

Ozone Generating Systems

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Brought to you by the APSP Recreational Water Quality Committee

I. INTRODUCTION

Ozone generating systems are electromechanical devices that generate and dissolve ozone gas into swimming pool or spa water. They provide antimicrobial oxidation for supplemental sanitation, oxidation of organic and inorganic contaminants, chlorine byproduct reduction and algacide activity. This fact sheet examines the properties and the application of these devices.

II. SUMMARY OF CHARACTERISTICS

- Ozone generating systems manufacture ozone gas and dissolve it into the water commonly through venturi injection in the recirculation flow
- Ozone (O₃) is a gas with three oxygen atoms per molecule which can be readily dissolved in water
- Gaseous ozone dissolved in water is referred to as aqueous ozone and has no odor
- Ozone is a powerful oxidizer and supplemental sanitizer, a micro-flocculant and anti-foaming agent
- Ozone leaves little or no residual in a pool or spa and is used in conjunction with an EPA registered primary sanitizer
- Ozone has the added benefit of destroying disinfection byproducts such as chloramines, as well as reducing chlorine consumption
- NSF/ANSI Standard 50 requires that ozone be used in conjunction with chlorine

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III. GENERAL DESCRIPTION

A. What It Is

NOTE: All equipment should be installed according to manufacturer's recommendations.

A commercial ozone generating system consists of two basic components:

The ozone generator

This component consists of an electrical enclosure which includes a compressor, oxygen concentrator, high voltage power supply, ozone producing cell, and ancillary items that control all these sub-components. Ambient air is drawn into the oxygen concentrator which removes moisture, nitrogen, trace gases, and contaminants. This clean and dry oxygen is then drawn into the ozone producing cell and some of it (2-5%) is converted into ozone gas.

The ozone management system

This component consists of a booster pump (on very small systems, booster pumps are not required), a venturi injector assembly, undissolved ozone degas tank, undissolved ozone destruct device, and an oxidation reduction potential (ORP) monitor/controller. The ozone management system maintains appropriate ozone levels in the water regulated with the ORP monitor/controller. These components operate in unison and are installed on a pool or spa as a side-stream of the main filtration system. Ozone is introduced to the water after filtration (and heating), and before the chlorine feeder. The side-stream flow is normally 15 to 25 percent of the main flow, depending on the size and type of pool. The system size is proportional to the water quantity or organic load.

A residential ozone generating system also consists of two basic components:

The ozone generator

For Corona Discharge (CD) ozone generation:

This component consists of an electrical enclosure which includes a high voltage power supply, ozone producing cell, and ancillary items that control these components. Ambient air is drawn into the ozone generator and some of it is converted into ozone gas.

For Ultraviolet (UV) ozone generation:

This component consists of an electrical power supply and an ozone-producing ultraviolet lamp (185 nm). Ambient air is drawn into the ozone generator and some of it is converted into ozone gas.

The ozone management system

This component consists of some means of injecting the ozone into the water. Ozone is typically introduced to the water after filtration (and heating), and before the chlorine feeder.

B. What It Does

Once the ozone has been dissolved in the water, an oxidation reaction occurs upon any collision between an ozone molecule and a molecule of an oxidizable substance. Organic contaminants are destroyed and many dissolved metals are no longer soluble.

Ozone kills all known microorganisms (including *Cryptosporidium* and *Giardia*), destroys organic contaminants that may create chloramines, and breaks down existing chloramines. This oxidation happens immediately at the ozone gas injection point and continues in the return lines. A small residual (~0.1 ppm) of dissolved ozone may enter the pool, providing further oxidation of contaminants.

Ozone generating systems are considered devices under US EPA, Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and have an EPA Establishment number.

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Commercial ozone generating systems are tested and listed under NSF/ANSI STANDARD 50, Equipment for Swimming Pools, Spas, Hot Tubs and Other Recreational Water Facilities; product must meet the requirements of NSF 50, Annex H.1: Disinfection Efficacy, and is intended for supplemental disinfection and should be used with registered or approved disinfection chemicals to impart residual concentrations in accordance with state or local regulations.

C. What It Does Not Do

Ozone generating systems do not leave a large residual in the pool or spa. All ozone generating systems must be used in conjunction with an EPA registered sanitizer.

IV. APPLICATION

A. Commercial Pools and Spas

Ozone is appropriate for use in conjunction with chlorine but is not recommended for use in conjunction with bromine or PHMB.

B. Residential Pools

Ozone is appropriate for use in conjunction with chlorine but is not recommended for use with bromine. UV generated ozone systems can be used with PHMB. Corona discharge units may destroy some of the PHMB.

C. Residential Spas

Ozone is appropriate for use with all EPA registered sanitizers.

V. PRECAUTIONS

Gaseous ozone is harmful to breathe. The OSHA Permissible Exposure Limit (PEL) is currently 0.1 ppm over an eight hour time weighted average. No OSHA Regulations apply to aqueous ozone; it is not harmful to humans.

Commercial Systems

Ozone gas is introduced into the water under vacuum. If a line is breached, the system loses vacuum, and the ozone generator immediately stops producing ozone gas.

Residential Systems

Please consult the manufacturer's literature regarding safe use and operation of their ozone generation system.

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