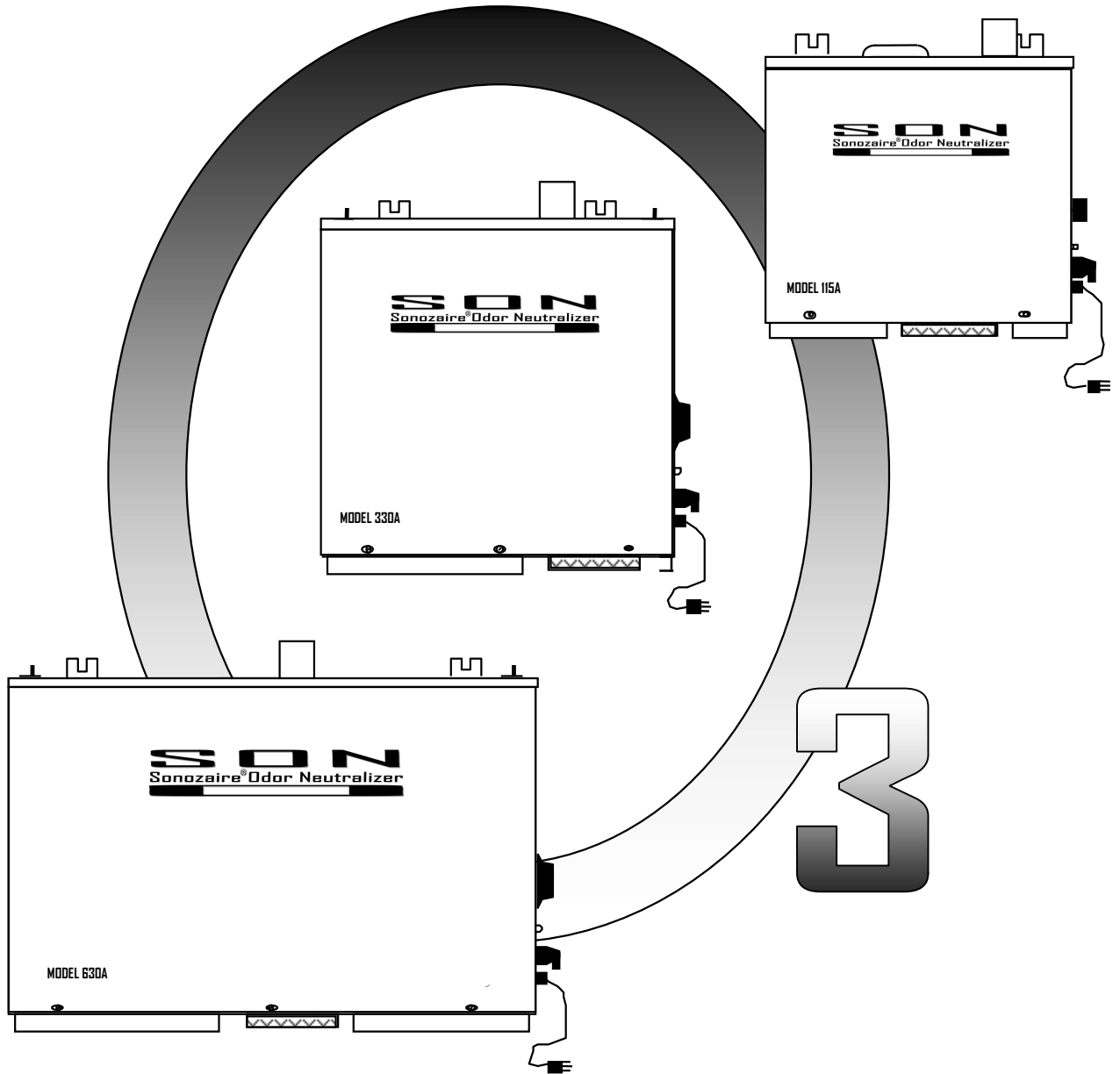


SON

SONOZAIRE[®] ODOR NEUTRALIZER



INSTALLATION, APPLICATION, AND SERVICE INSTRUCTIONS for Sonozaire Models 115A, 330A, 630A

Made in USA \$25.00 USD

phone 903-525-9336

SONOZAIRE ODOR NEUTRALIZER

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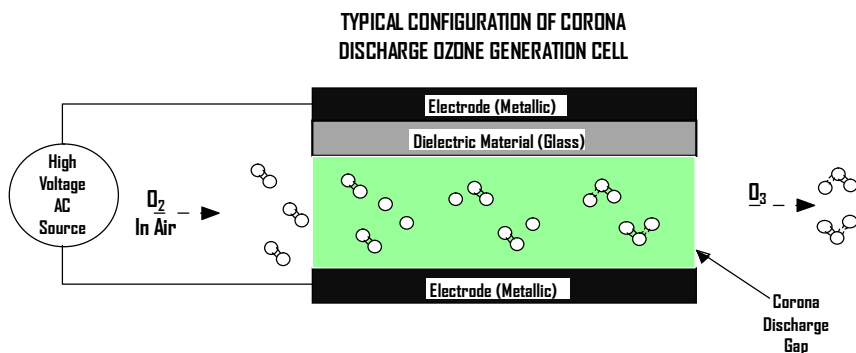
Installation Section

UNDERSTANDING OZONE

What is ozone?

The earth's air is typically 21% (210,000 ppm) oxygen and 78% (780,000 ppm) nitrogen. The remaining 1% is made of miscellaneous chemicals, including ozone that makes up only 0.02 to 0.07% of the air, based on seasonal variation. An oxygen molecule (O_2) is composed of two oxygen atoms with a stable bond. It has no color, odor, or taste, and its molecular weight is 31.9988. An ozone molecule (O_3) is composed of three oxygen atoms instead of the normal two, but the bond between the third atom is very unstable. Ozone has a molecular weight of 47.998, and in concentrated form has a clear to pale blue color. In trace concentration form, it has a sweet clean fragrance associated with thunderstorms. At higher concentrations, the odor is sharp and pungent, and irritating to the eyes and lungs. Due to its instability, the ozone molecule reacts with the first molecule it can oxidize. It is this reaction mechanism of ozone that destroys the odors and other contaminants in the air.

The production of ozone is quite simple: $3 O_2 \rightarrow 2 O_3$. This basic reaction can be created in a high voltage electrical field. See the figure below, which shows how ozone is formed. The reaction occurs when the high voltage electrical field provides the energy that breaks one O_2 molecule into two 'O' molecules. These 'O' molecules attach themselves onto two oxygen molecules, forming two ozone molecules. Once the ozone is introduced to other reactive molecules, it begins the process of oxidation, or breaking down, chemical structures into simpler or more stable compounds. Since it is air-borne, it reacts with available air-borne odors.



When ozone is introduced into an area, it will begin to react with airborne odors. By the oxidation process, it begins to convert many odors into simple and stable compounds of carbon dioxide, water, and oxygen. This process may be a single step, or it may take several steps, which means that several molecules of ozone may be required to breakdown certain odors. This is why larger concentrations or longer exposure times of ozone are needed to handle strong odors. During treatment, the amount of ozone that lingers in the air awaiting reaction with odors is referred to as **residual**. If the air is agitated, the residual ozone will be reduced due to the mixing and reacting with odor molecules. For this reason fans are recommended in many applications to speed up the reaction time and keep the residual ozone level at a minimum.

How can residual ozone be measured?

The nose can detect ozone concentration as low as 0.01 to 0.04 ppm. This is an extremely low concentration. This is similar to one penny in a million dollars. However, the nose has the ability to become desensitized to odors, and this is also true with ozone. Removing strong odors from garbage, sewage, and disasters such as fires and floods, require a high concentration of ozone. **WARNING: COMMERCIAL OR INDUSTRIAL OZONE GENERATORS CAN PRODUCE LEVELS THAT EXCEED OCCUPIED LIMITS. THIS MEANS THAT WHEN TREATING THESE ODORS, THE AREAS OF TREATMENT MUST NOT BE OCCUPIED.** If ozone is used in an occupied area, the ozone level must be maintained at a safe level. Monitoring devices available are: ozone badges, manual pumps with ozone sensitive tubes, electronic ozone meters, and electronic ozone controls that limit the amount of ozone in the air.

What happens to excess ozone?

Why does the clean air fragrance, created during a thunder and lightning storm, disappear? Several reasons including the reaction with the large quantity of polluting emissions in the urban environment, and due to the fact that ozone is unstable and highly reactive and if there are no lingering contaminants for ozone to destroy, it will soon revert back to oxygen, from which it came. Ozone molecules reacting with other ozone molecules accomplish this. The half-life of ozone is generally 10-20 minutes. At a 15-minute half-life, ozone levels will drop to approximately 3% in about 90 minutes after the ozone generator is stopped. This is one of the many advantages of using ozone as a deodorizing agent. It does the job we want done and converts itself back to oxygen. This safety factor of ozone is also enhanced by a noticeable and irritable odor at high concentrations. A short life span and warning of high concentration, makes ozone capable of being used safely in many applications.

How much ozone is allowed by various regulatory and advisory agencies?

The Environmental Protection Agency (EPA) determines the amount of ozone for national air quality standards for ambient air. The EPA value is presently 0.12 ppm per volume measured over one hour, and 0.08 ppm measured over eight hours. **Ozone exposure limits in the workplace are set by the Occupational Safety and Health Administration (OSHA) and by the U.S. National Institute for Occupational Safety and Health (NIOSH). OSHA limit is 0.1 ppm per volume for an 8-hour work shift. And limit for immediately dangerous to life and health (IDLH) level is 5 ppm per volume for a maximum of 30-minute exposure. Ozone can clean the air of unwanted odors and bacteria and make the air better to breathe, but large concentrations, or prolonged levels above 0.1 ppm should be avoided.** As mentioned previously, ozone generators can be supplied with controls that limit the amount of ozone to levels below all regulated values.

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What are proper precautions when using ozone?

- ✘ Use in uninhabited areas to prevent exposure of excessive residual.
- ✘ After the ozone generator's switch or timer is turned off, allow time for the ozone to revert back to oxygen before entering the area. The recommended time period is 90 minutes to two hours.
- ✘ Ventilate the area thoroughly after using ozone to eliminate problems for people with chemical sensitivities.
- ✘ Do not use in areas that are wet or have high humidity. Ozone reacts very fast in humid areas, but can produce a mild form of hydrogen peroxide when mixed with water. This might cause bleaching on some fabrics. Use a dehumidifier to remove excessive moisture.
- ✘ Remove all pets from the area while treating. If fish tanks cannot be moved, then cover them to prevent excess ozone from mixing with the water. Locate the aquarium oxygen pump so that it has fresh air to pump into the water. Remove plants, especially moist type, if treatment time is more than a few hours, or if located in a small room with a high concentration of ozone.
- ✘ Do not expose natural rubber (latex) to ozone, as it will cause it to deteriorate. Remove it from the treating area, or coat it with dry silicon spray. If any electronic equipment is suspected of having rubber drive belts, cover them.
- ✘ Leather should only be exposed to ozone for a few hours. Over exposure can cause possible drying of material or cause some of the oils to be driven out.

What are some uses of ozone?

- ✘ Controls odors from garbage or waste compactors for industrial applications.
- ✘ Oxidizes odors from buildings sustaining fire and smoke damage.
- ✘ Destroys odors from clothing or fabrics damaged by fire or other disaster.
- ✘ Removes odors from offices, homes, schools, hotels, casinos, restrooms, autos, gyms, funeral homes, etc.
- ✘ Retards or destroys bacteria in food storage on meats, fish, fruit and vegetables, eggs, etc.
- ✘ Destroys mold and mildew.
- ✘ Removes pet odors from kennels, pet stores, homes, clothing, etc.
- ✘ Controlling tobacco odors in restaurants, bars, smoking lounges.
- ✘ Eliminates odors from sewage lift stations or holding tanks.
- ✘ Removes exhaust hood odors from cooked food, or chemicals.
- ✘ Treats drinking water, bottled water, swimming pools, and wastewater.

After reviewing this list it is quite obvious that ozone is widely used. Why is it widely used? The answer is simple – it works. It works extremely well because it removes odors that no other process can match. Ozone needs special precautions that have been indicated; this useful chemical can be effectively applied by:

- ✘ Being knowledgeable about ozone.
- ✘ Utilizing ozone properly, following all safety requirements.
- ✘ Being aware that ozone has a self-destructive nature.
- ✘ Being aware of the odor of ozone, while using the proper tools and precautions to prevent exposure in excessive concentrations.

The bottom line is that ozone, like many effective chemical products, must be used properly and safely. You would never intentionally breathe strong chemical products; therefore, ozone gas should be used with the same common-sense precautions. **As with all commercial and industrial manufacturers of ozone equipment, IT IS STRESSED THAT THE UNITS ARE USED ONLY IN UNOCCUPIED AREAS. ADDITIONAL CONTROL METHODS ARE REQUIRED TO ENABLE THESE UNITS TO BE UTILIZED IN OCCUPIED AREAS, IN ORDER TO LIMIT THE CONCENTRATIONS TO REGULATORY VALUES.**

GENERAL

The Sonozaire models 115A, 330A, and 630A are ozone generators. The SON models produce **ozone** from oxygen taken from air in concentration amounts of less than 0.01% by volume. The chemical formula for ozone is **O₃**, and it is a powerful oxidizer for the control and removal of odors. When ozone comes in contact with odors, it chemically breaks down the odors into lesser chemical compounds. Many times these lesser compounds are oxygen (O₂), carbon dioxide (CO₂), and water (H₂O). The units do not require any chemicals because ozone is produced electrically.

CAUTIONS

Ozone is an extremely effective tool for use in odor control. However, it is an oxidizer and, like other industrial products, must be properly used. **Certain cautions must be observed to prevent human and animal exposures to ozone.** When using in the USA, the governing bodies are OSHA and the FDA. When ozone is used in other countries, the national health or occupational safety standard of that country is the likely governing body for determining the permissible amounts of ozone exposure. In the USA, the maximum permissible exposure limit (PEL) of ozone concentration in enclosed and inhabited areas is 0.1 parts/million (ppm) over an averaged eight-hour work period. The ozone limit for immediate exposure is 5 ppm (30-minute exposure). **THESE UNITS SHOULD NOT BE USED IN OCCUPIED AREAS NOR ARE THEY DESIGNED FOR USE IN HOSPITAL ROOMS OR SICK ROOMS. ADDITIONAL CONTROL METHODS ARE REQUIRED TO ENABLE THESE MACHINES TO BE UTILIZED IN INHABITED AREAS. THESE METHODS MUST LIMIT THE EXPOSURE LEVELS TO THOSE PERMITTED BY THE APPROPRIATE GOVERNING BODIES.** Refer to the Indoor Air Quality Section of this manual or contact Sonozaire LLC for additional information.

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Although higher ozone limits are typically required to effectively control industrial odors, **caution must be used to secure such areas to avoid inadvertent entry until the area can be properly ventilated.**

THESE UNITS SHOULD NEVER BE USED WHERE A FLAMMABLE GAS OR LIQUID MIGHT BE DRAWN IN THROUGH THE AIR INLET OR FORCED INTO THE MACHINE BY OTHER MEANS. FLAMMABLE GASES OR LIQUIDS DRAWN INTO THE ELECTRICAL EQUIPMENT MAY CAUSE IGNITION OF THE GASES. IF FLAMMABLE GAS OR LIQUID LEAK IS POSSIBLE, DO NOT USE THE UNIT BECAUSE A FIRE OR AN EXPLOSION COULD OCCUR.

INSTALLATION REQUIREMENTS

Installation must conform to applicable local codes.

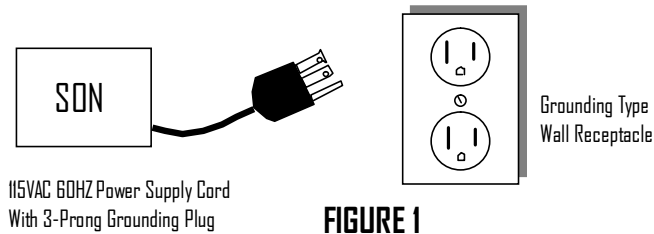
ELECTRICAL SUPPLY

The Sonozaire units have been designed for 115V, 60Hz or optional 230V, 50/60Hz operation, AC only. Standard models are certified by **CSA file 151665 and LR 30836**. Some modifications will not be in compliance. The power usage and airflow of each unit are as follows:

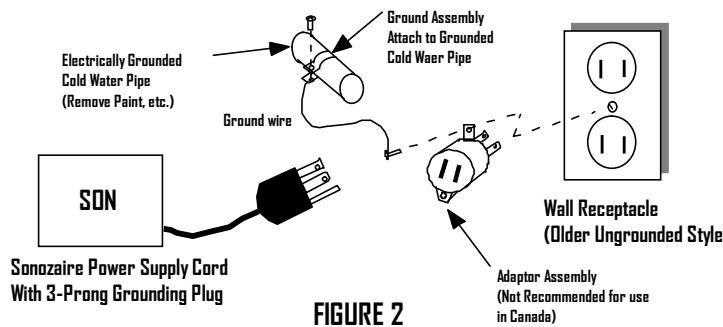
Models	Power	Air Volume Rating
115A	120VA	56 cfm @ 60Hz, 47 cfm @ 50Hz
330A	160 VA	56 cfm @ 60Hz, 47 cfm @ 50Hz
630A	290 VA	75 cfm @ 60Hz, 65 cfm @ 50Hz

IMPORTANT

To prevent damage to the equipment, be sure that the unit received is applicable to the electrical service in your area. In accordance with specifications of the National Electrical Code in the USA, or other applicable international codes, the 115V equipment is supplied with a three-prong (grounding) plug, which mates with a standard (three-prong) grounding wall receptacle (Figure 1). **Do not, under any circumstances, cut or remove the third (ground) prong from the cord set plug.** The 230V equipment is supplied in two configurations. For Europe (220V, 50Hz) it is supplied with a Schuko plug and other CE modifications. For other locations it is supplied with a three-wire cord without the male plug. The user must supply a male plug to match local receptacle configurations. In all configurations the cords must be three-wire cords with a ground or earth wire and have the correct plug for the corresponding receptacle of that nation or locality.



115VAC -- When a two-prong receptacle is encountered (Figure 2), a temporary connection may be made where local codes permit (not recommended for use in Canada) using an adapter (P & S #1919 or equivalent). The adapter provides a means for plugging a three-prong cord set into a two-prong receptacle. The adapter should not be used without a proper ground connection. Attaching the adapter ground wire to the receptacle cover screw will not ground the machine, unless it is known that the cover screw is grounded through the "house" wiring. To be certain to obtain proper ground when using this adapter, attach the machine ground wire to a metallic cold water pipe as shown in Figure 2.



230VAC -- Refer to Figure 3 for the 220-240VAC, 50HZ model that is supplied with the cord, but without the male plug provided. If the manufacturer supplies the cord without a male plug then the black wire will be the "phase" or "hot" wire, the white wire will be the "neutral" or "grounded current carrying" wire, and the green wire will be the "grounding" or "earthing" wire. Refer to Figure 4 for the model (CE) with the cord. Refer to Figure 5 for 230VAC, 60HZ installations where phase-to-phase voltage is used instead of phase to neutral.

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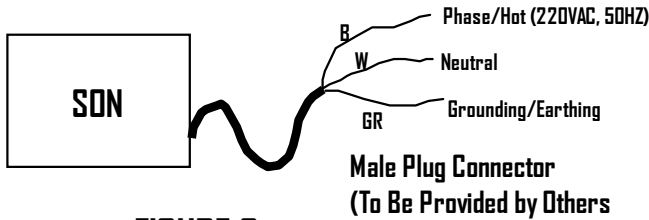


FIGURE 3

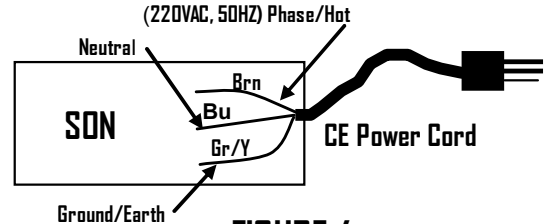
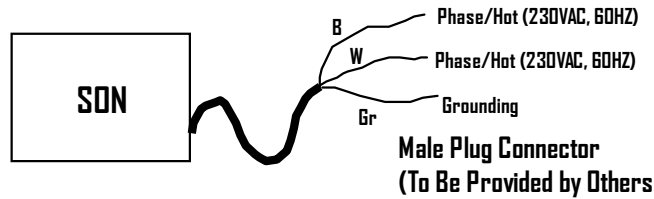


FIGURE 4



230VAC Phase to Phase Voltage

FIGURE 5

Do not, under any circumstances, cut or remove the third (ground) prong or wire from the cord plug.

INSPECTION

Upon receipt of the Sonozaire unit remove it from the shipment box, and remove the front cover by removing the bottom screws and gently pulling down on the cover. Once the cover is removed, please view the unit and compare it to the internal view of the appropriate unit within this manual. Verify that the glass insulator tube (s) is not broken and is pressed firmly against the gasket on the blower (model 115A) or against the plenum (models 330A and 630A). Look for any other obvious damage that may have occurred during shipment. After completing the inspection and making any corrections, replace the cover. Please note that the cover has a pin on the inside that presses against a small door safety switch located on the right lower corner of the cabinet. Verify that the pin is in alignment with this switch so that it presses the switch in when the cover is replaced. The switch will click when the door pin comes in contact with it and is pressed.

CHOICE OF LOCATION

The SONOZAIRE equipment should be placed near the treatment area, such as an adjoining room or space, and "piped" into the service area. This purpose is to allow fresh air to serve as supply air for the ozone generator. When such an installation is not practical, the machine should be placed directly into the immediate area to be treated. When the unit is not being used indoors, the unit should be installed where it will be protected from the weather or ordered with the weather protection option (not CSA approved). Place the unit as high as possible to prevent the entry of moisture through the bottom filter. If the unit is being used to treat large areas then additional airflow methods must be used, such as higher volume fans or HVAC systems. The purpose here is to distribute the ozone as widely and quickly for proper odor removal.

EFFECTIVENESS

For the maximum performance, place the Sonozaire units in an environmentally controlled area that has cool, dry air and a reliable power source. High humidity or moisture content, and high temperatures reduce ozone output and require more frequent maintenance. Also, the supply voltage should be no less than that for which it is designed since low voltage will reduce the ozone output. The models covered by this manual have variable output capability which allows variable ozone outputs to be chosen. Additionally timers are available which provides the ability to have the units operate a predetermined time and then turn off. This gives the user the ability to operate the unit and allow time after it turns off for the ozone level to decay.

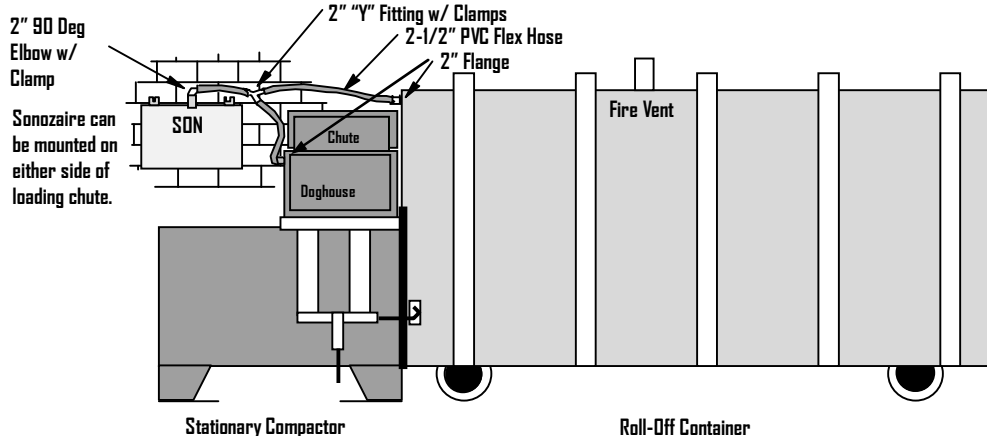
SONOZAIRE ODOR NEUTRALIZER

Application Section

WASTE MANAGEMENT INDUSTRY

COMPACTORS/CONTAINERS

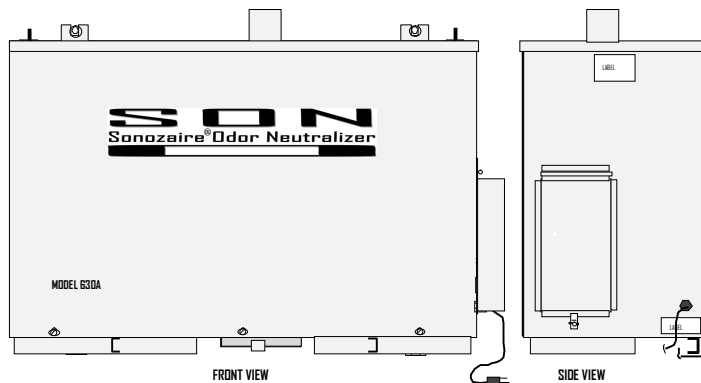
The Sonozaire units are recommended for garbage compactors/containers for the control of odors. Ozone controls or removes garbage odors, prevents fermentation, retards bacterial growth and slime production, destroys odors that attract pests (flies, bees, wasps, etc.), and provides cooling to the compactor/container. SON models help reduce customer/consumer complaints as well as neighborhood odor complaints, and operate without expensive chemicals or masking perfumes. The Sonozaire costs only pennies per day for operation and requires only periodic cleaning.



COMPACTOR AND ROLL-OFF CONTAINER INSTALLATION

Normally, the Sonozaire mounts separately from the compactor/container, and the ozone discharge is "piped" into the compactor/container. The Sonozaire works best if mounted indoors, where it has a cool, dry air supply and has the ozone piped outside to the compactor/container. If the Sonozaire is not mounted indoors, the unit should be installed where it will be protected from the weather or ordered with the weather protection option (not CSA approved). To prevent any moisture from draining back into the Sonozaire, mount it with the discharge higher than the connection point to the compactor. The piping can consist of PVC pipe type I (un-plasticized) or flexible PVC hose (ozone and sunlight resistant), flange(s), and a "Y" fitting, which may be required to direct the ozone to the desired locations. Use hose clamps on the items with hose connections, such as the "Y" fitting, but do not use hose clamps where the hose must be disconnected for removal of the container. It is essential that the Sonozaire output piping be placed in such a way as to avoid any possible clogging of the opening with garbage. Install the flexible hose or piping to prevent low points, which might become filled with moisture or debris and block the ozone flow into the compactor/container. It is advisable to place the Sonozaire outlet at the chute or ram end (doghouse) of a compactor and at the upper end of a container. Ozone reacts quicker when it treats the odor at the source. Do not locate hose or flange connections where ozone blows towards the chute door.

The SON units supply 60 cfm or 100 cfm of ozonated air and require a means for the treated air to exit the compactor/container. The fire hose vent will normally provide this exhaust means and should remain open. If there is no location for treated air to exit the equipment, then a vent location must be added.



SONOZAIRE MODEL 630A WITH CONTROL COVER AND WALL HANGER KIT

When a SON unit is in service, adjust the ozone level knob on the side of the unit to eliminate the odor. If objectionable garbage odor is detected in the general area around the compactor/container, increase the control knob. If excessive ozone is detected, decrease the control knob. Higher ambient temperatures require more ozone to treat the greater odor levels caused by heat.

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The type of garbage will also determine the Sonozaire model selected. If the waste contains a large amount of organic, odor-producing materials, such as vegetables, meats, eggs, etc., and the compactor/container size is near the maximum size indicated, then the next size Sonozaire is recommended. An example would be if a 25 or 30-yard compactor/container were used with large amounts of organic waste, then a model 630A is recommended over a model 330A. The same is true if the ambient temperature is physically hot such in states or countries where the temperature can exceed 95-100 degrees F. In those cases upsize the SDN model if the container is near the maximum size indicated.

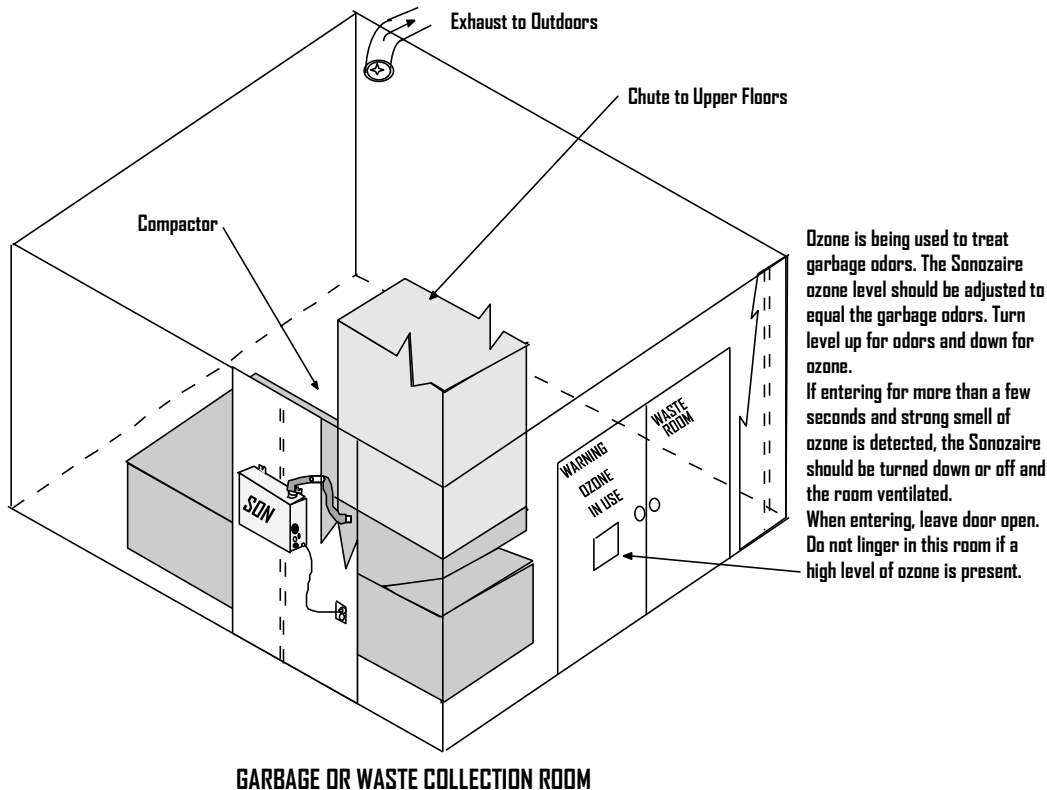
Compactor/Container Approximate Sizing:		
Model 115A	Model 330A	Model 630A
0 to 8 cu yd	8 to 30 cu yd	30 to 50 cu yd
0 to 6 cu m	6 to 23 cu m	23 to 38 cu m

GARBAGE ROOMS WITH OR WITHOUT COMPACTORS

When installing the SDN in a compactor or garbage room, it is best to install it with the ozone piped into the compactor and attached to the chute or hopper. If possible, mount the Sonozaire outside the room and pipe into the room, and over to the compactor. A vent from the room to the outside is necessary to allow air to leave the room.

If the garbage room does not have a compactor or if it has an open container, then the room partially serves as the ozonated area. In all cases, the Sonozaire should have the output adjusted to equal the garbage odors. If ozone is noticed, lower the level control knob. If garbage odor is noticed, then increase the level control knob. There is no reason to saturate the room with ozone; just adjust the ozone output to what is necessary to control the odor. The ozone should be injected as close to the garbage as possible.

For an enclosed garbage room, certain precautions should be observed. A **warning sign** should be placed on the doors entering the room, warning that ozone is being used. It is also advisable that the door(s) remain open when entering the room. If anyone enters the room for more than a few moments and smells excessive ozone, then the Sonozaire should be turned off. The room should then be mechanically ventilated or a time period must be allowed for the ozone level to decrease. This time limit should be 15-30 minutes at a minimum. If anyone enters the room, caution should be exercised so that they are not exposed to ozone for prolonged periods. Ozone sensors that automatically control the ozone level are available. Please contact your distributor or factory for this option.



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This demonstrates that it is better to have the SON mounted outside the room, so it is controllable without going into the garbage room. It is also easier to clean and provide any normal maintenance required without being in the garbage room. However, if the SON is mounted in the garbage room, it should be mounted on the wall near the container. If a container is not used, the recommended installation is that the unit be mounted near a doorway and piped over to the treatment area. The room should allow some fresh air to enter, as the SON needs fresh air as a source to make ozone. The SON output piping should be routed in such a way as to avoid any possible clogging of the opening with garbage. Install the flexible hose or piping to prevent low points, which might become filled with moisture or debris and block the ozone flow into the compactor/container.

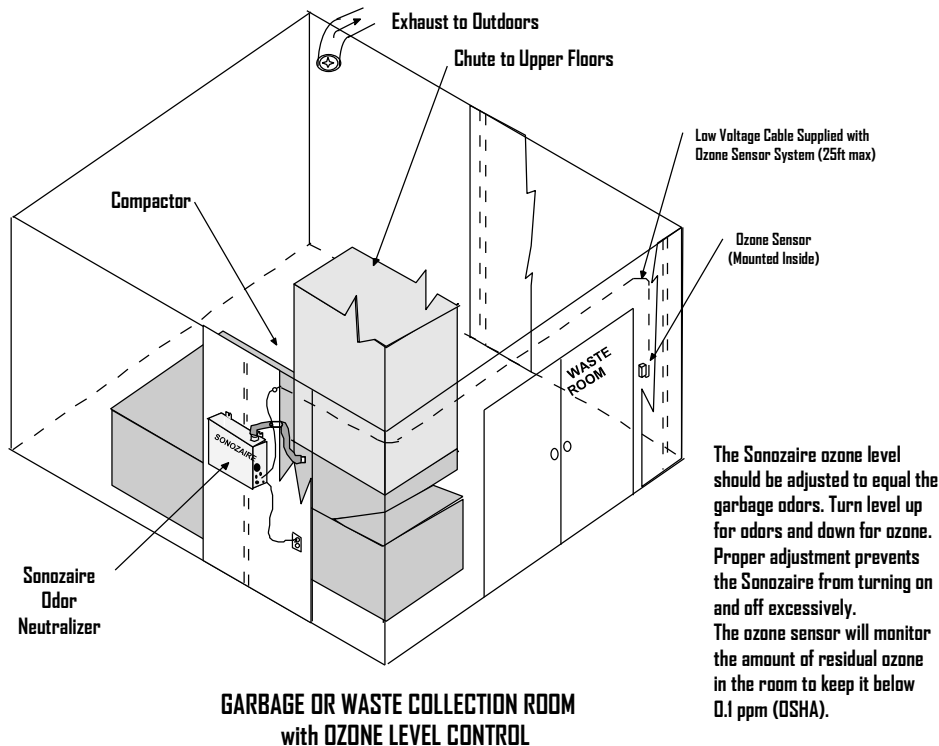
Often the garbage room or containers load from chutes coming from upper floors, and garbage bags drop down to the room or container. With this arrangement, the odors can draft upwards to the chute openings. Placing the SON at the garbage area will generally solve this problem because the ozone will either destroy the odors at the source and prevent the odors from being drafted upwards, or if updraft is adequate then some of the ozone will be drafted upwards and destroy odors in the chute. If excessive ozone is noticed, lower the setting on the level control knob.

In garbage rooms or holding areas, the cubic yardage of garbage determines the proper selection of the Sonozaire model. It is not necessary to use the room volume when calculating, only the volume of garbage. Use the chart for the compactor container sizing based on volume. Below, however, is an estimated volume of room that contains some amounts of non-compacted garbage:

Garbage Rooms Approximate Sizing:		
Model 115A	Model 330A	Model 630A
405 to 3,240 cu ft	3,240 to 12,150 cu ft	12,150 to 20,250 cu ft
11 to 92 cu m	92 to 344 cu m	344 to 574 cu m

How much ozone is enough? When a SON unit is in service, adjust the ozone level knob on the side of the unit to eliminate the odor. Typical initial setting is 50-60 on the output dial. In the garbage room, if objectionable garbage odor is detected, increase the control knob. If excessive ozone is detected, decrease the control knob. Higher ambient temperatures require more ozone to treat the greater odor levels caused by heat.

Some garbage rooms have minimal odors; therefore, it may not be necessary to operate the Sonozaire units 24 hours a day. In this case, the units can be ordered with the optional 12-hour timer with a hold-on feature. Another method of operation is to order the outdoor clock timer accessory that cycles the unit on and off periodically. In garbage rooms, ozone sensors are also available to turn on and off the SON based upon residual ozone levels. The use of OSHA level sensors are most often used in garbage rooms in locations like mall food courts, or large company waste rooms where multiple employees are in and out of the room daily and a higher degree of control of the ozone level is desired or required.

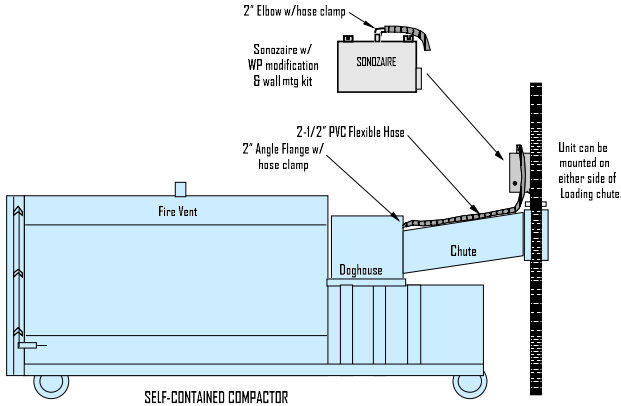


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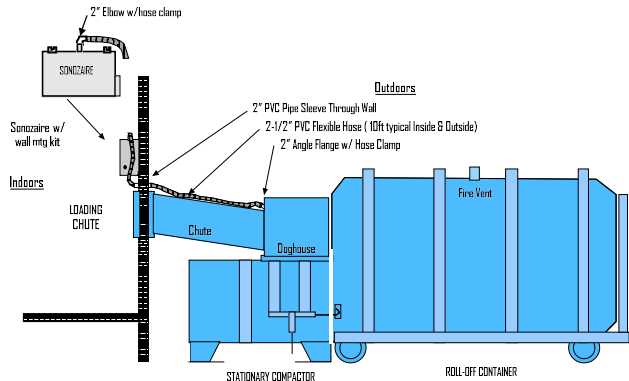
Application Section

The Sonozaire models can also be used in other areas of the waste management industry. They can be used with balers, packers, and at transfer stations. The SON units are to be used in a manner that prohibits excessive exposure to workers. Ozone can also be used to treat garbage trucks while they are not in use. Sonozaire units can be mounted on stands and have the ozone piped over to the refuse body for odor removal at nights, or during off-hours. The ozone destroys the odors and bacteria, improving the truck's sanitation for the employees.

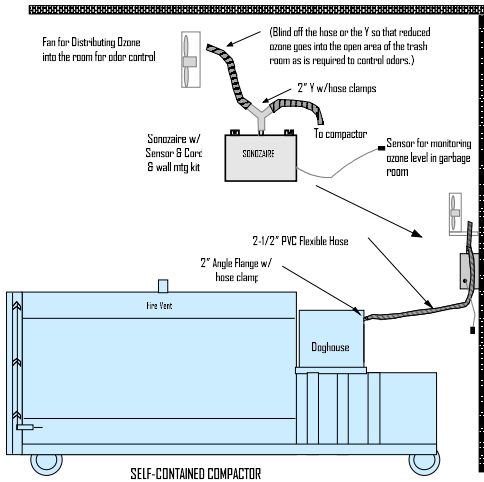
Below are some additional installation drawings showing various connections possible for different applications of compaction equipment.



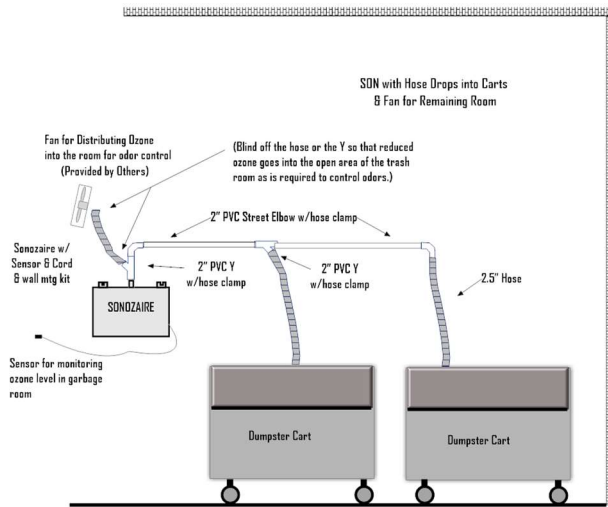
TYPICAL INSTALLATION OF SONOZAIRE ODOR NEUTRALIZER ON A SELF-CONTAINED COMPACTOR



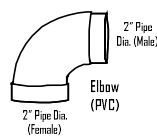
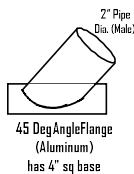
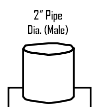
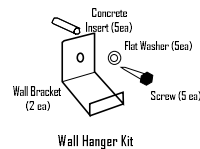
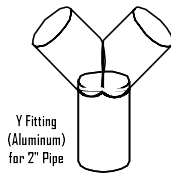
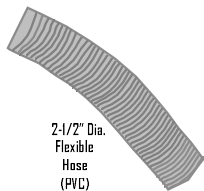
TYPICAL INSTALLATION OF SONOZAIRE ODOR NEUTRALIZER MOUNTED ON A STATIONARY COMPACTOR AND ROLL-OFF CONTAINER



SELF-CONTAINED COMPACTOR



Below are some optional items available to make installation easier.



SONOZAIRE ODOR NEUTRALIZER

Application Section

RESTORATION

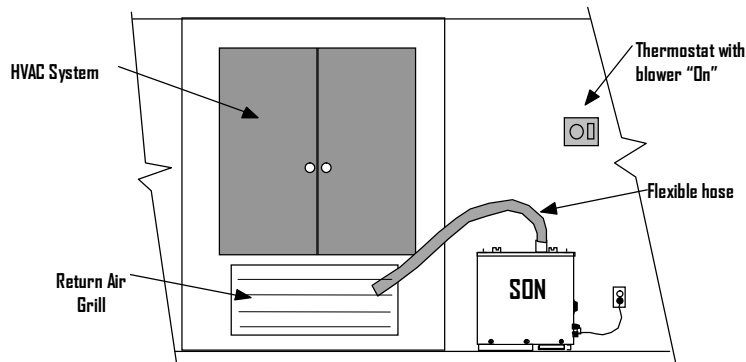
Removing odors in homes, apartments, hotels, motels, offices, buildings, etc., due to fire or flood, are businesses that utilize all models of the Sonozaire Odor Neutralizer. SDN units destroy smoke and mildew odors by the use of ozone. Fires cause smoke and soot to cover almost all surfaces, as well as penetrating within the wall and beneath the floor surfaces. Water damage can occur from floods, fire hoses, storms, etc. To treat all of the various damages several methods of treatment are typically required. Some methods include: thoroughly cleaning all surface areas, sealing exposed surfaces, replacing contaminated or damaged materials, and utilizing neutralizing counteractants such as fogging, thermal fogging, and ozone treatment.

Ozone is the method of choice for eliminating smoke odors from contaminated clothing, fabrics, draperies, books, paintings, or any moisture sensitive surface. Ozone works thoroughly because it permanently removes the odor. Even when other methods are utilized, ozone is often the final method to remove any traces of odors that have not been removed. If an item is composed of natural rubber or latex, it should not be treated, since ozone will disintegrate rubber. This does not apply to foam rubber cushions covered with fabric or synthetic rubber used in dry cleanable fabrics. If a rubber surface is exposed, then a dry silicon spray should be used to coat it before treating. Items to be considered are the back of drapes, rubber belts on electronic equipment, rubber rollers on cassette players, children's toys or dolls, furniture coasters, etc. Plants, especially moist type, should be removed if exposure time or concentration is high. Pets should be removed. If fish tanks cannot be removed, they should be covered to prevent excess ozone from getting into the water. Valuable items such as irreplaceable paintings should be removed and processed properly. Electronic items should be evaluated to determine if they should be opened and cleaned of soot and treated separately.

Ozone is effective in destroying mold and mildew and the odors they generate. Mold and mildew thrive in warm, moist environments. Therefore drying and dehumidifying the room or area is necessary. Ozone can be used to destroy the airborne mold and mildew spores. Ozone can also destroy small growths of mildew on walls, floors, items, etc. However, the exposure time needs to be a few days, at adequately high concentrations, to kill not only the surface of the mold and mildew, but also the spores that will migrate through the dead surfaces.

Ozone is normally dispensed by two methods for disaster restoration. One method is commonly referred to as "shock" treatment. This method consists of placing the SDN in a room and treating the room at maximum output with the room sealed. This method will blast or shock the room with a large dose of ozone, and allow it to penetrate all areas and seek out the odors. The residual ozone in the room needs to be exhausted, or vented, before inhabiting the room again. This method is often used in rooms or areas that have strong odors, perhaps from being closer to the fire or flood. The second method is referred to as "soak" treatment, and consists of exposing larger areas to smaller amounts of ozone. This method not only allows longer time for ozone to seek out the odors, but it also allows odors time to seep out of areas and mix with ozone. In both methods, additional circulating fans are necessary to provide the mixing of odors with ozone. Both methods can be used effectively, and each user should utilize the method that works best for the type of odor being treated.

Utilizing the SDN adjacent to the return air vent of a building's HVAC unit completes many disaster restoration jobs. The HVAC blower fan should run continuously. This utilizes the building blower to spread the ozone throughout the entire area, and provide a final treatment of any remaining odors. This method is an example of the "soak" method. If it is possible, use the HVAC in the cooling mode with the blower on constantly. The cooling mode has two beneficial effects. First, it keeps the building cooler and allows more ozone to form. Second, the cooling will remove much of the moisture that can be formed by the oxidization of odors.

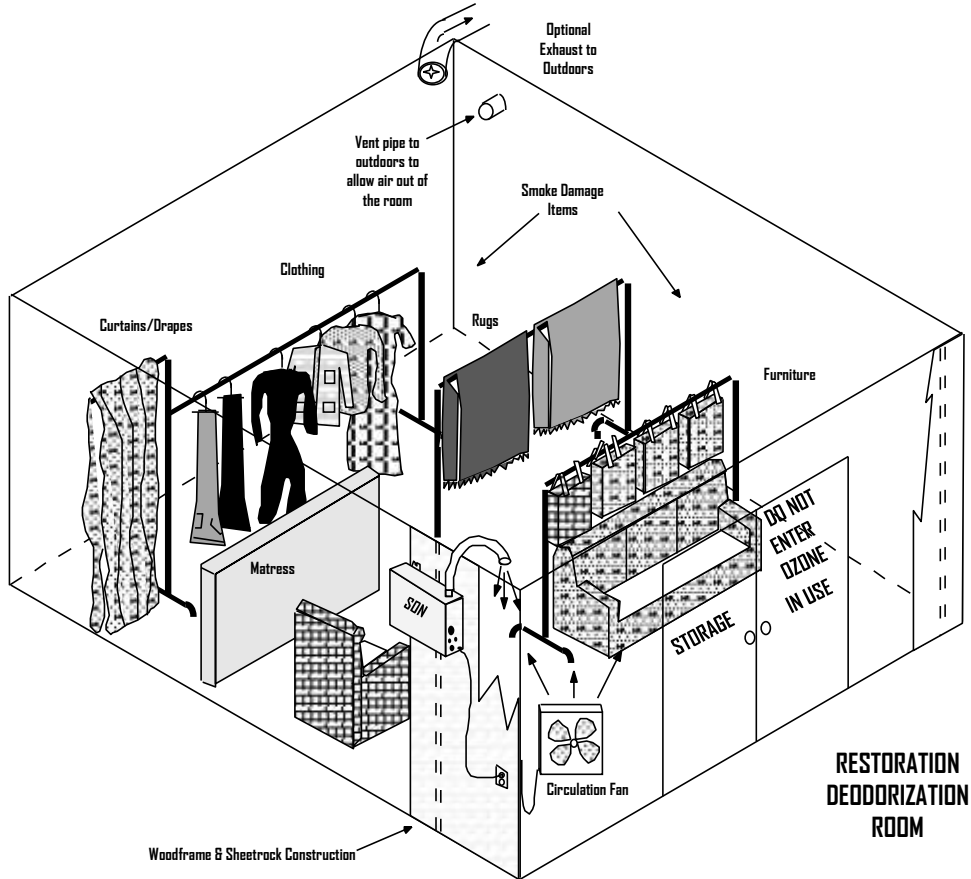


"SOAK" TREATMENT FOR RESTORATION

Many restoration contractors use Restoration Rooms similar to those utilized by dry cleaners, except the rooms are generally larger, since furniture is usually being treated in them. Items such as carpets, drapes, etc., are also treated. Many of these items may need additional services to them, which the restoration contractor is also providing. When using a restoration room, generally the treatment is "shock," although the items can be "soaked" by running the SDN at a lower setting for a longer period of time. Furniture treatment times typically can be between 12 and 48 hours. These restoration rooms require moving furniture to the room, but provide the convenience of complete control of the odor removal process. See also the Dry Cleaning section.

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Ozone is being used in all areas of restoration in concentration levels that exceed those recommended by OSHA, for inhabited areas; therefore, it is essential that warning signs be posted on all doors of rooms or buildings being treated. Nighttime treatment is recommended while all personnel are absent. It is useful to have timers or other external means of turning off the ozone generator. It is also important that methods of venting or removing any residual ozone from the room be used before entering. This will provide additional levels of safety. Wait at least 1.5-2 hours after Sonozaire units have turned off before entering the area to allow the majority of ozone to revert back to oxygen. Leave air circulation going in the room during the waiting time before entering, and introduce fresh air into the treated area after waiting period.

Always remember that flammable gases or liquids (including oils) should not be used where the gas or liquid can be drawn into the air intake of the ozone generator. Remember that the Sonozaire is an effective tool, but the best tool is the knowledge of the restorer.

Use the chart below to select the Sonozaire model that will provide the best ozone output for treating the size of buildings you normally handle in disaster restoration. Each machine can be used in larger areas, but the exposure time required will be longer.

Onsite Fire or Disaster Restoration Volumes:		
Model 115A	Model 330A	Model 630A
2,500 to 15,000 cu ft	6,000 to 150,000 cu ft	15,000 to 750,000 cu ft
70 to 425 cu m	170 to 4,250 cu m	425 to 21,240 cu m

Carpets often require cleaning and deodorization after a fire, flood, or other disaster. The treatment is typically part of the procedure of fire or disaster restoration previously described. However, cleaning the carpet requires additional steps. Most restoration companies send technicians to training seminars to provide instructions for cleaning carpets that work well for the particular disaster that is common for their area. An example would be that flood disasters are more common on coastlines and along rivers than on mountainous areas.

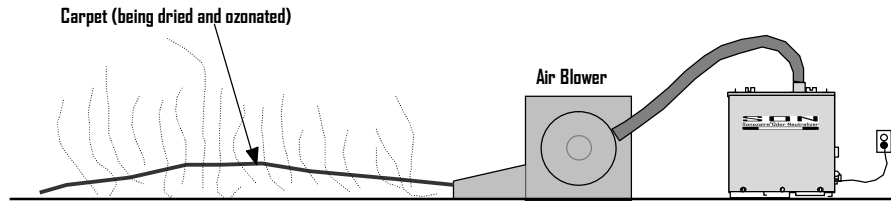
Some of the ideas below may be accomplished in slightly different methods, but the following ways have produced positive results. Use these suggestions as beginning guidelines, but experience and good procedures are the best tools available to a carpet-cleaning technician.

SONOZAIRE ODOR NEUTRALIZER

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One of the important items in carpet cleaning is that the carpet should be treated with the conventional methods to remove the contamination. Remove moisture as completely as possible. Sonozaire Odor Neutralizers produce ozone for removal of odors that are imbedded in the carpet and not removable by other methods. Do not use the Sonozaire unit or any electrical arc producing equipment if flammable gases are present. This is also true of cleaning products containing oil-based substances, including fragrant oils. Flammable gases and oils could ignition of the fumes that can cause, at minimum, smoke. Be careful and know what chemicals are being used.

For onsite carpet cleaning, one of the procedures in removing moisture is to blow dry the carpet after cleaning. Forcing air beneath the carpet allows the air to absorb moisture in the carpet. To remove odors, such as smoke, mildew, urine, or fragrances from treatments, ozone is added to the air stream blowing under the carpet. The Sonozaire can be piped into the suction of the blower, or it can be piped so that it mixes with the air. The ozone will be diluted, and unless it is treated for a long period, it will not harm the carpet or its backing. Most rubber-backed carpets have material that is largely vinyl, which has good resistance to ozone. However, it is always advisable to know the carpet and to contact the manufacturer if any concerns exist concerning treatment with ozone. Please note that ozone is not recommended for mixing with moisture. However, it can be used during the drying of carpet. This is because the carpet, while being aerated, should contain very little moisture, and the ozone levels should be very low.

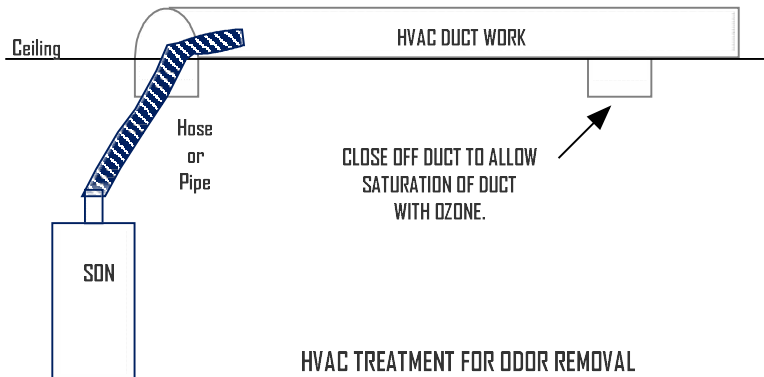


CARPET TREATMENT FOR ODDOR REMOVAL

Carpets can also be removed from the premises and taken to a carpet treating facility where the treatment procedures include the use of ozone in at least one step. This treatment often is in the final step of the cleaning process where ozone is used to remove any remaining odors, including those caused by the other treatment phases. Ozone can provide a fresh smell to treated carpet that cannot be provided from other sources.

A difficult odor for most carpet cleaners to remove is that of urine, especially pet urine. Pet urine (including cats) consists of a lot of urea, creatine, uric acid, and other detoxified substances, along with sodium chloride and other electrolytes. Fresh urine has little smell, but bacterial decomposition causes the ammoniac odor to develop. Urine often penetrates into the wood or concrete substructure, as well as baseboards, wall materials, etc., and even after being washed, the odors can reoccur. Since oxygen and humidity will break down urine odors, then by using ozone, this process can be accelerated. If the urine area is small, or has only a slight odor, then treating directly with ozone without removing the carpet can often remove the odor. However, for more serious problems, pull back the damaged carpet and remove the affected padding. Clean and treat the substructure with water, enzymes, and/or antimicrobial. Clean both sides of the carpet thoroughly with lots of water and antimicrobial. After drying, the substructure can be coated with a sealant such as urethane, or both the carpet and the substructure can be treated with ozone before the sealant is applied. If the carpet has only slight odors, then direct the ozone onto the affected area. On greater odors, direct the ozone under the carpet and force the ozone to pass through the carpet. Put new carpet padding down and place the carpet over the area. Treat the entire room with ozone if any faint odors still exist.

HVAC duct cleaning often includes treatment with ozone. Typically the duct work is cleaned using conventional methods, and then ozone is used in the previously shown "soak" method, or it is piped up into the duct system without the HVAC blower operating for a higher concentration to destroy the remaining bacteria. The Sonozaire, equipped with flexible hose, can be routed into the duct system through one of the HVAC outlets.



SONOZAIRE ODOR NEUTRALIZER

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DRY CLEANING

Odor removal in the dry cleaning business is a service that is often overlooked. Fire and flood damage in homes, offices, storage facilities, etc., are areas where odor removal services can save the customer, or insurance company, the cost of replacing damaged items. The Drycleaning and Laundry Institute (DLI) recommends the use of an odor treatment chamber for removal of smoke and other odors from clothing, drapes, furniture, carpets, etc. Sonozaire models are ozone generators that are extremely effective in removing odors. In dry cleaning, smoke is the main source of odors. Ozone is used to oxidize the smoke odor into carbon dioxide (CO₂) and water (H₂O). Ozone also removes other odors caused by mildew, pets, urine, spoiled food, fish, sewage, tear gas, mothballs, ammonia, skunks, etc. Many clothing items are irreplaceable to their owners. Dry cleaners can remove the odor from garments and clean the garments successfully, which makes happy customers. Odor removal is an expansion that dry cleaners need to consider -- because if someone else provides the odor removal service, they are also providing the dry cleaning.

Silk, wool, cotton, synthetic fabrics, and other materials can trap odors that require treatment other than normal dry cleaning methods. Articles that contain odors should be treated with ozone before they are dry-cleaned. Most dry cleaning solvents lock in the odors, making it more difficult to remove. However, if garments must be dry-cleaned first, then ozoning afterwards can have some satisfactory results. If garments or fabrics are "dry clean only," then they should be acceptable for treatment with ozone in an odor treatment room. If the garments or fabrics are washable, they should be washed instead of treated by ozone. Verify that garments or articles are not composed of natural rubber (latex). Latex should not be treated, since ozone will attack rubber. This does not apply to foam rubber cushions covered with fabric or synthetic rubber used in dry cleanable fabrics. Some dry cleaners will dry clean the items that have elastic in them, and simply replace the elastic. If collar, cuffs, or waste band of dry cleanable items have elastic with latex and need to be treated, these should be treated for only very short time. These elastic bands can then be covered with plastic, and clipped or pinned in place to prevent exposure to ozone. If a rubber surface is exposed, then a dry silicon spray should be used to coat it before treating. If furniture is treated, remove the cushions and expose the surfaces of the fabric to the ozonated air.

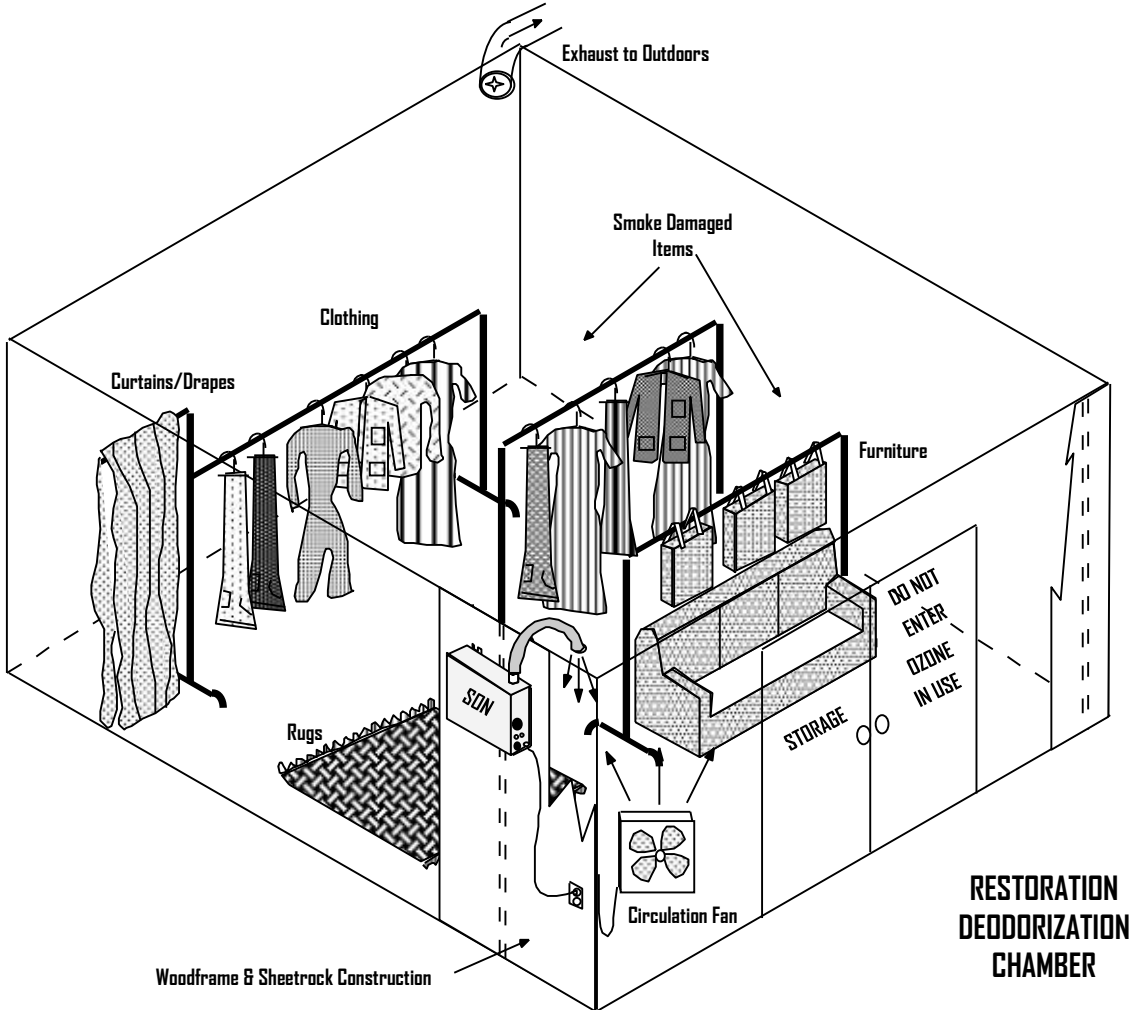
Remove any soot or residue from the garments by shaking or vacuuming, and hang them on racks with open buttons and zippers; leaving a minimum of three inches of spacing to insure exposure of entire garment surfaces to ozonated air. Thick garments, such as heavy wool coats or ski jackets, should be treated, turned inside out, and treated a second time. Treatment times vary with the type of odor, but 8-12 hours has shown to produce the best overall results. Fires that are classified as protein fires will typically require longer treatment times. Note that articles should not be treated while wet or moist. Ozone, when mixed with water, can form a mild form of hydrogen peroxide that can cause bleaching.

The odor treatment area is typically a sealed, dedicated room, which is uninhabited. The odor treatment chamber can be made out of sheetrock, plastic sheets, or can be an existing storage room, restroom, boiler room, etc. It should have a door wide enough to accommodate furniture. It should also contain a circulation fan to thoroughly mix the ozone with the odors. The Sonozaire can be installed inside the room, but works best if mounted outside the room and piped into the top of the room. This allows the controls and the on/off switch, or timer, to be operated without going into the room. Also, the ozone generator will produce the maximum level of ozone, with a constant supply of oxygen. A method of exhausting the room of ozone or forcing fresh air into the room is recommended. The room must have a ventilation path from the room as ozonated air is being forced into the room. If it is impossible to have an exhaust fan in the room, turn down the Sonozaire ozone level to zero and allow the blower to purge the room with air. Purging the room with one volume of air takes a minimum of 20 to 30 minutes (1200-1500 cubic feet). Please note that an "Ozone in Use" warning sign should be placed on the entry points into the room to prevent unwarranted entry into the treatment chamber. Locking the room is another method for further preventing workers from entering the room during treatment.

DO NOT ENTER!
Ozone Treatment in Progress.
Room must not be occupied
during treatment.

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The most common method of treatment in an odor treatment room is to ozonate the articles at night while you sleep. This further minimizes chances of personnel exposure to ozone. If the odor load requires longer than a 12-hour treatment time, then turn the timer counter-clockwise and the model will stay on continuously until it is turned off. Allow between 90 minutes to 2 hours for the residual ozone to revert back to oxygen. Should quicker entry into the room be required, use the exhaust fan to ventilate the room. When an exhaust fan is operating, the door is opened slightly to allow air to be drawn into the room. Treatment can be performed any time of the day following all safety procedures to prevent exposure to ozone.

Below is the maximum room volume for selecting the proper model of Sonozaire to match the size of the user's room. Room volume is simply the length times the width times the height of the interior of the room. If additional information is needed, please contact the local dry cleaner association, DLI, NCA, or Sonozaire LLC for help.

Odor Treatment Chamber:		
Model 115A	Model 330A	Model 630A
1,700 cu ft	7,500 cu ft	15,000 cu ft
48 cu m	210 cu m	420 cu m

SONOZAIRE ODOR NEUTRALIZER

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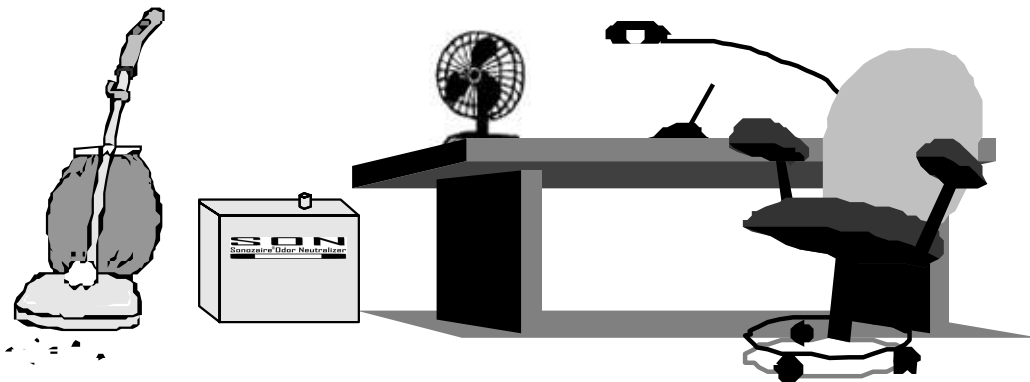
CLEANING MANAGEMENT

Cleaning management is a modern description for cleaning maintenance, janitorial services, and custodial duties. The new millennium brings a new emphasis on indoor air quality (IAQ). This requires cleaning management companies, from single entrepreneur to multilevel service companies, to be properly prepared to handle volatile organic compounds (VOCs), bacteria, and odor control. VOCs, bacterial disinfecting, and odor control can be handled in numerous ways, and ozone is one of the best methods. IAQ problems may consist of odors such as: fire/smoke, mold, mildew, paint, sewage gas, tobacco, athletic body odor, urine, chemicals, cooking, spoiled food, new installation materials, cleaning products, bacterial odors associated with illness or death, etc. Treatment with ozone is often used to improve IAQ in offices, stores, showrooms, bathrooms, malls, schools, health facilities, restaurants, clubs, warehouses, homes, etc. Ozone is a clean, easy, and thorough method of odor removal that can be added to present cleaning methods and does not require expensive chemicals.

Providing IAQ services are essential for buildings that are energy efficient and perhaps suffering from sick building syndrome in some degree. The Sonozaire Odor Neutralizer is an industrial strength ozone generator that can effectively improve IAQ. Ozone is generated from oxygen, and is an oxidizer that destroys odors by breaking them down into odorless compounds such as carbon dioxide, water, and oxygen. Ozone destroys most bacteria by breaking into the cellular membrane and disrupting the enzymatic system. Treating a room or area for a short time may be all that is necessary to remove the odors and keep bacteria destroyed. Studies show that clean air promotes less absenteeism, and reduces illnesses of unknown origin. Cleaning management firms can include the IAQ improvements along with their general services, or they can offer these services when requested. These services can improve the air quality, satisfy your customers, and increase profit margins. Most IAQ programs include cleaning with chemicals using environmental friendly components. Ozone is produced from oxygen and will revert back to oxygen. Advantages of using Sonozaire to improve IAQ are they operate unattended, they reduce the labor costs, and existing employees can be taught how to use the Sonozaire models easily and safely.

A common method of treatment for a single office, room, etc., is after the cleaning technician completes the normal room cleaning, simply move the Sonozaire into the room, adjust the ozone level and time desired, and let it operate. If the room is large, an additional fan or blower may be necessary to thoroughly mix the room odors with ozone. Since the Sonozaire models produce ozone levels above OSHA and NIOSH levels, no one should be allowed in the room during treatment.

If an entire building, floor, etc. has a central air handler and has an IAQ problem, locate the machine near the return grill and turn the thermostat fan from the "automatic" to the "on" position. This causes the air handler to operate continuously and allows the ozonated air to be drawn through the air handler and circulated throughout the affected area. When areas are being treated via ductwork, make sure that workers or other personnel are not in the treatment area. After treatment by ozone, allow at least 1.5-2 hours before entering the area. If ozone is detectable, wait an additional hour. Large areas are treated with smaller levels of ozone, while small areas, where odor problems can be pinpointed, are treated with higher concentrations. Always secure the areas being treated and place a warning sign on all doors. The sign should indicate that ozone treatment is in progress, and the room should not be entered. At end of treatment, return the thermostat fan switch to the "automatic" position.



SONOZAIRE USED IN CLEANING MANAGEMENT

SONOZAIRE ODOR NEUTRALIZER

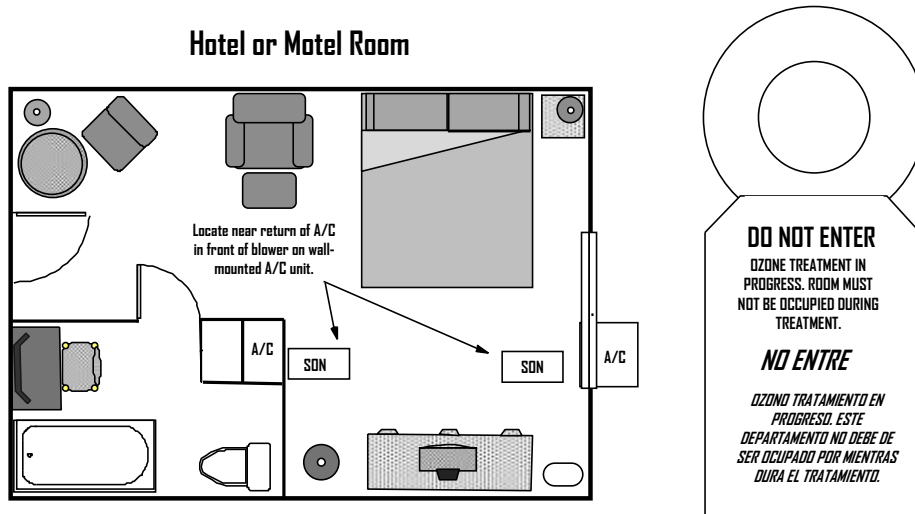
Application Section

HOTELS/MOTELS/APARTMENTS/CONDOMINIUMS

Hotel/motel rooms often hold odors such as tobacco smoke, which may prevent the room from being occupied by someone who requests a nonsmoking room. Someone moves out of an apartment and leaves behind smells such as tobacco smoke, spoiled food, mildew, pet odors, urine, or perhaps odors caused by someone being sick. Fresh paint smells often require removal before someone will rent the apartment. The condo has been closed up for several months and the musty smells are awful.

If any of the above "smells" familiar, what can be done about it? The method that has been proven extremely effective is to destroy the odor by using the Sonozaire Odor Neutralizer. Ozone effectively destroys the odors in a short time for these applications. Odors can be removed and a clean, fresh smell produced. The model 105A is the unit most often used for hotel/motel rooms, but the larger 115A is also quite popular especially for larger rooms, conference rooms, or ballrooms.

After the cleaning person completes the normal cleaning of the room, they turn on the wall-mount air conditioner blower to run continuously and plug in the Sonozaire near the air conditioner blower. The Sonozaire model should have the output adjusted to a preferred level and the optional timer adjusted. The cleaning person should leave the room and allow the ozone to destroy the odors. After the unit times off, the cleaning person should wait about 1 hour before entering and moving the unit to another room.



The purpose of turning on the air conditioner is to move the air around in the room. Air movement speeds up the reaction of ozone with odor molecules. If the A/C is a central unit, locate the machine near the return grill so the ozone will be drawn through the air handler and circulated throughout the room. Turn on the thermostat fan switch from "Auto" to "On." For a wall-mounted unit, place the Sonozaire so that the discharge from the air conditioner will blow and mix with discharge from the Sonozaire. Switch the A/C fan control to "On." Typical treatment time at maximum output would typically be approximately 1/2 - 2 hours for tobacco or similar odors. Longer times will be required for more severe odors. Lowering the output level requires longer treatment times, but is often preferred because of maintaining a lower level of ozone in the room.

The method for treating an apartment or a condominium is very similar to that of a hotel/motel room, except the treatment time needed may be longer. Since many apartments consist of several rooms, the Sonozaire can be placed in each room along with a fan. If a room can be closed off and treated without having excessive ozone escaping from the room, then personnel can simultaneously work in other rooms. Alternately, for treating the entire apartment, the Sonozaire may also be placed near the return air grill and use the central unit to circulate ozonated air throughout the apartment via the air ducts.

When treating a room, it is always recommended that additional air circulation be provided to insure a good mixture of odors with ozone. This is essential if the room, apartment, etc. does not have a central HVAC system. The ozone must be mixed in with the odors. Allow approximately 1.5-2 hours before entering a room after the Sonozaire has turned off. Introduce fresh air if possible.

The above descriptions are also applicable to real estate or rental property, which has been closed up for some time, or has odors. Before a property is shown, use the Sonozaire with the HVAC system as described above. Treat the property for a few hours to remove the stale air. Make sure that the Sonozaire has turned off and allow the ozone to revert back to oxygen before showing the property. Introduce fresh air by opening windows and doors.

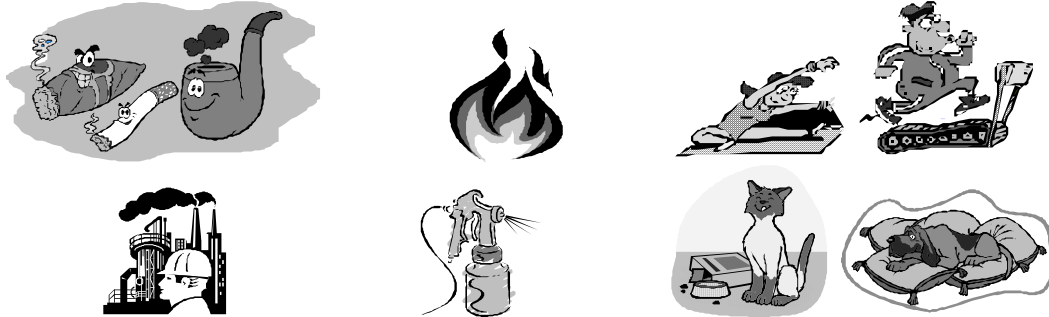
SONOZAIRE ODOR NEUTRALIZER

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INDOOR AIR QUALITY

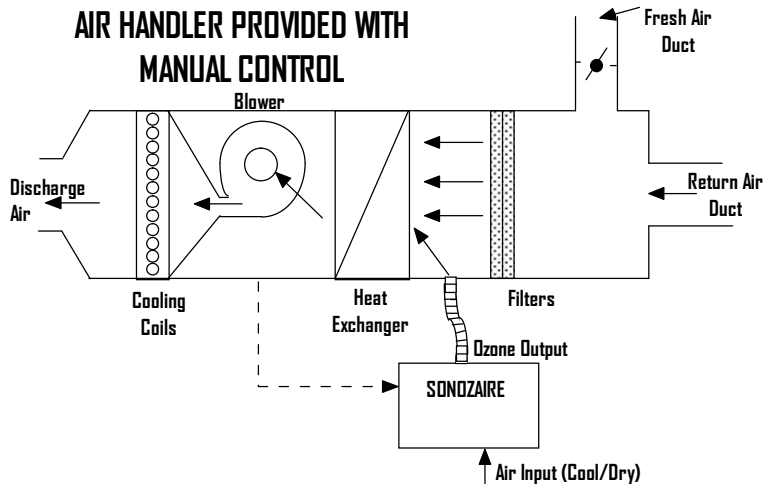
Indoor air quality is a current problem often associated with high-efficiency building designs. Buildings typically conserve energy by being more airtight, thus reducing the heating and cooling requirements, but resulting in less fresh or make-up air. This is a simple description that can lead to the "sick building syndrome" phenomenon. Air laden with odors, bacteria, impurities, etc., does not provide the fresh air sensation to occupants. However, using fresh make-up air is not always the solution to this phenomenon, as some fresh air taken in has more impurities than the indoor air being treated.

Additional problems with indoor air quality are tobacco smoke, fire/smoke, process odors, body odors from workers or athletic endeavors, pet odors, chemical odors, etc. Organic odors are unpleasant and result in stale, stuffy air. Fresh air is necessary, but is not always available as make-up air due to energy design, or outdoor air quality. Studies have advocated that people need fresh air. Poor air quality affects people in ways such as attitude, productivity, absenteeism, and sickness. Clean healthy air makes people work well and feel happier.



What can be done to improve indoor air quality? The first step is with air filters that are designed for removing some of the particulate that will be carried by air. Possibly, duct cleaning is the second step for removing odor-causing dust, mold, mildew, etc., which may have built up in the duct system. The third line of defense is ozone treatment of the air to destroy the odors and many of the bacteria, as well as deodorizing the air. Ozone is nature's method of freshening and cleaning the air. Ozone deodorizes by chemically reducing the odors to lesser compounds.

Offices, factories, warehouses, health clubs, casinos, bars, laboratories, schools, libraries, kitchens, restrooms, conference rooms, etc., all may need the Sonozaire models to purify the air. The simplest method of treating the facilities is to use ozone to treat the indoor air at periods of time when the building or rooms are unoccupied. This may be at nights, or weekends, or other periods of time when occupancy is zero. Ozone levels during off-hours should be adjusted to low levels, but levels that will clean and freshen the air. Timers are a method of turning on and off the Sonozaire machines. These units can be integrated into air handler controls for more advanced on/off switching. Ozone is not to be generated unless the HVAC blower is operating, so the units must be interlocked to air handler controls to switch on and off when the air handler cycles.

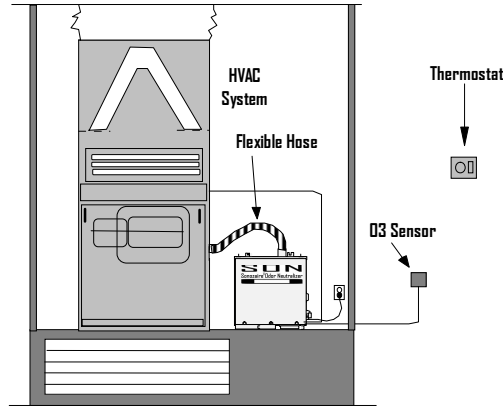


If a treatment area is to be occupied by people or animals, then the ozone unit must be controlled so that the ozone level will not exceed a 0.05 ppm ozone level. This is the lowest level is governed by the U.S. Food and Drug Administration. OSHA allows 0.1 ppm for an 8-hour day, 5-day week. Ozone level slightly above these, irritates the eyes, causes headaches, dries the throat, and stresses the lungs. When the air is stale or foul, ozone can freshen the air, and when properly controlled, will not expose anyone to excessive amounts of ozone. The Sonozaire units are industrial ozone generators that can be equipped with ozone sensors, controls and timers for automatically turning on and off the ozone generation sections to keep ozone use safe.

SONOZAIRE ODOR NEUTRALIZER

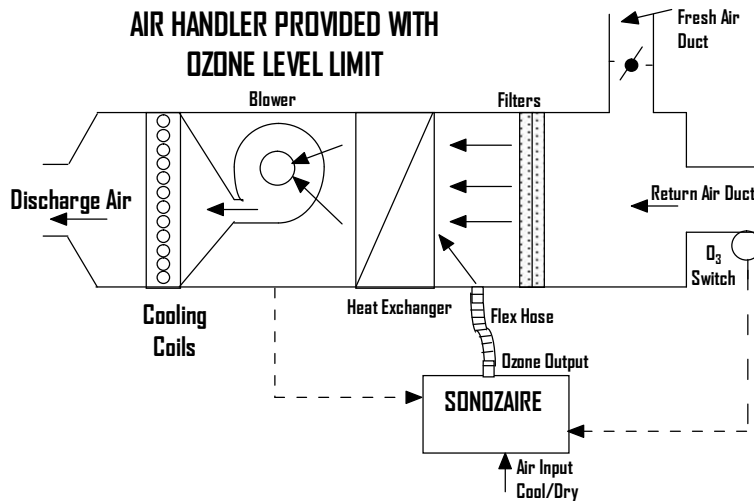
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Generally the Sonozaire are used in large areas that have air handlers blowing conditioned air throughout the area. Refer to the previous figure that shows how the Sonozaire is connected between the filter and the blower of the HVAC air handler. The Sonozaire should be connected on the suction side, and not the discharge side of the HVAC blower. The Sonozaire blower doesn't have enough pressure to overcome the discharge pressure of the air handler. Please note also, that the Sonozaire power must be interlocked, so that it turns on and off with the air handler blower. Methods can include using an interlock from the air handler fan with an auxiliary contact, or an airflow or pressure differential switch.



CONNECTION TO HVAC FOR AIR QUALITY CONTROL

Various automatic ozone controls can be used identical for all Sonozaire models. These controls typically have components within each cabinet and use low voltage cable optional lengths. Some cables are molded with either 6ft or 25ft lengths. Other cable can be cut to length and is factory terminated inside the Sonozaire cabinet, while the other end requires field terminating. The ozone sensor terminates to cable, or the sensor plugs into the molded cables. The controls act similar to a thermostat. The ozone sensor should be mounted where it can get a good average value of ozone in the area being treated. This area might be where the thermostat is located or in the return air. It is not normally located near a discharge duct from HVAC system to prevent excessive cycling. The sensor is typically adjusted to turn off the Sonozaire at 0.03 - 0.05 ppm of ozone.



When a complete system is placed in operation, the Sonozaire unit's ozone output is adjusted using the ozone level knob, to the point where the ozone sensor will occasionally turn off the unit. If the unit is set too high, the unit will cycle on and off excessively; however if it is set too low, it stays on all the time, but may not have enough ozone output to control the odors. If the air quality is good, the Sonozaire can be manually turned off. An application of this might be a bar that has smoke odors only during certain times of the day or night.

Please note that if ozone levels require measuring, then several methods can be utilized. First, ozone tags or badges are designed to change colors at low levels of ozone. Second, manual vacuum pumps and dragger tubes for measuring ozone levels can be used. Third, digital monitors for measuring ozone concentrations can be utilized. Many of these systems require engineering expertise and system installation. Please contact Sonozaire LLC for companies specializing in systems with ozone monitors, which will switch on when ozone is detected. The companies often provide other air quality services such as filters, duct cleaning, etc., and can do a complete system installation.

SONOZAIRE ODOR NEUTRALIZER

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VEHICLES

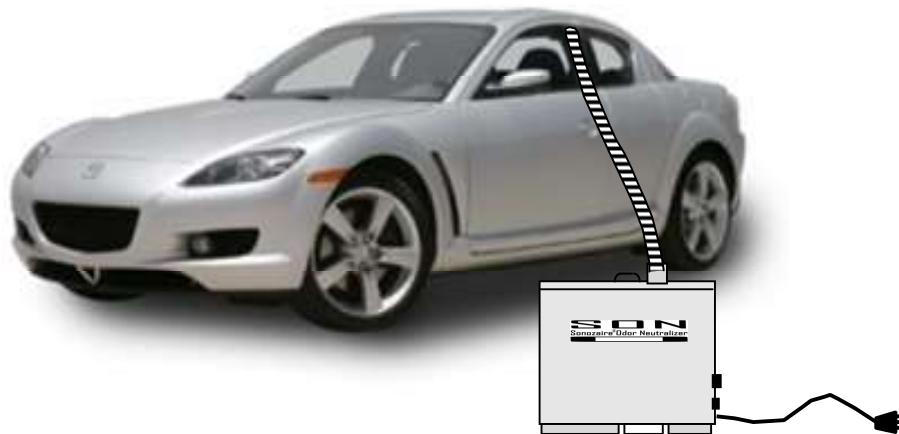
Removing odors from cars, vans, trucks, RVs, limousines, etc., can be difficult, if not impossible, using normal cleaning methods, and the expensive chemicals, or fragrant sprays. However, using ozone can turn a difficult problem into a profitable solution. Vehicles often are plagued with numerous odor problems, with the largest problem being tobacco smoke. Other common odors are: mildew, pets, sour milk, foods, decaying matter, vomit, body smells, urine, skunk, and general stale air odors. Ozone breaks these odors into chemical compounds that do not have odors. After treatment, and allowing adequate time for the ozone to change back to oxygen, the vehicle will have a fresh, clean, pleasant aroma, compliments of ozone.

Most car detailers, pre-owned car dealers, rental car companies, taxi companies, limousine services, bus services, RV rental and sales, yacht owners, etc., need to remove some of the odors described above. Vehicles that are clean and smell clean make happy owners, happy riders, happy renters, happy buyers, and happy sellers. All of this can be accomplished by adding an odor removal service to the normal cleaning already being provided. Purchasing Sonozaire is an inexpensive, one-time investment that requires no expensive chemicals.



The method of treating vehicles is simple. The vehicle should have the normal cleaning procedures such as cleaning, vacuuming, shampooing, etc. Finally, the vehicle should be treated for odor removal. Allowing a Sonozaire to blow ozone into the vehicle, destroys the odors, and provides that desired clean smell.

Do not treat the vehicle when the interior is hot, only when it is cool. Place the vehicle in a shaded area, and turn on the air conditioner and cool it down. Heat destroys the ozone before it can react. Place the Sonozaire on the ground near one side of the vehicle and route the flexible hose from the discharge nozzle into the window. Roll up the window until it will hold the hose in place. Then drape a towel or similar item over the remaining opening of the window. On the opposite side of the vehicle roll down another window about 1/2 to 1 inch to allow air to exit. This serves as a vent for the ozonated air being forced into the vehicle. Next, close all the vehicle doors until the only openings are the hose into the window, and the opposite window slightly opened.



Switch on the Sonozaire and adjust the ozone output to the desired level. For first time users, or for minimizing the treatment time, turn the generator up to the maximum setting. Treatment times will vary based on a few variables, such as the degree of the odor itself (most important), temperature of the vehicle, humidity of the outside air, and full voltage to the Sonozaire. Treatment times will vary typically from 30 minutes to 2 hours. Extremely large areas, such as vans, buses, RVs, limousines, etc., may take a little longer if the odors are extreme. Conversely, if the odors are not strong, then the times will be shorter.

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The Sonozaire models are industrial ozone generators and produce amounts of ozone that exceed OSHA levels for inhabited working environments. Do not sit in the car when treating with ozone or expose anyone to excessive amounts of ozone. Once the Sonozaire has been turned off, the ozone will revert back to oxygen within 90 minutes to 2 hours. A good procedure is to turn the Sonozaire level knob to zero and allow the Sonozaire fan to continue blowing. This will force the remaining ozone out of the car, allowing faster re-entry. And to speed up decay of ozone windows and doors can be opened for a few minutes after treatment to dilute any remaining ozone. Additional method to protect against excessive ozone is to use respirators with ozone cartridges.

Before starting the ozone treatment, crank the engine of the vehicle and place the air conditioner in the re-circulate mode so that the ozonated air will be circulated through the vehicle ductwork, removing existing odors. The recommended time for duct treating is 10-15 minutes, minimum. Begin treatment of the vehicle with ozone after exiting the vehicle. After the designated time, turn off the Sonozaire, open the door and turn off the vehicle. Do not linger in the vehicle, but exit and restart the ozone treatment for the remaining time period.

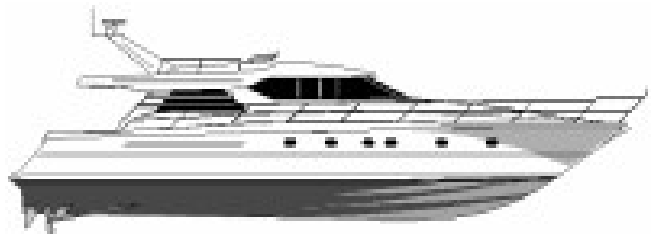
Additional treatment ideas include placing a small circulating fan inside the vehicle to circulate ozone better. Place the Sonozaire inside large vehicles. Move the hose in the window to direct ozone flow into the front seat area and later direct it to the back seat area. If possible, ensure that ozonated air goes under the seats to areas that might contain odors. Direct the ozone flow toward problem areas. After treating, allow the vehicle approximately 15-30 minutes with the windows closed. Then roll down the windows and open the doors and windows for 15 minutes. If slight ozone smell lingers in the vehicle, drive with windows down to air out as necessary.

A method of treating two vehicles simultaneously is shown below. For treating more than one vehicle, it is recommended that a small fan be used in each vehicle to ensure good airflow. If only one vehicle is being treated, cap off the remaining hose.



Natural rubber surfaces are vulnerable to ozone. It is recommended that a dry silicon spray be applied to coat and protect rubber surfaces. Older autos and antique vehicles will have more natural rubber items than new vehicles. Neoprene door gaskets on newer vehicles should not require protection. Remove the item or silicon-protect any items that are believed to be rubber. Treatment times for leather seats should be limited to a few hours and for extreme odors a maximum of eight hours should not be exceeded unless the seats have a protective coating applied to them.

If any waterproofing or stain resisting fabric treatment is to be applied to vehicle seats, carpets, or headliners, deodorize with ozone before applying the fabric treatment.



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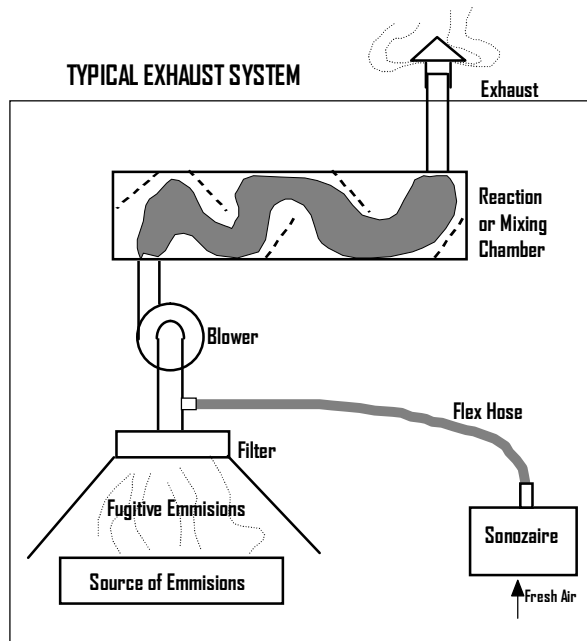
EXHAUST GAS TREATMENT

Ozone in exhaust gas treatment has been used successfully for many years. The basic principle involves adding ozone into the exhaust air stream containing the malodorous compounds. The ozone is diluted when added to the larger airflow of the exhaust, but when added in proper ratios, will eliminate the odors by oxidizing them. Sonozaire models can be used in exhaust systems for commercial kitchens, restaurants, cafeterias, food or fish processing facilities, rendering facilities, chemical plants, rubber compounding, paint spraying, sewage treatment, etc.

Ozone must be added to the suction side of the exhaust and should not be used directly in an area where people are present without proper control. Ozone is an oxidizing agent, and exposure to people must not exceed 0.1 ppm for an 8-hour day, as determined by OSHA. An exhaust ductwork system serves well as the confined area for ozone reaction with odors. The exhaust draws the ozone into the duct and prevents leakage into the general area. The exhaust gas must be vented outside the building.

The concentration, or intensity of the odor, is usually where complaints begin. Some odors are detectable, but are not unpleasant at limited levels. However, given higher levels, the threshold concentration can cause odoriferous problems. In many cases, the malodors do not have to be eliminated, only lowered. The odor problems may only occur during peak periods of operation, and it may be possible to control the concentration by using small levels of ozone during these periods.

The temperature and humidity in exhaust systems also affect the amount of ozone required for odor control. Ozone is generated in higher quantities at low temperature and humidity conditions, but reacts quickly in a warm, slightly humid, environment. However, it can react too quickly if the temperature or humidity is too high. Generally, the exhaust gas temperature where the ozone is injected should not exceed 130 degrees F and 90% relative humidity. The best location for a Sonozaire is to mount it in an area with cool, dry air as the main air source, and pipe the discharge over to the connection point to the ductwork.



In most exhaust systems, the retention time of ozone treating should be a minimum of 3-4 seconds. The time period is from the point of injection of ozone to the discharge of the exhaust outside. Longer retention times will produce better results, specifically if the mixing of ozone with the air is inadequately designed. Determine the retention time by finding the cfm of the exhaust fan (i.e., 2000 cfm), calculating the volume of the duct, and then dividing by 60 (sec/min). Calculating the duct volume is accomplished by the following calculations:

Round duct Volume in cubic feet	$V = (D/2) \times (D/2) \times 3.14 \times L$	
Rectangular duct Volume in cubic feet	$V = W \times H \times L$	
Retention Time in seconds	$RT = V / (CFM / 60)$	
D = Diameter in feet	L = Duct Length in feet	W = Duct Width in feet
H = Duct Depth in feet	CFM = Cubic Feet per Minute of Air Flow	

If the retention time is not long enough, increasing the volume of the duct system can extend the time. Increase the volume by making the ductwork longer or larger. If this is not possible, or not economical, then a reaction chamber can be added to the ductwork to provide a longer retention time. The reaction chamber should be designed with baffles to insure that air is thoroughly mixed within the chamber.

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The mixing of ozone within the exhaust duct or stack is extremely important. If ozone is not mixed with the odors, it will not react with them. If ozone is injected directly into the duct, it can "channel," meaning it flows along in its own stream and does not mix. Methods of insuring good ozone mixture are: always inject ozone on the suction side of the blower, place baffles or turns in the duct work, inject the ozone into the air stream within a perforated pipe, injecting into a venturi mixer, or combinations of all of these methods.

The amount of ozone needed varies with the degree and amount of the odor, but generally 1-3 ppm of ozone is needed for the volume of air. This amount can be reduced in some cases because the air volume is high enough to insure some reduction of odors, even without ozone. In large airflow cases, 0.3-0.5 ppm is adequate. In low ppm cases, a longer retention time or good mixing becomes more important. To calculate the amount of ozone needed, use the following formula:

$$\text{Ozone (gm/hr)} = \text{Air flow of blower (cfm)} \times \text{PPM of ozone needed} \times 0.0034$$

KITCHENS

Using ozone in restaurant, cafeteria, or other types of kitchen exhaust systems can be a successful and economical method of controlling odors. Not all kitchens need ozone control, but many cooking odors are offensive to surrounding businesses and neighborhoods. Restaurants that receive complaints or citations can generally modify their existing systems, or on new installations, add the proper Sonozaire equipment to eliminate the odor problems.

Significant considerations in the selection of an ozone system for controlling malodors in restaurant or kitchen exhaust systems are:

- ✕ Type of odor
- ✕ Concentration of odor
- ✕ Temperature and humidity of exhaust system
- ✕ Retention time in the exhaust stack
- ✕ Mixing or distribution of ozone with the exhaust stack system

The type of odor is extremely significant because some foods will generate various odors that may exceed the thresholds of odor tolerance. This can be compounded if the odors do not agree with business or ethnic neighborhoods. Odors high in amines, mercaptans, and sulfides, such as fish, can have strong odors as well as other foods. Many restaurants are required to limit odor levels by building restrictions, city ordinances, etc. Many odor problems can be solved with proper planning and study of similar food establishments. Proper planning can provide odor control using the Sonozaire models as very economical control methods.

It is also important in kitchens that a good grease removal system be installed before the ozone injection point. Ozone will not remove the particulate matter that is in the exhaust gas, so it is necessary to remove the grease particles by the grease filter system. Removing the grease vapor and fumes from the exhaust system allows the ozone to react with the odors. Some of the most effective grease filters or removal systems use a detergent bath to strip the grease. These can consist of scrubber type of filters that are detergent wet. With an ineffective or dirty removal system, a greasy layer builds up on the duct walls reducing ozone reaction.

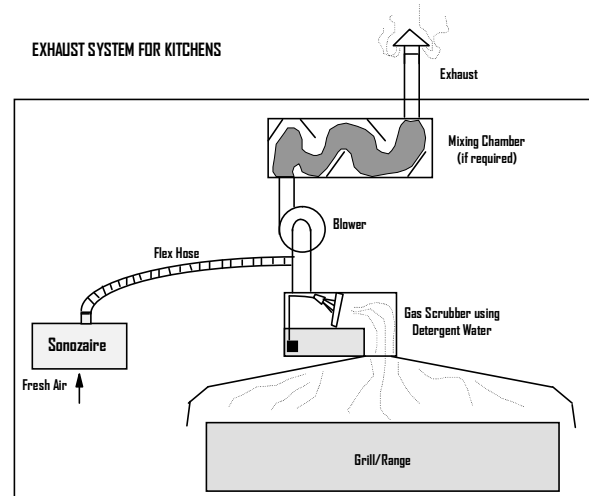
Below is a **sample** calculation for a typical restaurant:

Restaurant that serves hamburgers (Select 1ppm of ozone for the odors)

Temperature and humidity at ozone injection point 100 degrees F and 80-90%

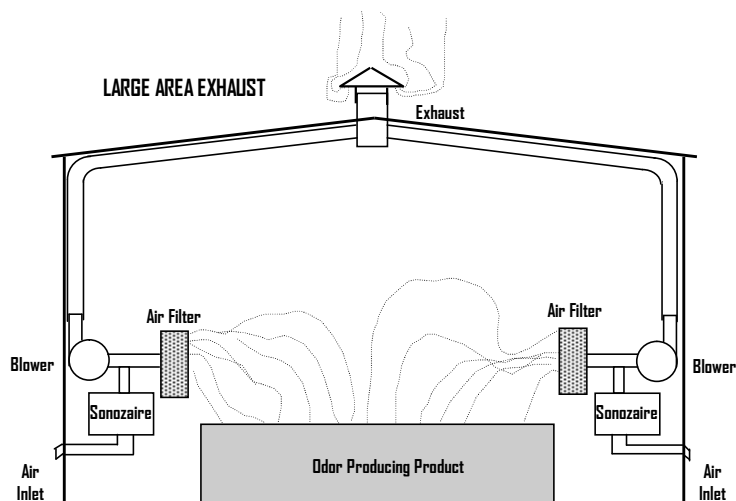
Exhaust fan 1800 cfm and has round exhaust duct work 24" diameter 5 feet vertical length, 20 feet horizontal length, and then 15 feet vertical length.

$$\begin{aligned} \text{Duct Volume} &= (1) \times (1) \times 3.14 \times 40 = 125.6 \text{ cu ft} \\ \text{Retention Time} &= 125.6 / (1800 / 60) = 4.19 \text{ seconds} \\ \text{Ozone (gm/hr)} &= 1800 \text{ cfm} \times 1 \text{ ppm} \times 0.0034 = 6.12 \text{ gm/hr} \end{aligned}$$



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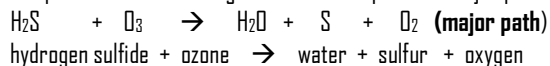
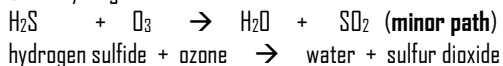
When installing the Sonozaire units with the exhaust systems, the Sonozaire should be interlocked with the exhaust fan, so that when the exhaust fan turns off, the Sonozaire turns off also. This will prevent ozone from being blown back into the kitchen or other areas that might be occupied. Refer to some of the interlocking methods described under the Indoor Air Quality section of this manual.

SEWAGE TREATMENT

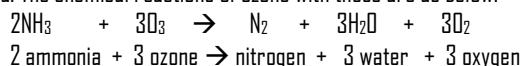
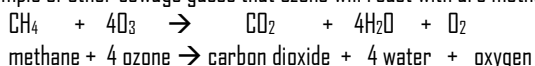
Ozone has been used effectively for odor control associated with sewage treatment for many years. There are several methods of application, but the direct method is the simplest and is described herein for use in wet wells and lift stations. In many cases a single unit can be used, and more units can be used for larger applications. Note that Sonozaire models have a maximum of 1/2" discharge pressure. Therefore the Sonozaire must be installed where there is no static pressure, or in an installation where a slight vacuum exists. Generally, this means that if an exhaust fan is used, the Sonozaire must be installed on the suction side of the fan.

The method of odor removal by ozone is fundamentally simple. Malodors are electron-rich and ozone is electron-deficient and therefore they are attracted to one another. When these two are brought into contact an oxidation reaction occurs. The ozone molecule loses the extra ozone molecule and reverts back to oxygen (O₂). The addition of the single oxygen molecule to the odor compound causes the compound to breakdown into smaller, less odoriferous compounds, or to combine into a compound that is stable (e.g., CO into CO₂ or H₂ into H₂O). Since oxidation of malodorous compounds requires several steps, time and contact between odors and ozone are critical.

Sewage odors are made up of various chemicals. Sulfides are oxidized to sulfoxides and amines to amine oxides, both being non-odoriferous. The chemical that has the most easily detectable odor is hydrogen sulfide (H₂S), which has the aroma of rotten eggs. Other detectable odors are ammonia, sulfides, mercaptans, etc. Hydrogen sulfide treated with ozone can have two different chemical reaction paths. These are categorized as minor path and major paths.



Example of other sewage gases that ozone will react with are methane and ammonia. The chemical reactions of ozone with these are as below:

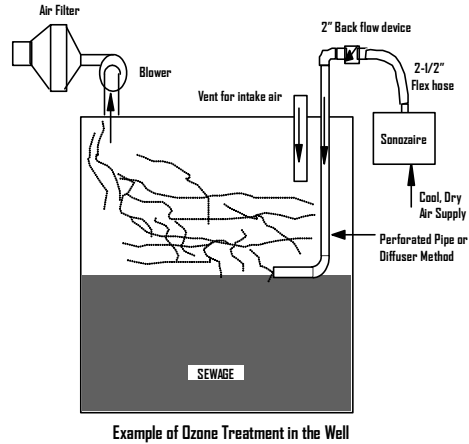
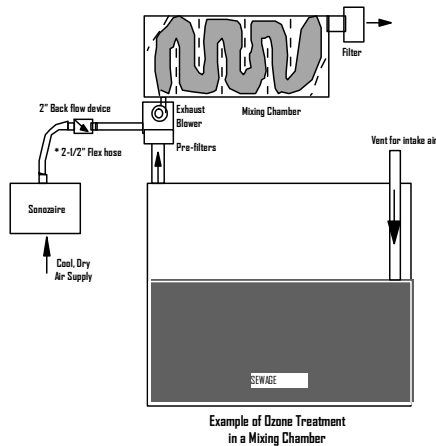


Some important items in treating sewage odors with ozone are the concentration of the odors, the temperature and humidity, the distribution of ozone into the sewage gasses, the retention time for ozone to react with the gases, and the exhaust blower airflow volume. Ozone can be used to completely destroy odors or reduced the odors to an acceptable level. Generally, experience has shown that 1-2 ppm is generally enough if other conditions are good. For complete destruction, or in high temperature and humidity times (summer months), a slightly higher level may be necessary. Installations, such as sludge storage tanks, and some filter screens will require greater levels.

Temperature and humidity are important in two separate ways. The Sonozaire should be placed in an area that is cool and dry, such as an air-conditioned room or building. Cool, dry air will produce the largest amount of ozone and will allow the longest times between cleaning of electrodes in the Sonozaire models. The ozone can be hose connected to the site of injection. Alternatively, ozone reacts best when it is injected into a warm, humid air stream, however hot streams should be avoided. Ozonated air blown into the air space of a wet well and sewer pipes reduces concrete corrosion as well as drying the walls and ceiling of the lift station.

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A major consideration in designing an effective ozone system is mixing the ozone with the malodors. When a few ppm of odor molecules must “collide” with a few ozone molecules, it can be easily seen that effective mixing is extremely important for oxidation to occur. If ozone is injected near the suction side of an exhaust blower, as shown in the left figure above, this usually creates sufficient turbulence to ensure complete contact between the odor and ozone molecules. However, if ozone must be injected directly into a well, or upstream of an exhaust blower, then the ozone must be diffused adequately. Many methods of diffusing, such as a perforated pipe, can be used to disperse the ozone effectively. Care should be taken so that ozone does not channel in an exhaust pipe, or mixing chamber, or that it is not drawn directly to the exhaust pipe when injected into a well.

With efficient mixing, time must be allowed for the ozone and odor molecules to come in contact with each other. Some reactions can occur quickly, but generally require 10 - 15 seconds of retention at a minimum. If volumetric space allows, 30 - 40 seconds is recommended. Adequate space is determined by airflow of exhaust and volumes of exhaust pipe, wet-well volumes, or mixing chamber volumes. If retention time goes down, then higher ppm levels of ozone are required to compensate. Excessive ozone production may result in the necessity to scrub out the residual ozone being exhausted into the atmosphere. Also, avoid large excesses of ozone and long contact times, since sulfur trioxide can form. This further step is undesirable because sulfur trioxide combines with water to form sulfuric acid, a highly corrosive substance.

How much ozone is needed to treat the malodors from sewage lift stations? To properly size the amount of ozone for the treatment there is certain data that must be known.

Steps for sizing ozone requirement for lift stations and wet wells:

1. Determine the ppm of hydrogen sulfide, ammonia, methane, etc., with a Bendix air sampler or other approved method.
2. Determine or estimate the cubic footage of treatment area.
3. If system has blower, determine cfm (speed or number of changes per hour).
4. Determine the retention time for the airflow.

Calculate as per following example:

Determine that there is 8 ppm of H₂S in the discharge air stream.

Determine that the air volume in the well is 1000 cubic feet.

Determine that a 250 cfm exhaust fan is ventilating the well.

The retention time can be calculated by dividing 1000 cu ft by 250 cfm, which is 4 minutes.

Having 8 ppm of H₂S at 250cfm provides a malodor volume of 2000 ppm/min. Use a model 630A, at a conservative, continuous use rating of 6 gm/hour, with about 25ppm at 75cfm (airflow loses through the machine). This would be an ozone volume of 1875 ppm/min. Using a 1.5 to 1 ratio of ozone to hydrogen sulfide would require a volume of 3000 ppm/min ozone. Two model 630As would produce a volume of 3750 ppm/min, which would allow lower settings under normal conditions, and additional ozone during peak odor periods.

In some application automatic controls may be desired. Sensors that measure the discharge level of ozone or VOCs, can be added for controlling the production of ozone being injected.

Cautions should always be observed when working around high levels of hydrogen sulfide and methane due to their exposure limits and also their explosive capabilities.

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ROUTINE MAINTENANCE

The Sonozaire requires routine maintenance for years of service at maximum ozone output. This occasional maintenance requires only minor cleaning and will take only a few minutes. Failing to routinely clean the unit will reduce the ozone output and require longer times for treatment. A complete failure to perform maintenance can cause a total failure of ozone output and a possible failure of Sonozaire components, which voids the warranty.

The amount of time between cleaning will depend upon a few variables. Below is a list of important operating factors that increase the frequency for cleaning:

- ✘ Unit operated 24 hours a day.
- ✘ Unit operated 365 days a year.
- ✘ Unit mounted outdoors.
- ✘ Unit operated in a high moisture or humidity environment.
- ✘ Unit operated in an area of excessive dust or dirt.

The harder the service, the more often the maintenance is required. Sonozaire's, which are mounted outdoors, should be cleaned every 1-3 months. For fire restoration applications, check after every couple of jobs to determine if cleaning is necessary. Notice that if the unit is elevated above floor level, cleaning frequency should be less. This is because at floor level more moisture is drawn into the Sonozaire. Dry cleaners, hotels, motels, vehicles, or air purification applications should require cleaning approximately every 2-3 months. Please note the above cleaning suggestions are averages. Check your equipment more often initially to determine if your use will allow you to go longer or shorter periods between cleanings.

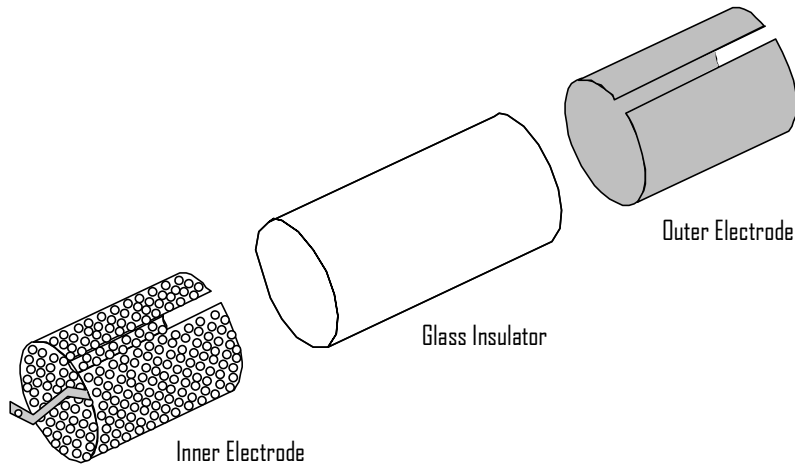
An easy way to determine if your machine is really dirty is to listen to it. With a clean Sonozaire, turn the ozone level knob to zero, and then turn on the machine. The blower will come on, and it has a low volume fan sound. Next, turn up the ozone knob briefly to hear the sound of corona being formed. This corona formation is the result of a high voltage causing an air gap to ionize. The sound is a low tone hissing or buzzing. A really dirty unit will have no corona sound. If a unit has too much moisture in it or is dirty, a snapping or arcing sound occurs. Please shutdown the unit and perform the necessary cleaning.

Routine maintenance consists of cleaning the air filter, cleaning the cabinet interior, cleaning of electrodes and glass, and oiling the blower motor. All of these tasks can be performed by almost anyone with a few simple instructions. The Sonozaire can be cleaned in the shop or on the job site. Cleaning supplies consist of clean water, glass cleaner, abrasive cleaner, abrasive brush, cleaning cloths or pads, and twenty-weight oil. Rubber gloves are recommended for handling the electrodes to prevent slippage or possible broken or breakage of glass.

- 1 Unplug the Sonozaire.** remove and clean the air filter from beneath the Sonozaire. Standard filter is of a spun polyester material and the enhanced air filter (outdoor use) is of electrostatic material and aluminum frame. Both can be cleaned by washing it out with water and possibly cleansing soap. Wash out both thoroughly and remove as much moisture as possible before reinstalling in the unit.
- 2** Remove the front cover by removing two or three screws at the bottom and pulling down on the cover. Look at the inside of the cabinet and compare it to the internal drawings of the proper model in this manual. Identify the following components: the high voltage transformer(s), the electrode assembly(s), and the blower motor. The electrode assembly(s) consists of an outer electrode(s), a glass cylinder(s), and a perforated inner electrode(s). See if the glass appears to be broken, dirty, or has a chalky appearance.
- 3** Clean the electrode assembly(s). If possible, the cabinet should be laid on its back with the opening upward. Begin by removing the high voltage wire connected to the inner electrode(s) directly or via the bus bar(s). This requires removing the wing nut from this connection point. Be careful not to break the glass insulator tube(s). Next, loosen the generator holder retaining straps around the electrodes. On the model 115A, only a single electrode is in the cabinet. On the models 330A and 630A, the electrodes are in sets of three. Disconnect the bus bar from the three inner electrodes and remove each individual electrode. They can also be carefully removed, as an assembly. Place the electrode assembly(s) on a table or counter for cleaning. Wipe off the high voltage transformer wire and the round gaskets on the blower or the plenum chamber where the glass contacts them to remove any moisture on substance on them.
- 4** Disassemble the electrodes. Remove the bus bar on the triple electrode assembly to individualize each electrode if not done in step 3. From each assembly remove the outer electrode by slightly springing it open and carefully sliding it off the glass insulator tube. If the outer electrode is stuck to the glass, soak the entire assembly in hot water (soapy if necessary), or in some other solution such as Lime-A-Way. Next, remove the inner electrode by slightly squeezing it together and sliding it out of the glass tube.

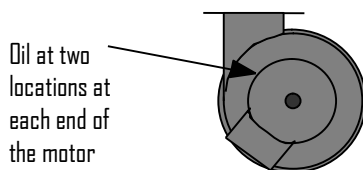
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SINGLE ELECTRODE ASSEMBLY

- 5 Clean each of the electrode components. Thoroughly clean the glass by normal methods used with glassware such as window cleaner, ammonia cleaners, or detergent and water. If the glass tube is extremely dirty, or appears to have oxidized, then clean thoroughly using a stiff bottlebrush. The inner and outer electrodes should then be cleaned. To remove any oxidation that might have built up on the electrodes, use an abrasive means, such as wire brush, SDS pad, stiff plastic brush with abrasive powders (Ajax or Comet), etc. The chalky substance on the aluminum electrodes is aluminum oxide that is a result of moisture. Clean the electrodes until they are back to the basic metal surfaces. Make sure to wash off any residue. Dry each of the electrode(s) and the glass tube(s) thoroughly.
- 6 Reassemble the electrode assembly(s). Spring the inner electrode(s) open slightly to insure a tight fit, and install into the glass tube(s) until it is in the center of the glass (approximately 1-1/2 inches of clear glass on each end). Next, slide the outer electrode(s) over the glass and align it with the inner electrode(s) in the center of the glass. The bus bar can be installed for the model 330A and 630A here, but may be easier to install in next step.
- 7 Reinstall the electrode assembly(s) into the cabinet. Look at the gaskets on the blower (115A), or on the plenum (330A & 630A), and verify they are in good shape. If they have any deterioration, order new ones and change out at next cleaning. Next, insert the electrode assembly(s) back into the generator holder and push the end of the glass firmly against the gasket on the blower, or plenum. Align the electrodes with the inner electrode tab down for the 115A and directed toward the back of the cabinet so that the bus bar (330A & 630A) dimples will slip into the holes on the inner electrode strap. Reattach the generator holder retaining straps around the electrode assembly and tighten securely all straps. Duplicate this for remaining electrode assemblies on the 330A and 630A models. Connect the bus bar if not done previously. Connect the high voltage lead wire from the transformer back to the inner electrode tab, or the bus bar. To prevent arcing, do not get the high voltage wire lead, bus bar, or inner electrode tab too close to the side or rear of the cabinet. Please refer to the internal drawing of the cabinet in this manual to verify that all components look as shown.
- 8 Use a damp cloth to wipe out the cabinet's interior to remove dust, dirt, etc. If a cleanser is required, use one that does not have an alcohol or hydrocarbon base that might be flammable. Over scrubbing the cabinet's exterior or interior might destroy the paint. Wipe the interior out with a clean, dry, cloth.
- 9 Newer models have permanently lubricated bearings and do not require oiling, but older models require oiling. If the blower part number begins with "42" then it does not require oiling. Oil the older blower motor with 10-20 drops of 20W oil or Teflon lubricant at each end of the blower motor. Do not over oil. Once every three months should be adequate. Wipe off the motor and verify that no oil has leaked onto the bottom of the cabinet.



OLDER MODELS REQUIRE OILING OF BLOWERS

- 10 Replace the cover and test the unit. Test by plugging in the unit and turning it up slowly to raise the ozone level. Determine if the corona sound occurs and the smell of ozone is present. The unit should be ready to put back into operation.

After cleaning, if no ozone is detected, or corona sound is heard, unplug the unit. Remove the door and verify that the glass electrode(s) is up against the gasket(s), and that transformers are connected to the inner electrode, or bus bar. If all appears correct, refer to the troubleshooting section of this manual for directions.

SONOZAIRE ODOR NEUTRALIZER

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TROUBLE-SHOOTING

Troubleshooting the Sonozaire models require a familiarity with the machines, as well as general electrical troubleshooting and electrical safety skills. Testing can be done with a volt-ohmmeter, and some troubleshooting can even be done without electrical meters. However, do not attempt to do any troubleshooting until you are familiar with the function and components of the equipment. Do not attempt testing if any test or procedure is not fully understood. All grounding and bonding connections are to be properly reinstalled if items are replaced.

Refer to the appropriate model's internal layout to follow operation and troubleshooting steps. Item numbers in bold will follow the descriptors below.

The Sonozaire units use a blower (**18**) to draw air in through the air filter (**20**) at the bottom of the cabinet (**1**). Air is drawn into the open end of the glass tube(s) (**6**), into the plenum (**35**) on the 330A/630A, into the blower (**18**), and out the top of the cabinet (**1**). The glass tube(s) (**6**) with inner and outer electrode(s) (**4&7**) is the location where the ozone is created. A high voltage field between the inner and outer electrode(s) (**4&7**) generates ozone. The voltage level to the generator is adjusted by the level control on the side of the Sonozaire. On model 115A, a rheostat (**19**), and on models 330A/630A, a variable transformer (**19**) is used to adjust the voltage to the high voltage transformer (**16**). Additional controls are the on-off selector switch (**22**) or the optional timer (**22B**), which controls the blower as well as power to the level control. There is also an optional control configuration that is referred to as the ventilation timer on some models. In this configuration, the ventilation timer controls only the time period that ozone is generated, and has no control over the blower.

Begin by removing the front cover (**2**) and looking inside the Sonozaire. Check for things that seem abnormal such as excessive dirt or film on cabinet, or any components. If a machine is stored for an extended period of time, moisture or humidity can cause a film to develop on some of the electrical components, such as where the brush (wiper) touches the windings on the variable transformer (**19**). Examine items that appear to need cleaning, such as the generator section (glass and electrodes). Look especially for components that appear to have heated or arced. These items can often determine what the cause of the problem is, and how to prevent it in the future.

On a following page is a list of symptoms, probable causes, and solutions to the problems. Please refer to this page for a starting point in troubleshooting the Sonozaire models. After extended service of the machine, any component can fail. However, the most common failures come from a lack of cleaning and maintenance.

MOST COMMON ELECTRICAL TROUBLESHOOTING PROCEDURE

If the Sonozaire blower will operate, but no ozone is detected, the first step is to check to see if the unit needs cleaning. Unplug the unit before removing the front cover (**2**) to inspect the electrode(s) (**4&7**), and glass tube(s) (**6**). If they appear dirty or chalky, remove and clean as instructed under Routine Maintenance section of this manual. If the glass tube(s) is not up against the gasket(s) (**39**) on the blower (**18**), or the plenum (**35**), push it up against the gasket(s) firmly. Check the transformer fuse(s) (**34**) on the side of the newer cabinet, or located next to the transformer in the older style cabinets (**16**). Use an ohmmeter to verify the fuse is good. Fuses can look good, but be open in the end region that is not visible. If the fuse is good, place it back in the fuse holder (**25** in new cabinets or **33** in older cabinets). If the fuse is bad, replace it with the correct size and type.

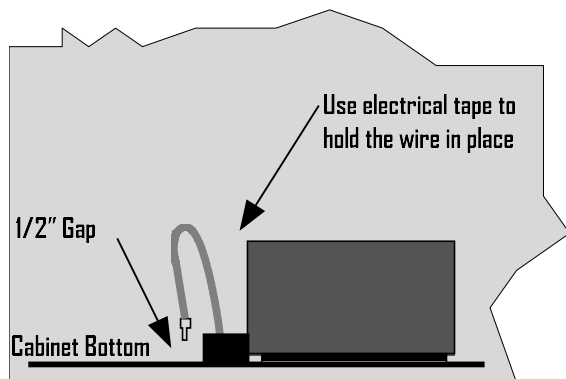
If everything above appears to be correct, test the unit while the door is removed. This can be accomplished by being careful to keep hands out of the inside of the cabinet. Turn down the ozone level control (**19**) to zero, plug in the unit, press in the door safety switch (**21**), and turn on the selector switch or timer (**22** or **22B**). When the blower (**18**) comes on, turn up the ozone level control slowly. Listen for the distinctive "ionization" sound. It should intensify as the level increases. Verify that no arcing or sparking occurs. If an arc occurs, verify its location, turn off and unplug the machine. Determine the reason for the arc and correct it. Typical problems are dirty glass and electrodes, moisture in the glass, misalignment of electrodes, cracked glass, etc. If problem is not located, it is recommended that the high voltage transformer circuit be tested.

Proper testing of high voltage transformer (**16**) requires an AC voltmeter that will measure approximately 15KV. Actual voltage should be between 10KV and 14KV. If a HV test meter is unavailable, then an "arc" or "spark" test can be performed to determine if high voltage is available. Note that on a model 630A the transformer fuse on the transformer not being tested is to be removed, to prevent it from being energizing while the other HV transformer is tested. With the unit unplugged, disconnect the transformer (**16**) high voltage wire from the inner electrode(s) (**4**). Loop the high voltage wire down in front of the transformer and form it or tape it to the side of the transformer so that the wire is approximately ½ inch from the bottom of the cabinet. Do not hold the wire or use a screwdriver to hold it in place. With the door off, turn the ozone level knob (**19**) to zero, plug the unit in, hold down the door safety switch (**21**) and turn the selector switch or timer (**22** or **22B**) on. The blower should turn on. To "arc" test: raise the ozone level knob (**19**) gradually toward the maximum setting.

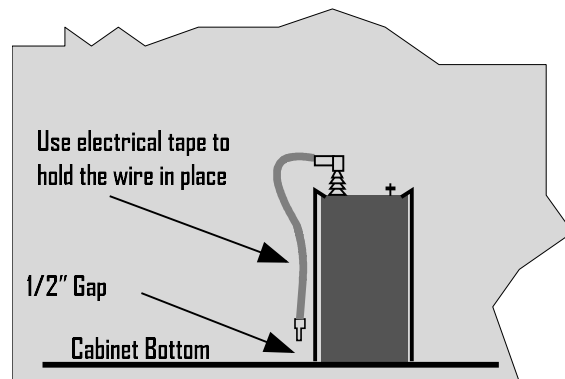
SONOZAIRE ODOR NEUTRALIZER

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When the knob approaches the maximum output, an arc should occur from the high voltage wire to the bottom of the cabinet. The arc should be a strong arc, but should not damage the cabinet, other than minor etching to the paint. If a strong arc occurs, then the high voltage and control circuits are good. The problem is in the electrode-glass assembly and can be fixed by cleaning or replacing electrodes or glass.



ARC TEST FOR TRANSFORMER



If the arc does not occur or is very weak, the transformer could be bad. Also, the voltage coming into the transformer might not be present or high enough. Repeat test for second transformer on model 630A. If voltage coming into the HV transformer is suspected not to be correct then a 150VAC voltmeter is required to test the primary voltage coming into the high voltage transformer.

Testing Voltage into HV Transformer on Model 115A

On the model 115A, begin by verifying that the unit is unplugged. Check that the transformer fuse is good as instructed above. Connect a 150VAC voltmeter from the left side (transformer side) of the brown resistor (30) located in the center of the cabinet and attached to the rear, near the bottom. Connect the other voltmeter probe to the cabinet ground. If possible, connect the voltmeter to the resistor with a jumper or alligator clip to hold it in place. If the probe must be held onto the resistor by hand, be very careful not to come near, or in contact with the high voltage transformer lead, or the inner electrode (4) to the left. This may have extremely high voltage present. Plug in the model 115A, set the ozone level control (19) to zero, turn on the selector switch (22), and press in the door safety switch (21). The voltmeter should read approximately 50 volts. Adjust the ozone level knob to mid-scale, and the voltmeter should read approximately 60-65 volts. Adjust the ozone level knob to maximum, and the voltmeter should read approximately 95-100 volts. If these readings are observed, then the rheostat (19) is good. If the rheostat appears to be bad unplug the 115A, then place a temporary jumper between the two terminals on the rheostat (19) that have wires. This will bypass the rheostat, and the unit will be at full output. Plug in the unit, turn on the selector switch, press in the door safety switch, and the unit should come on at full output. If the "arc" test is being checked, it should produce a hot arc. If a hot arc occurs then the transformer (16) is good and the rheostat (19) is bad. If a hot arc is not seen, then the transformer is bad and should be replaced.

Testing Voltage into HV Transformer(s) on Models 330A and 630A

On the 330A/630A begin by verifying that the unit is unplugged and then remove the fuse(s) to the transformer(s). Check that the transformer fuse(s) is good as instructed above. With the transformer fuse(s) removed, there will be no voltage above 120VAC in the cabinet. Next, the voltage at the line side of the transformer fuse holder should be measured. To do this, connect the 150VAC voltmeter from the line-side of the fuse holder(s) (33) and the cabinet ground, or test between terminals 3 and 4 on the level control variable transformer (19). Plug in the unit's cord, turn the selector switch on, press in the door interlock switch, and turn up the level control knob to mid-scale (50%). The voltmeter should read approximately 60 volts. Turn up the level control knob to maximum (100%), and the voltmeter should read approximately 120 volts. If readings are correct, then the variable transformer (19) is good. If readings are much lower or erratic, then the variable transformer wiper, or variable transformer, is dirty or bad. Clean the area that the wiper (brush) contacts the variable transformer windings with a rubber eraser or electrical contact cleaner. Also, clean the wiper to remove film buildup. If this does not correct, replace the bad component. If the variable transformer (19) tests good, and the HV transformer (16) does not produce a strong arc, then the transformer is bad. Replace the transformer and verify that the unit performs correctly.

Replace all components with factory-approved components only. Failure to replace with factory-approved components could result in damage to equipment or injury to personnel. Do not attempt to repair the machines unless you have a complete understanding of the procedure, and the proper test equipment is used. Call your local distributor for parts and assistance. Call the factory direct if a local distributor is unavailable or unknown. Additionally check the website www.sonozaire.com for additional instructions, photos, instruction videos, etc.

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Service Instruction Section

TROUBLE-SHOOTING LIST

Note: Before beginning troubleshooting problems, always refer to all diagrams and manual instructions. These units have high voltages in excess of 10KV.

Symptom	Probable Cause	Solution
Machine not working.	Power to the receptacle off.	Check receptacle for power or tripped GFI.
	Cover not on good enough to close the door limit switch.	Tighten or adjust the cover.
	Main fuse blown.	Replace the main fuse with spare fuse.
	Failure of on-off switch or timer.	Replace on-off switch, contacts, or timer.
	Failure of door limit switch.	Replace the limit switch.
	Failure of blower motor.	Verify that blower motor will rotate and has not failed. If oil type motor, then lubricate or replace if necessary.
No Ozone or Low Output	Glass tube(s) not up against the gasket(s) on the blower or the plenum.	Push the glass tube(s) up against the gasket(s) to prevent air from bypassing the generator.
	Ozone level setting too low.	Increase the setting.
	Dirty or oxidized glass tube(s) and electrodes.	Clean the glass and electrodes, or replace them.
	Cracked glass insulator(s).	Replace the glass insulator tube(s).
	Blown HV transformer fuse.	Verify fuse is blown and replace. Check glass.
	HV transformer failed.	Test transformer and replace if required.
	Dirty, worn, or broken variable transformer wiper (brush).	Clean or replace the variable transformer wiper.
	Variable transformer, rheostat or resistor failed.	Test and replace components if required.
Main Fuses Blown	No air movement (blower not operating).	Clean filter. Free the blower from obstructions and oil motor with 20W oil. Replace motor, if necessary.
	Shorted variable transformer or rheostat.	Replace the component.
Transformer Fuses Blown	Shorted blower motor.	Replace the blower motor.
	Transformer shorted.	Replace the transformer.
	Glass insulator tube is very dirty, has excessive moisture in it, or is cracked.	Clean the glass and electrodes, or replace the glass tube(s) and electrode(s).
	Wire insulation breakdown.	Locate the wire failure and replace.

SONOZAIRE ODOR NEUTRALIZER

Service Instruction Section

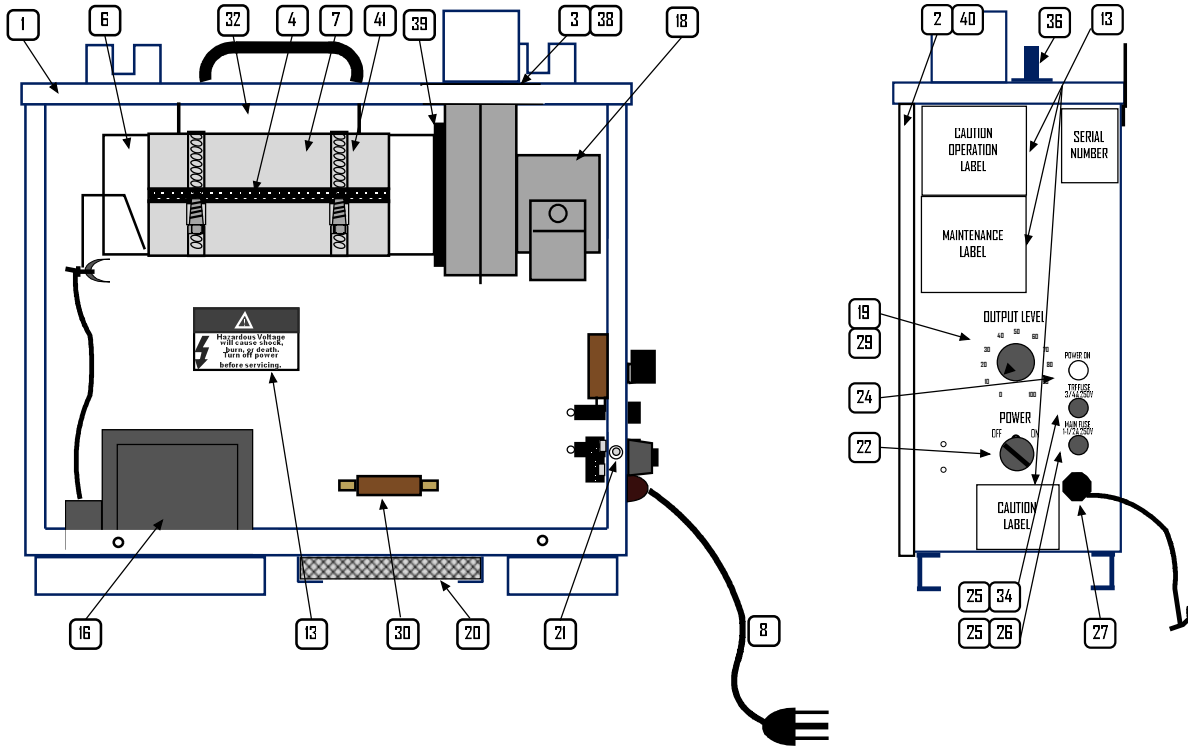
PARTS LIST

ITEM #	SONOZAIRE PARTS DESCRIPTION	115A PARTS #	330A PARTS #	630A PARTS #
1	Enclosure Assembly	1007-91-2	1045-4-2	1045-3-2
2	Cover Assembly	1007-92-1	1045-7-1	1045-6-1
3	Gasket-Blower to Cabinet	1007-25-2	1007-25-2	1007-25-2
4	Inner Electrode	1007-98-1	1007-98-1	1007-98-1
5	Nameplate Decal	1007-40-1	1007-40-1	1007-40-1
6	Glass Insulator Tube	1007-19-2	1007-19-2	1007-19-2
7	Outer Electrode	1007-99-2	1007-99-2	1007-99-2
8	Line Cord	WI	WI	WI
9	Term Lug No. 10	R416IGSF	R416IGSF	R416IGSF
10	Term Lug No. 8	S416GS	S416GS	S416GS
11	Butt Splice	B4071	B4071	B4071
12	Wire Nut 16-18AWG	NP5115	NP5115	NP5115
13	Instruction Decals, Set of 4	1007-85-1	1007-85-1	1007-85-1
14	Cable Ties	ELAM	ELAM	ELAM
15	Cable Anchor	AAABMM	AAABMM	AAABMM
16	Transformer (HV) Step-up	T1	T2	T2,T3
17	Transformer Step-down	TSD1 (150VA)	TSD2 (350VA)	TSD2 (350VA)
18	Blower Motor	1007-71-1	1007-71-1	1007-72-1
19	Rheostat/Variable Transformer	R1	VT1	VT1
20	Air Filter	1007-110-1	1007-110-1	1007-110-1
21	Micro Switch (Door Safety)	S1	S1	S1
22	Selector Switch (On-Off)	S2	S2	S2
23	Lamp, Red	DS1	DS1	DS1
24	Lamp, White	DS2	DS2	DS2
25	Fuse Holder, Panel Mtd	XF1	XF1	XF1
26	Fuses, Main	F1 (MDL 1-1/2)	F1 (MDL 3)	F1 (MDL 5)
27	Bushing, Strain Relief	8103-375	8103-375	8103-375
28				
29	Knob, Ozone Level	5150	5530	5530
30	Resistor	RS1	----	----
31	Transformer Bracket (old style cab)	1007-79-1	1045-5-1	1045-5-1
32	Strap Support Assembly	1007-80-2	1045-9-2	1045-9-2
33	Fuse Holder, In-Line (Trf old style)	XF2	XF2	XF2
34	Fuses, Transformer	F2 (MDL3/4)	F2 (MDL1-1/4)	F2 (MDL1-1/4)
35	Plenum Chamber	----	1045-10-1	1045-10-2
36	Handles	2644	2644	2644
37	Bus Bar	----	BB2	BB2
38	Blower Discharge Screen	BDSC25	BDSC25	BDSC25
39	Gasket-Glass to Blower/Plenum	1007-97-1	1007-97-1	1007-97-1
40	Cover Gasket Set	1007-97-2,-3,-4	1045-8-2,-3,-5	1045-8-1,-2,-3
41	Generator Support Gasket (old style)	----	1045-8-4	1045-8-4
42	Gasket-Blower to Plenum	----	1007-97-7	1007-97-7
43	Fuse Bracket (old style)	1007-93-1	1007-93-1	1007-93-1
44	Standoff	8067-A-10	8067-A-10	8067-A-10
45	Brush for Superior Powerstat	----	----	----
16A	Hi-Performance HV Transformer Oil-Filled	TFSPEC	TFSPEC	TFSPEC (Zea)
20A	Enhanced Multi-Media Air Filter	AF136	AF136	AF136
21A	Micro Switch (240V), DP	S1A	S1A	S1A
22A	Selector Switch (240V), DP	S2A	S1A	S1A
22B	Timer, 12 Hour, 120V, SP	TMI	TMI	TMI
22C	Timer, 12 Hour 240V, DP	TMIA	TMIA	TMIA
45A	Brush for Staco Variac	----	----	----

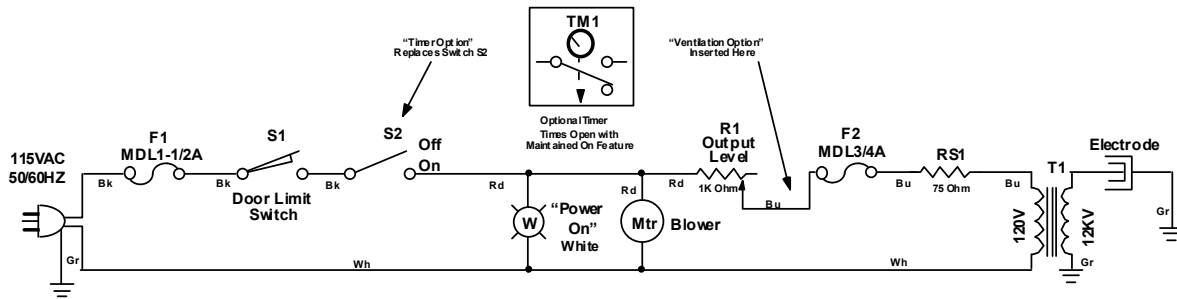
SONOZAIRE ODOR NEUTRALIZER

Service Instruction Section

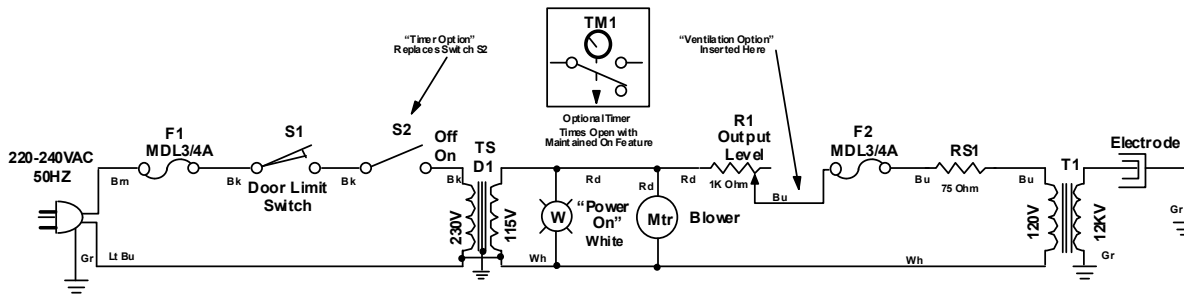
Model 115A Drawing and Parts



Sonozaire Model 115A



Schematic for Sonozaire Model 115A (115vac, 50/60hz)

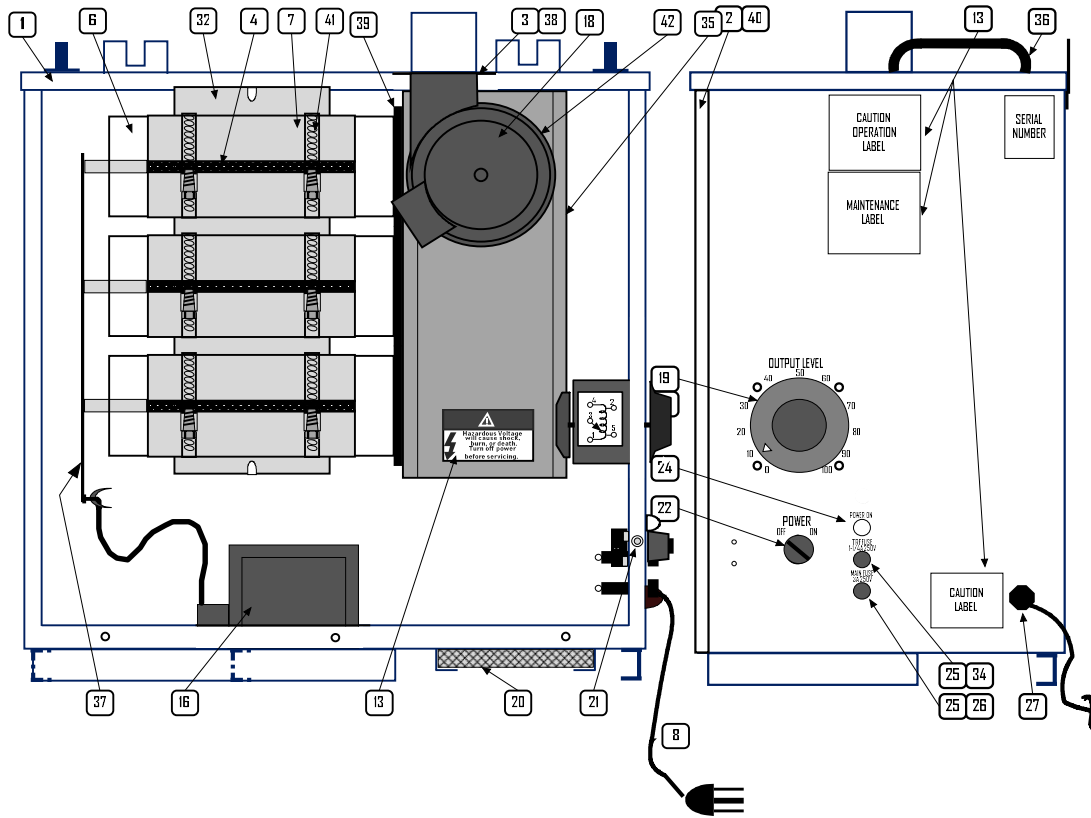


Schematic for Sonozaire Model 115A (230vac, 50hz)

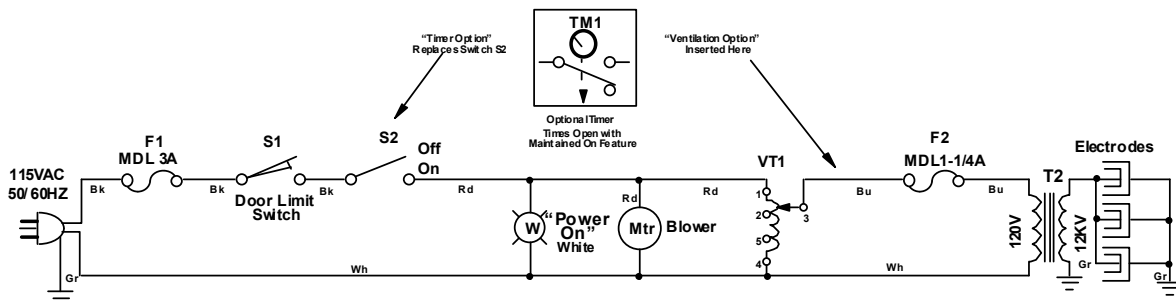
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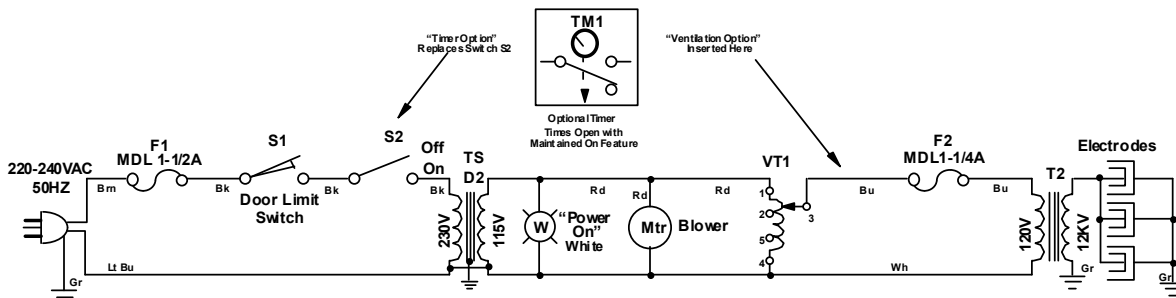
Model 330A Drawings and Parts



Sonozaire Model 330A



Schematic for Sonozaire Model 330A (115vac, 50/60hz)

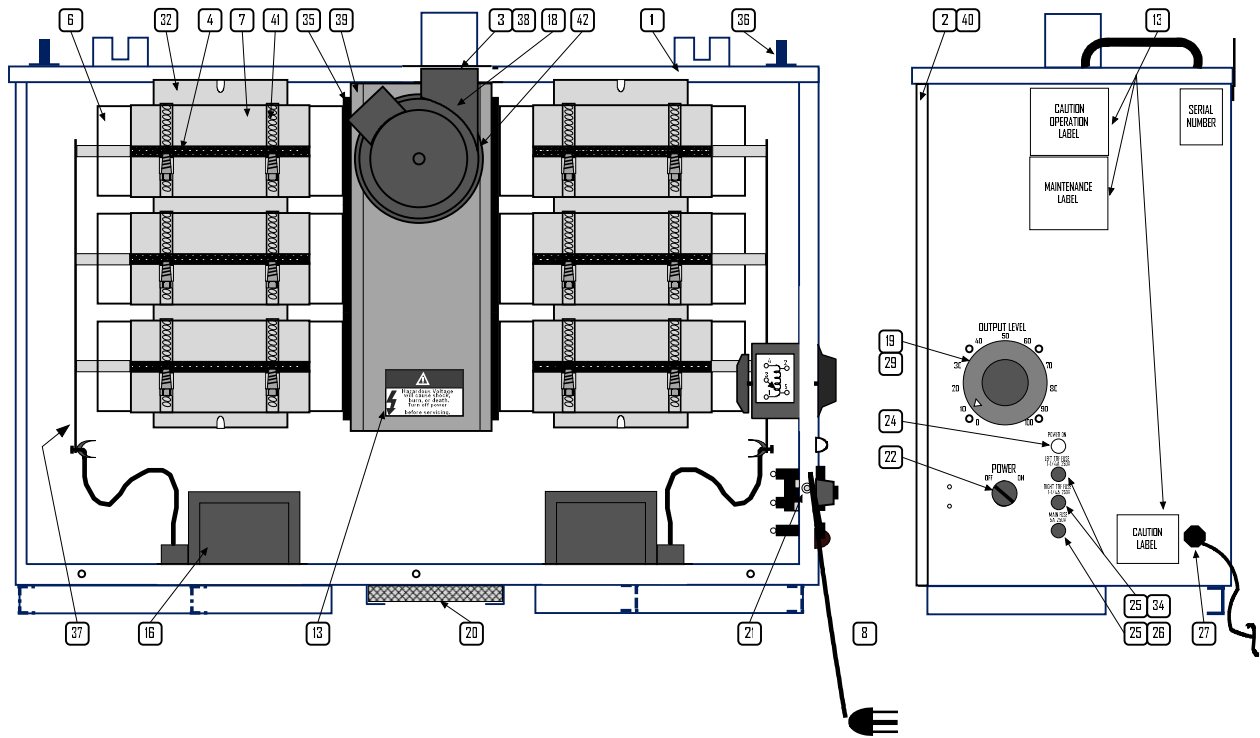


Schematic for Sonozaire Model 330A (230vac, 50hz)

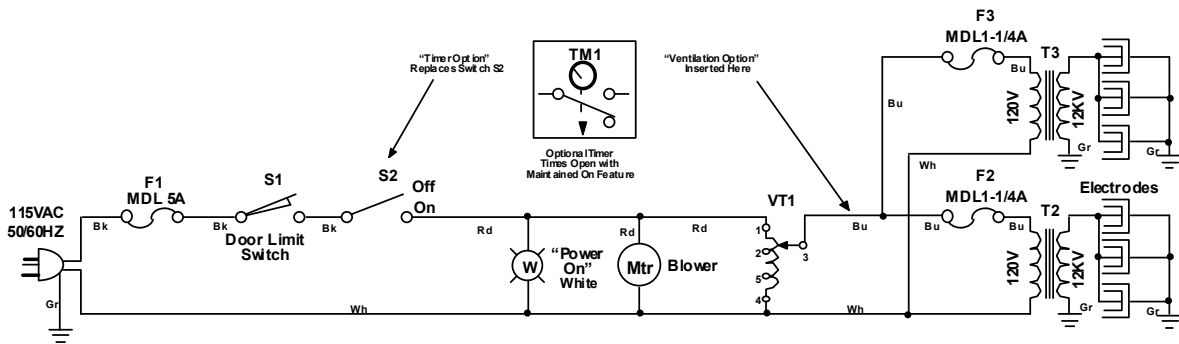
SONOZAIRE ODOR NEUTRALIZER

Service Instruction Section

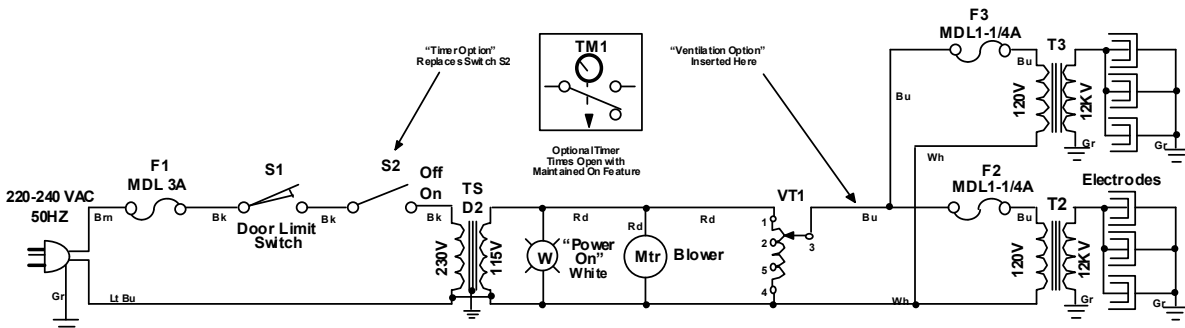
Model 630A Drawings and Parts



Sonozaire Model 630A



Schematic for Sonozaire Model 630A (115vac, 50/60hz)



Schematic for Sonozaire Model 630A (230vac, 50hz)

SONOZAIRE ODOR NEUTRALIZER

Miscellaneous Section
SAFETY DATA SHEET

1. Product Identification

Product Name: Ozone

Other Common Names: O₃, triatomic oxygen, trioxygen

Product Use: This SDS is limited to the ozone produced in gaseous form onsite by small commercial ozone generators in low concentrations (less than 10 gm/hr.). The use is typically for odor abatement and is for air-borne applications only (not for water treatment).

Ozone Generator Manufacturer: Sonozaire LLC., 3836 Shiloh Rd, Tyler, TX 75707 USA. Trade name for units: Sonozaire Odor Neutralizer.

Main Phone No: 903 525 9336

Website: www.sonozaire.com

Email: Sales@sonozaire.com

2. Hazard Identification



GHS Classifications

Physical Hazards	Health Hazards	Environmental Hazards
Output levels do not qualify as an oxidizing gas under GHS Chapter 2.4	Respiratory Irritation/Toxicity (Category 1) Eye Irritation (Category 2B)	Equipment is not useable for water treatment.

Notes: Anyone with chronic pulmonary problems, including asthma and COPD, should avoid exposure to ozone.

Respiratory toxicity will develop before eye irritation goes beyond listed categories.

Ozone levels produced by ozone generators covered here do not have levels harmful to skin.

3. Composition

Chemical Name: Ozone

Common Names: Ozone, triatomic oxygen, trioxygen

CAS Registry No: 10028-15-6

NIOSH RTECS #: RS8225000

Chemical Formula: O₃

4. First-Aid Measures

Route of Entry	Symptoms	First Aid
Eyes	Irritation, dryness	Rinse with water (remove contacts)
Inhalation	Headache, dry throat, cough, shortness of breath, heaviness of chest, drowsiness, fatigue, inflammation of upper respiratory tract	Remove to a fresh air area, if necessary a trained person should administer oxygen.

For severe cases or when symptoms don't improve, seek medical help.

5. Fire Fighting Measures

Ozone is not flammable, but is considered an oxidant at higher levels. However the levels of ozone generated below 50 ppm do not increase the rate of burning. Use standard extinguishing agents for indicated burning materials. The ozone generating equipment covered by this SDS does not generate more than the 1/2 lb/day (0.23kg/day) indicated in the 2012 NFPA Chapter 54, Article 54.1.1.

6. Accidental Release Measures

Turn off the ozone generator, or remove power and evacuate the area. Ventilate the area with fresh air by opening windows and doors. Do not occupy the area until the ozone level has subsided to safe levels, which should occur within minutes to hours

7. Handling and Storage

Ozone is to be used in enclosed unoccupied areas and transported from generation point to application point with ozone resistant hose or pipe.

8. Exposure Controls/Personal Protection

OSHA Permissible Exposure Limit/NIOSH Relative Exposure Limit: 0.1 ppm (0.2 mg/m³) 8-hr/day, 40hr/week time weighted average.

OSHA/NIOSH Short Time Exposure Limit: 0.3 ppm (0.6mg/m³) 15 minutes.

OSHA/NIOSH Immediately Dangerous to Life or Health: 5 ppm (10 mg/m³.)

FDA Continuous Exposure: 0.05 ppm (0.1 mg/m³.)

SONOZAIRE ODOR NEUTRALIZER

Miscellaneous Section

WARNING PROPERTIES: Odor threshold is detectible in the 0.01-0.04 ppm range, and is treated as a material with adequate warning properties. Ozone is an oxidant and must be used carefully. Fortunately, the odor of ozone generally prevents long periods of prolonged exposure.

RESPIRATORY PROTECTION:

NIOSH	Respirator Recommendations
0-1 ppm	Any chemical cartridge respirator with cartridges providing protection against compound of concern. Any supplied-air respirator.
0-2.5 ppm	Any supplied-air respirator operating in a continuous-flow mode. Any powered air-purifying respirator with cartridges providing protection against compound of concern.
0-5 ppm	Any chemical cartridge respirator with a full facepiece and cartridges providing protection against compound of concern. Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front-or back-mounted canister providing protection against compound of concern. Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece.
Emergency or Entry into Unknown	Any self-contained breathing apparatus with a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
IDLH Conditions	Any supplied-air respirator with a full facepiece and is operated in a pressure demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.
Escape	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front-or back-mounted canister providing protection against compound of concern. Any appropriate escape-type self-contained breathing apparatus.

ENGINEERING CONTROLS: For small levels of ozone use forced ventilation to remove ozone from areas. Use ozone level controls to monitor and control levels of ozone in areas that are occupied or unoccupied as necessary to maintain ozone levels for personnel protection or selected operational levels.

DESTRUCTION OF EXCESSIVE OZONE: To reduce levels of ozone in treatment area introduce fresh and/or warm air with dynamic airflow. Heat, humidity, and air movement will speed up the reaction of ozone thereby lowering the levels and increasing oxygen level.

9. Physical and Chemical Properties

Physical State	Gas, clear to bluish color	Boiling Point	-111.9°C/-169.4°F	Solubility	0.001% (0°C)
Molecular Weight	48.0 g/mole	Evaporation Rate	N/A	Auto-Ignition Temp	N/A
Odor	Distinctive Pungent Odor	Flammability (gas)	N/A	Decomposition Temp	N/A
Odor Threshold	0.01-0.04 ppm; sensitivity decreases with exposure	Explosive Limits	N/A	Viscosity	N/A
pH	N/A	Vapor Pressure	>1 atm	Specific Gravity	2.144 g/L
Melting Point	-192.5°C/-314.5°F	Vapor Density	1.6 (air=1)	Ionization Potential	12.52eV
Flash Point	N/A	Relative Gas Density	1.66		

10. Stability and Reactivity

Ozone is very unstable and reacts very quickly with air-borne and surface contaminants, odors, and many chemicals. It will decompose very rapidly in normal ambient temperatures. Warmer temperatures and higher humidity levels, along with dynamic airflow radically increase rate of decomposition. Therefore colder, drier temperatures with static airflow reduce rate of decomposition. Materials that react adversely to ozone are natural rubber (latex), nitrile rubber (hoses for fuels), latex foam rubber, bare steel, nylons, and some thin plastics. Items that require removal or covering include plants, animals, fish tanks, oil paintings (dyes and pigments), some leathers (if treated for long periods), and tires.

11. Toxicological Information

Likely routes of exposure for low levels of ozone production: Inhalation, eyes.

Effects of Acute (short term) Exposure: Irritation and dryness of eyes, nose, and throat and may cause shortness of breath and/or coughing. Other effects include headaches, fatigue, drowsiness and inflammation of the upper respiratory tract.

Effects of Chronic (long term) Exposure: Similar to short exposure, with possibility of breathing disorders, including asthma, or other pulmonary conditions

SONOZAIRE ODOR NEUTRALIZER

Miscellaneous Section

Irritancy of Ozone	Yes	Teratogenicity	Not Proven
Sensitization to Ozone	No	Mutagenicity	Not Proven
Carcinogenicity (NTP, IARC, OSHA)	No	Toxicologically Synergistic Products	Increased susceptibility to allergens, pathogens, irritants
Reproductive Toxicity	Not Proven		

12. Ecological Information

Ozone can have adverse effects on plant life at high concentrations, or at lower concentrations for long time periods. This is particularly true where ozone is being used indoors where plants are present. Remove plants from ozone exposure. Avoid ozone contact with water or wet materials to prevent the formation of hydrogen peroxide.

13. Disposal Considerations

Stop the production of ozone. Residual ozone should be allowed time to decay back to oxygen. Air movement and higher temperatures and humidity increase the decay rate.

14. Transport Information

NOT APPLICABLE – Ozone is not transportable and is required to be generated at the site location and at time it is being used. It is unstable and will decompose or react with other substances in the environment.

15. Regulatory Information

2012 NFPA 1 Chapter 54 – Uniform Fire Code

OSHA/NIOSH – Exposure Limits, Respiratory Protection

FDA - General Recognized as Safe (1982), Title 21 Section 801.415 - Continuous Exposure Limits (2013)

16. Other Information

The practical half-life of ozone in air is variable based upon the temperature, relative humidity, air movement and presence of contaminants. When odors or air contaminants are present, ozone oxidizes immediately when in contact with odor molecules. Thus ozone level in a treatment area will begin low and as the odors are neutralized, the ozone level will rise. Air movement is necessary to provide the interaction of ozone with the odors. EPA report EPA-600/R-95-154 (Oct 1995) indicated that low levels of ozone decayed completely in 12 minutes. A 2010 study of decay time by Purdue University Agricultural and Biological Engineering with high levels of ozone (700-1700 ppm) indicates that for each degree centigrade of temperature increase the half-life decreases by 45.6 minutes, while an increase of humidity from 0% up to 87% provided a 70% decrease in half-life of ozone (24deg C). The study also indicated that air movement provided the greatest decrease in the decay time of ozone. Airflow at 109 cfm and at 217 cfm reduced half-life of ozone to 49 and 39 minutes at 24 degree C and 0% RH. Thus in odor treatment areas where it is warm and humid, and with high airflow levels all of the decreases will come into effect. In odor removal applications for rooms or buildings where the ozone levels might reach the 3-10 ppm range and where air movers, HVAC systems, or fans are used, with airflows of 1000 cfm or larger the half-life, with approximately 50% RH, would be in the 10-20 minute range or lower. With odors elements in the room, the decay of ozone will be even faster. For an example, for 15 minute half-life a treatment area with an ozone level of 5 ppm, within 90 minutes the ozone level should be reduced to approximately 0.094 ppm which is below the OSHA PEL limit of 0.1 ppm. A similar example with 30 minute half-life and same ozone level of 5 ppm would require 180 minutes to reduce to approximately 0.094 ppm. In all cases airflow should continue during ozone decaying time, and after this fresh air should be introduced into the treatment area to increase the oxygen level and reduce any lingering ozone.

Preparer: Sonozaire LLC.

Date of Preparation: 7/1/2014

Disclaimer: Sonozaire LLC. provides this information in good faith, but makes no claim as to its comprehensiveness or accuracy. This SDS is provided based upon the output levels of the Sonozaire Odor Neutralizers, and not for larger amounts of ozone production. This is intended solely as a guide for the safe handling of the product by trained personnel, and makes no representations for warranties, expressed or implied, of the merchantability or fitness of the product for any purpose, and Sonozaire LLC. will not be responsible for any damages resulting from the use of, or reliance upon, this information.

SONOZAIRE ODOR NEUTRALIZER

Miscellaneous Section

ATTENTION

DO NOT ENTER

OZONE ODOR NEUTRALIZATION IN PROGRESS

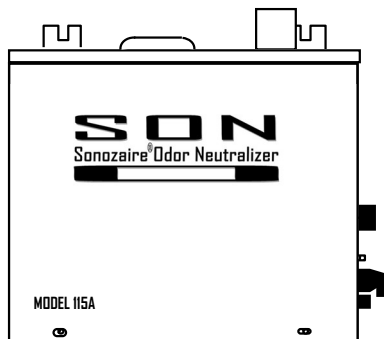
OZONE BEING USED IS POSSIBLY ABOVE OSHA AND NIOSH CONCENTRATION LEVELS FOR HUMAN OCCUPANCY.
AFTER TREATMENT BY OZONE, ALLOW OZONE TO REVERT BACK TO OXYGEN AND/OR VENTILATE THE
AREA THOROUGHLY BEFORE OCCUPYING THE TREATED AREA.

ATENCION

NO ENTRE

OZONO OLOR NEATRULIZACION EN PROGRESO

OZONO USAR ES QUIZAS EN ALTO NIVELS OSHA Y NIOSH CONCENTRACION PARA OCUPAR PAR SER EL HUMANO.
LUEGO EL TRATAMIENTO POR OZONO, PERMITIR OZONO REVERTIR A EL OXIGENO O EVACUAR EL
AREA TRATARLA ANTES DE OCUPAR POR EL HUMANO.



DESTROYS ODOR MOLECULES

DESTRUIR OLOR LAS MOLECULAS

UNIT # / UNIDAD NUMERO

INSTALLER / ESCRIBA SU NOMBRE DEL EMPLEADO

INSTALLED DATE & TIME / ESCRIBA FECHA Y LA HORA

EST. REMOVAL DATE & TIME / ESTIMACION DE REMOBER LA FECHA Y LA HORA

AM / PM

AM / PM

ACTUAL REMOVAL DATE & TIME / REMVEBA LA FECHA Y LA HORA PRESENTA

AM / PM

COMMENTS / COMENTARIOS

RESTORATION CO. INFORMATION / RESTAURACION DE LA INFORMACION DE LA CO.

Sonozaire LLC.

Sonozaire[®] Warranty

The Company agrees to repair or replace without charge, any equipment, parts or accessories which are defective as to workmanship or material to the extent that:

- a. The defect occurs within and notice of the claimed defect is given to the Company within one (1) year from date of purchase.
- b. The parts or accessories are returned to the company at its factory, transportation prepaid, and
- c. The company is satisfied that the claimed defects are traceable to original materials or workmanship.

Failure of the Equipment to operate in a normal and proper manner due to exposure to any environmental condition in excess of the Equipment specification, failure due to improper use, or failure due to inadequate maintenance, shall not be deemed a defect.

This warranty is void if Equipment is altered or repaired by anyone other than the Company.

THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE SET FORTH HEREIN AND A WARRANTY OF TITLE AS PROVIDED IN THE UNIFORM COMMERCIAL CODE. NO WARRANTIES BY SELLER SHALL BE IMPLIED OR OTHERWISE CREATED UNDER THE UNIFORM COMMERCIAL CODE OR OTHER APPLICABLE LAW, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY AND WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER OR NOT RESULTING FROM THE NEGLIGENCE OF SELLER. COMPANY SHALL NOT BE RESPONSIBLE FOR ANY LABOR COSTS ASSOCIATED WITH ANY DEFECTS.

This Warranty shall be construed in accordance with laws of the State of Texas.

The purchase and receipt of the Company's equipment constitutes acceptance by the Distributor or the scope of Distributor's remedies against the Company, as set forth herein.

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