Venturi Injector Installation/Calibration Guidelines

1.0 Theory of Operation

A venturi injector provides the most efficient means of transferring ozone from the gas phase to the dissolved state, where it can then be applied to perform oxidation functions. When properly sized and calibrated, **efficiency rates of mass transfer (gas to solution) can reach 99%**. This manual will assist in calibrating your venturi injector to achieve its maximum performance potential.

2.0 Sizing

This manual is not meant as a venturi injector sizing aid, however it is helpful to understand the basics. The purpose of correctly sizing a venturi injector is to attain the highest level of mass transfer. This is done by following the formula: Optimum Mass Transfer = 1GPM(Water) + 1SCFH(Ozone).

Basic sizing of venturi injectors requires that three variables be known: 1) Fluid (water) flow rate in gallons per minute (GPM) 2) Available water pressure, and 3) Ozone Generator model and Air Preparation equipment model (if used). A properly sized venturi injector will "pass" a given volume of water (based on user requirements), while producing a suction air flow rate, based upon available water pressure, that is compatible with efficient ozone production for the selected ozone generator/air prep package.

Table 1 lists optimum flow rates for standard Ozotech, Inc., ozone generators and air preparation equipment. Subsequent sections of this manual will offer guidelines for installation and air flow calibration of a properly sized venturi injector.

3.0 Venturi Injector Installation

There are two typical approaches to venturi installation. Deciding on which approach to use will depend upon the nature of your application. This manual will discuss installation of both methods. Determination of which approach to use will be up to you.

- In all cases, sound plumbing practices should be followed. Remember that the venturi injector may require replacement at some time. Installation between isolation valves and unions can facilitate future service, repair or replacement.

- The most common venturi injectors are cast from various plastic compounds, making structural strength an important consideration. Care should be taken to avoid damage during installation.

Approach #1 - (*Simplified Approach*)

This approach places the venturi injector in series, or in-line, with the water stream to be treated. With this approach, all of the water passing through the system enters the venturi injector.

Installation Procedure

① Choose a point in the water line for installation.

Factors in choosing a location:

*Minimum distance of **8 times the pipe diameter** on both sides of the venturi from bends in the water line.*

Venturi should be installed after the pump, unless pump is constructed of ozone resistant materials.

② Cut out a portion of the plumbing, and thoroughly deburr pipe. It is extremely important that all debris be cleaned from the system to avoid blockage within the venturi.

③ Install venturi injector between unions and isolation valves, with suction port facing up. Note: Facing the suction port upward will reduce the chance of water leaking into the ozone delivery line.

Approach #2 - (*Preferred Approach*)

This approach places the venturi injector in a bypass loop, or in parallel, with the main water stream, allowing only a portion of the stream to enter the venturi. This approach has been developed to cope with common challenges faced in sizing and installation of venturi injectors. Examples include: difficulty in sizing a standard venturi for both (GPM) flow and suction air flow, back-pressure on the venturi resulting from pressurized systems, water flow rates that exceed the standard range of venturi sizes, ORP controlled injection of ozone, etc. Figure 1 shows a typical bypass loop.

Installation Procedure

① Choose a point in the water line for installation.

Factors in choosing a location:
Venturi should be installed after the pump, unless pump is constructed of ozone resistant materials.

② Cut out a portion of the plumbing, and thoroughly deburr pipe. It is extremely important that all debris be cleaned from the system to avoid blockage within the venturi.

③ Install bypass. You may wish to place the bypass between unions and isolation valves.

④ Allow water to pass through the system at the "normal operation" flow rate. Adjust ball valve to provide the venturi suction air flow rate compatible with optimum air flow rate of your ozone generator/air preparation package.

4.0 Air Flow Calibration

Air flow calibration is meant to fine-tune the air flow through the ozone generator. It is not meant as a substitute for correct venturi sizing. The first step in air flow calibration is determining the optimum air flow rate for your selected ozone generator/air preparation package (see Table 1).

The second step is deciding whether your air preparation device is positive pressure or negative pressure. For example, the IQ40 is a passive device that must rely upon movement of air from an outside source. Hence, air flow through the IQ40 and the ozone generator is due to **negative pressure** derived from venturi suction. Conversely, oxygen concentrators move air independent of an outside source. These devices move air through the ozone generator by **positive pressure**.

The third step is following the steps outlined in the correct Air Flow Calibration section.

4.1 Air Flow Calibration, Negative Pressure

Air flow calibration for systems utilizing negative pressure air preparation, or for systems not using air preparation, is very simple.

① After system installation, allow water to pass through the venturi injector at the "normal operation" flow rate.

② Using an air flow meter, adjust air flow to desired rate.
Note: Depending on ozone generator model, an air flow meter may be built-in. Flow meters are not installed in some models, and must be purchased separately.

4.2 Air Flow Calibration, Positive Pressure Air Prep

Air flow calibration with positive pressure air prep requires additional manipulation. Any time a positive pressure air preparation device is used, there is a chance that ozone could be released into the environment should a leak develop in the ozone delivery line. Positive pressure air preparation devices will not withstand direct exposure to ambient ozone.

The following steps will produce a condition where the ozone delivery line is always under negative pressure. Calibration of your system in this manner is required for warranty coverage of Ozotech, Inc.,

positive pressure air prep devices.

① After system installation, disconnect the air preparation equipment from the ozone generator. Allow water to pass through the venturi injector, at the "normal operation" flow rate. Using an air flow meter, check the air flow rate through the ozone generator.
Note: Depending on ozone generator model, an air flow meter may be built-in. Flow meters are not installed in some models, and must be purchased separately.

② Apply power to the air preparation device. Connect the air preparation device to the ozone generator input.

③ Using a flow meter between the air prep equipment and the ozone generator, adjust the air flow. Proper flow is a minimum of .25-.50 SCFH *less* than the air flow rate found in step 1, **provided that it does not exceed the maximum air flow rate specified in the Operation/Maintenance Manual supplied with the air preparation equipment.** If it does exceed the limit, continue to restrict air flow by turning air flow meter dial until it is within limits specified in your manuals.