the air tubing from the Vapex™ PICO to the nozzle for any leaks.

### 3.2 SITE INSPECTION & TROUBLESHOOTING CHECKLIST

**Serial #: VP-**

**Inspected by:**

**Date:**

Please complete the following inspection checklist then contact.

Vapex™ Customer Service at 1-877-907-0044 or Service@Vapex.com.

✓ or ✗

Item Description

- External water and power sources to the Vapex™ PICO are ON and in good condition.
- Oxidant, Air and Water tubing are securely connected both at the Vapex™ PICO and at the nozzle.
- Internal water connection on the Process Module is securely attached.
- Internal power connection on the Process Module is securely attached.
- Cabinet power switch is in the **ON** position.
- Main Breaker switch is in the **ON** position.
- Water Switch is in the **ON** position.
- Oxidant Switch is in the **ON** position.
- Oxidant Generator **ON** indicator light is lit.
- Water Flow Meter is reading between reads between 80-120 cc/min. Reading: \_\_\_ cc/min.
- Water Flow Meter indicator shuttle drops when Water On-Off is switched to **OFF** position.
- Oxygen Flow Gauge is reading 4 lpm (use Oxidant Flow Control Dial to adjust)
- Oxygen Pressure Gauge is reading between 7 psi: Reading: \_\_\_\_\_ psi.
- Exhaust fan on the top of the Process Module is functioning.
- Nozzle is clean and functioning properly. (**IMPORTANT: Before inspecting or cleaning the nozzle, the Oxidant must first be turned OFF on the Process Module.**)
- All filter elements are clean:
  - Intake Air,                       nozzle air,
  - In-line,                               O2 Filter,
  - Oxidant,                               Pre-filter.
- Vapex™ PICO Cabinet Covers are securely fastened in place.

## 4. SAFETY

### 4.1 SAFETY ITEMS

Included with the unit are several safety items. MSDS information is included in this chapter. A separate copy is supplied with the system to keep near the unit. A metal oxidizer warning label is also included. The warning label shall be mounted near the unit if it is located outdoors or near the entry door if located indoors.

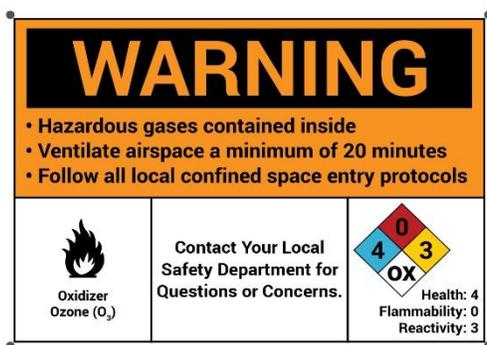


Figure 13: Warning Label

### 4.2 SAFETY OVERVIEW

The unique and patented design of the Vapex™ unit hydroxyl radical odor control system addresses the concerns of using oxidant. The system utilizes three (3) unique application techniques that are the basis of the Vapex™ existing patents and pending patent(s):

1. Oxidant dilution with air
2. Absorption of oxidant and H<sub>2</sub>S with fine water particles
3. Dispersion of oxidant via high volume air blast

The system uses high purity oxygen to make the oxidant, thus producing non-contaminated oxidant output.

The Vapex™ unit applies oxidant as an aerosol over the waste stream in an enclosed area. This aerosol mixes with the airborne contaminants such as H<sub>2</sub>S gas and chemically breaks down the contaminants into harmless liquid particles, which condense into droplets that reenter the waste stream. Germs and bacteria are killed, and organic compounds are oxidized. The Vapex™ unit is **NOT** designed to be used in habitable environments.

The unit oxidant output exceeds 10 ppm. Therefore, the direct ozone output mixes with significant amounts of dilution air and water particles and then applied, using a Vapex™ Patented application nozzle, into the enclosed area. This mixture reduces the toxicity level to a safe level, though extended exposure in a non-ventilated area could cause irritation. The toxicity levels will vary based upon the type and size of the enclosed area. Forced ventilation is recommended prior to entering the treatment area. However, the local confined space protocols and standards shall always be followed prior to entry.

### 4.3 INSTALLATION PRECAUTIONS

The provided warning placard shall be posted near the treatment area entry. A copy of ozone SDS shall be placed in plain view.

### 4.4 EQUIPMENT PRECAUTIONS

The Vapex™ unit is designed to direct 100% of the produced oxidant to the nozzle. However, it is possible to have an oxidant leak. The unit shall be mounted in an area with adequate ventilation. If high levels of ozone are smelled in the area:

- **DO NOT** stay in the area.
- Switch the unit **OFF** (if this can be accomplished safely)
- Ventilate the area.
- With the oxidant switched **OFF**, diagnose, and repair the problem.

Electrical Disconnection:

1. To disconnect, switch the unit **OFF**
2. Turn **OFF** circuit breaker.
3. **DO NOT** operate the Vapex™ unit if the unit malfunctions or is dropped or damaged in any manner. Call Vapex™ or a certified electrician for examination, repair or electrical or mechanical adjustment.

### 4.5 TREATED AIRSPACE ENTRY PROCEDURE

The Vapex™ Radical Odor Control system is designed for closed environments including lift (pump) stations, closed tanks and ducts for odor and corrosion control. Vapex™ strongly recommends the equipment only be used in an area with little or no human exposure. For personnel entry:

1. Switch the unit **OFF** using the red button in the control box. This will stop the production of oxidant and stop the creation of the mist.
2. Vent the treated area by opening the door / hatch to allow the existing reaction condition to dissipate.
3. Wait a minimum of twenty (20) minutes for the reaction condition to dissipate to a point where no mist is present. A fan or blower may be used to help dissipate the water vapor.
4. Follow all confined space entry procedures established by municipal, local and/or state regulations.

**IMPORTANT: THESE STEPS ARE IN ADDITION TO THE EXISTING WELL ENTRY PROCEDURES.**

To restart the odor control equipment:

1. Confirm all personnel have exited the treatment area.
2. Close all doors/hatches.
3. Follow normal start-up procedures.

## 4.6 SAFETY CONCERNS

Electronic handheld hydrogen sulfide meters may register ozone as H<sub>2</sub>S producing spurious readings.

## 4.7 SAFETY DATA SHEET (MSDS) – OZONE

### **Section 1 – Product Identification**

*Product Name:* OZONE

*Synonyms:* Tri-atomic Oxygen, O<sub>3</sub>

*Chemical Family:* Oxidizer

*Molecular Formula:* O<sub>3</sub>

*Molecular Weight:* 48.0

### **Section 2 – Hazardous Ingredients**

*Components:* Ozone Gas

*Concentration:* 0–20% by weight

*Gas Registry Number:* 10028-15-6

### **Section 3 – Physical Data**

*Boiling Point:* -111.9° C

*Melting Point:* -192.7° C

*Solubility in Water by weight at 20° C:* 0.003 g/l (3 PPM)

*Vapor Density (air = 1)*

*Appearance and Odor:* Ozone is colorless at all concentrations experienced in industry. It has a very pungent characteristic odor usually associated with electrical sparks. Ozone odor is generally detectable at concentrations of 0.02–0.05 PPM.

### **Section 4 – Fire/Explosion Hazards Data**

Ozone is a powerful oxidizing agent and oxidation with ozone evolves more heat and usually starts at a lower temperature than oxidation with oxygen. It reacts with non-saturated organic compounds to produce ozonide's, which are unstable and may decompose with explosive violence.

Ozone is an unstable gas which, at normal temperatures, decomposes to bi-atomic oxygen. At elevated temperatures and in the presence of certain catalysts such as hydrogen, iron, copper, and chromium, this decomposition may be explosive.

*FLASHPOINT:* Not Applicable

*AUTO IGNITION:* Not Applicable

*FLAMMABILITY:* Non-Flammable but vigorously supports combustion

*EXTINGUISHING MEDIA:* Depends on Source Media

### **Section 5 – Reactivity Data**

*Conditions Contributing to Instability:* Ozone spontaneously decomposes under all ordinary conditions, so that is not encountered except in the immediate vicinity of where it was formed. The decomposition is speeded by solid surfaces and by many chemical substances.

*Incompatibilities:* Ozone is a powerful oxidizing agent and reacts with all oxidizable materials, both organic and inorganic. Some reactions are highly explosive.

*Hazardous Decomposition Products:* None

*Special Precautions:* None

### **Section 6 – Health Hazard Data:**

*Permissible Exposure limit:* The current standard for ozone is 0.1 part of ozone per million parts of air (PPM) averaged over an eight-hour work shift. This may also be expressed as 0.2 milligrams of ozone per cubic meter of air ( $\text{mg}/\text{m}^3$ ). No criteria are set for the permissible concentration of ozone in water.

*Symptom Exposure:* A sharp irritating odor is noticed after exposure to very low concentrations ( $>0.04$  PPM) of ozone for a very brief period. As the concentration of ozone increases, the ability to smell it may decrease.

Irritation to the eyes, dryness of the nose and throat, and a cough may be experienced.

If the ozone concentrations continue to rise, more severe symptoms may develop. These may include headache, upset stomach, vomiting, pain or tightness of the chest, shortness of breath or tiredness, which may last for several days or weeks.

Finally, with higher levels of exposure, the lungs may be damaged, and death may occur.

*Toxicological Properties:* Ozone is extremely irritating to the upper and lower respiratory tract. The characteristic odor is readily detectable at low concentrations (0.02 PPM to 0.05 PPM). Ozone produces local irritation of the eyes and mucous membranes and may cause pulmonary edema at high exposure. Systematically, ozone has been reported to mimic the effects of ionizing radiation and may cause damage to chromosomal structures. A partial tolerance appears to develop with repeated exposures. Although most effects are acute, the possibility of chronic lung impairment should be considered, based upon animal experimentation.