#B26

Ozone 1000 Series Generator for Water Treatment

This project as shown in figure 26-1 can very effectively purify water for uses around the home or farm. The system as shown will produce up to 5 grams per hour sufficient for swimming pools, laundries and other medium volume applications. Systems are shown in five sizes and use easy to construct modules requiring only a flow of air for operation.
This is an intermediate level project requiring basic electrical hookup. Expect to spend $50 to $250 depending on the size system chosen and availability of the required air source. All parts are readily available with specialized parts through Information Unlimited (www.amazing1.com) and are listed in Table 26-1 at the end of these plans.

Introduction to the benefits of ozone

Ozone is an unstable form of oxygen. Normal oxygen is diatomic (02) existing as two atoms of oxygen making up the molecule. Ozone is tri-atomic (03) existing as three atoms of oxygen for the molecule. The tri-atomic form of oxygen is very unstable, wanting to lose the third oxygen atom and combine with whatever atom possible (oxidization). This property makes it the most active oxidizer known with the exception of the very hazardous fluorine gas.

Ozone at normal pressures is colorless and produces a pleasing fresh air odor often like that after an old fashioned thunder storm. Under pressure it becomes a bluish gas.

Ozone is also a very powerful bactericide. It is not affected by PH as is chlorine thus making it an excellent candidate for pools, spas, laundries and general water treatment applications. It is many times more soluble in water further enhancing its purifying effect. Ozone will combine with diatomic nitrogen N2 forming nitrous oxide 2NO. This oxide quickly combines with water forming nitric acid HNO3. This is often a very undesirable effect when used with straight air. Pure oxygen greatly minimizes this effect and is often required in many applications.

However those requiring a supply of concentrated nitric acid for nitration etc may wish to consider ozone and air with a condensing apparatus to obtain this useful acid.

Ozone for water applications

It is estimated that 20% of all ground water is contaminated by pesticides, benzene and phenol derivatives along with other undesirable organic substances. Ozone will oxidize many of these compounds along with deactivating many viruses and harmful bacteria. Ozone will also oxidize certain inorganic compounds such as iron and manganese making them more easily removable by filtration.

Chlorine and bromine is often the choice of disinfectant for swimming pools, and spas. The effect of these halogens is often dictated by PH, temperature and agitation. Extreme heat and agitation can produce chloroform, a very toxic carcinogenic. The EPA is already taking a dim look at these chemicals for this use.

Ozone treated water will destroy fungus, mold and many pathogens found in water when used for washing fruits and vegetables in packing lines. When discharged, ozone causes little change to the beneficial bacteria in sewage treatment facilities.

Freshly caught fish will last longer when washed with ozone treated water. The odors from the storing cheese can be eliminated by the oxidizing action of ozone. Egg storage time is increased, wine can be aged faster. The removal of odors produced by bleaching of bees wax starch, flour, straw, bones, feathers etc are all aided by ozone treatment.
The grease and wax on cotton and wool fibers are decomposed by ozone. Gray mold on the surface of fruits and vegetables is controlled by ozone.

Ways to generate ozone

Ozone can be produced by an electrical discharge or by a high frequency electromagnetic wave. High frequency requires the wave to be in the ultra-violet where Plancks energy formula W=hc/v starts to become effective. This where energy in a wave packet in (ergs) is equal to Plancks constant times the speed of light in centimeters divided by the wave length in centimeters. It is this energy that cause the stable O2 to break up and recombine with other O2 to form unstable O3. Germicidal lamps operating at 253.7 nm can produce ozone.
The method presented here utilizes the ozone producing properties of an electrical discharge. We have all at one time have smelled the by products of ozone. After a thunderstorm it can be detected. On certain days where electrical activity is spawning storm it can de detected. A sparking electric discharge such as brushes on a motor will create ozone.

Our method uses a conducting metal tube with a conductor running down the center. The conductor and the tube are insulated by one another and must support the high frequency high voltage necessary to create a corona with out breaking down into an arc. The ozone produced in the tubular cavity must be made to flow using moving air for cooling and replenishing air to be converted. This method while producing usable ozone has several disadvantages. First normal air contains nitrogen that likes to combine with the ozone to produce nitrous oxides. Second air contains water in the form of moisture. Without getting into basic chemistry we know that water plus nitrous oxides form nitric acid that is corrosive and undesirable for air purification applications. How ever a very effective way of making this acid is to allow the oxides to combine with water vapor or steam and condense in a cooling tube producing concentrated nitric acid that can be used in the manufacture of high explosives. The five gram per hour system can produce enough nitric acid that when mixed with battery acid (sulphuric) can produce usable amounts of high explosives by simple nitration of many organic compounds.

Select the system you require from figure 26-2. Note that each is complete with the mating power supply.

Wire up the system as directed on figure 26-3. Obtain a suitable air supply and connect up the hoses as shown. Use ozone resistant material for connections to the cell.

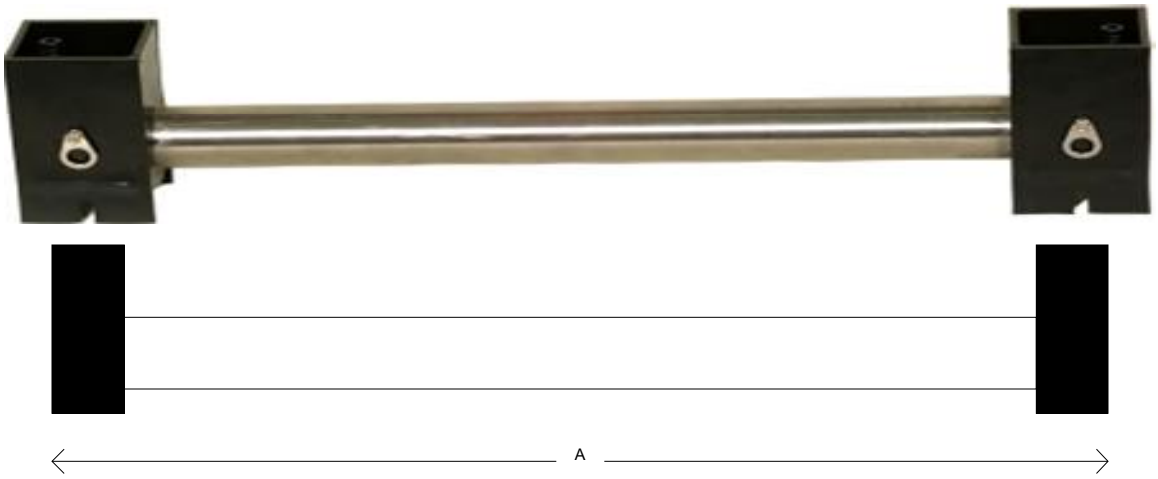
Turn on the air supply and note a bubbling from the output hose immersed under the water. Apply power to the high voltage and note a distinct smell coming from the hose when pulled out of the water. Reinsert and rig hose end to stay under the water.

Unit is now ozonating the water.

Table 26-1 Parts List

Ref#	Qty	Description	DB#
OZONE300/500		100-500 mg/hr system / 182 mm / 12vdc @1 amps	#OZONE500
OZONE800		500-1000 mg/hr system / 282 mm / 115 vac @ . 6 amps	#OZONE800
OZONE2000		1000-2000 mg/hr system / 382 mm / 115 vac @ .9 amps	#OZONE2000
OZONE5000		2500-5000 mg/hr system / 482 mm / 115 vac @ .2 amps	#OZONE5000
HOSE		Connecting hoses use ozone resistant VITOR or HYPALON	
COMPRESSOR		Rotary vane compressor at required air flow	
CORD1		3 wire power cord	
SWITCH	2	Switches to control air compressor and high voltage supply	
FAN		Small fan to cool cell if required 12 vdc or 115 vac	

Figure 26-2 Cell and power supply selector

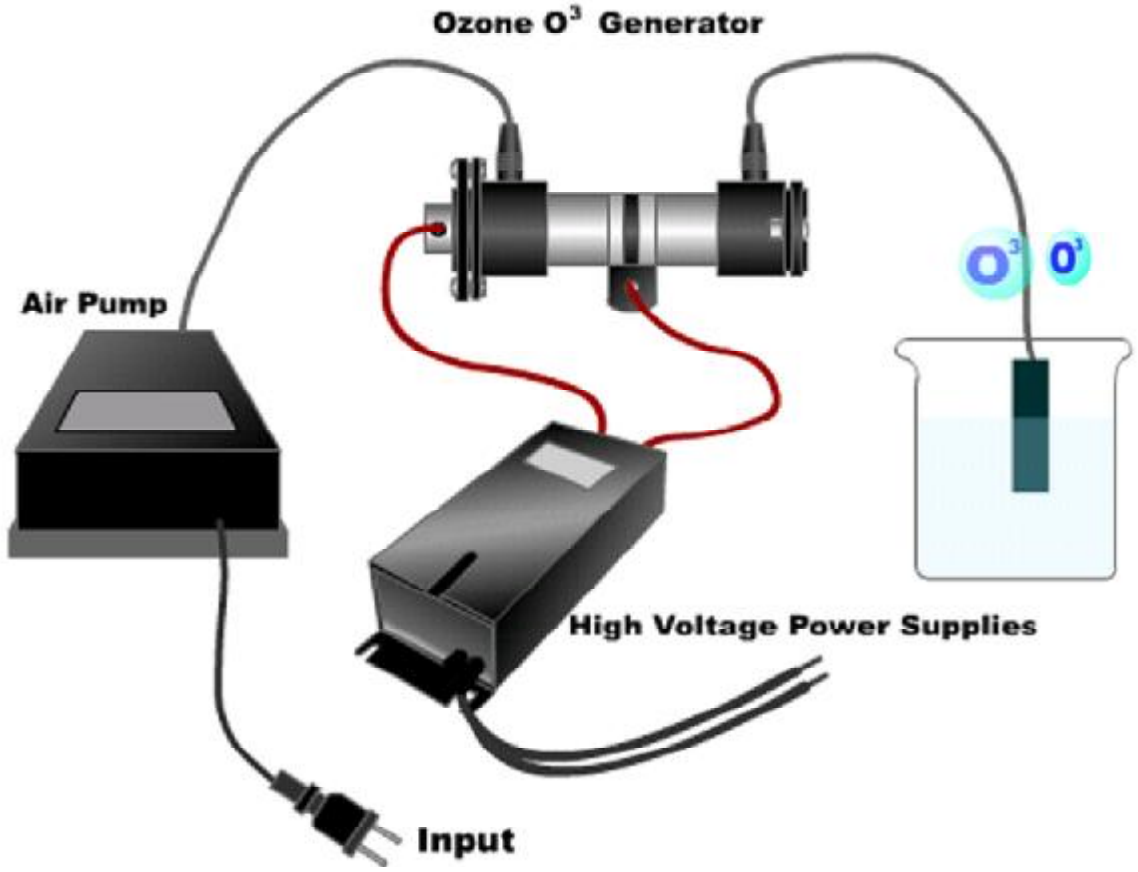


DATA BASE#	LENGTH A	OZONE OUTPUT/HR	AIR/O3 FLOW/MIN	INPUT V	INPUT I
OZONE300/500	182mm	100-500 mg/hr	.25-.55 CFM*	12 Vdc	1 Amps
OZONE800	282mm	500-1000 mg/hr	.35-.7 CFM*	115 Vac	.6 Amps
OZONE2000	382mm	1000-2500 mg/hr	1-1.5 CFM*	115 Vac	.9 Amps
OZONE5000	482mm	2500-5000 mg/hr	1.5-3 CFM*	115 Vac	I.2 Amps

* Multiply CFM by 28.3 to get Liters per minute

Each DATA BASE# system is complete with a matching power supply and ready to connect up as shown on figure 26-3

Figure 26-3 Ozone water treatment diagram



The high voltage power supplies used in the 800 to 5000 systems operate from normal 115 Vac 60 Hz.
The OZONE300/500 power supply operates from a 12 vdc 1 amp wall adapter included.
They are listed with the appropriate ozone cell on figure 26-2

The air pumps used can be that appropriate for the volume of the particular system. A flow meter should be used when first setting up the system to verify proper air flow. Pure oxygen works the best and is available in cylinders with regulator valves and optional flow meters. Large aquarium air pumps may be used with the smaller systems while rotary vane air compressors are suggested for the larger systems. Note to multiply cubic feet per minute (CFM) by the factor 28.3 when converting to liters per minute. Use ozone resistant tubing such as VITOR or HYPALON for connection to the cell

Use standard wiring codes for all 115 vac connections. The high voltage output wires from the high voltage power supply must be free from conductive objects and should be as short as possible. Do not twist together.