DISSOLVED OZONE

OZONE BASICS

CD, corona discharge, method produces ozone by creating a constant, controlled spark (corona) across an air gap through which a feed gas is passed. The feed gas can be dry air or oxygen enhanced air. The feed gas is dried to a dew point of -60 degrees F minimum.

If moisture is present, nitric oxides produced by the corona will form nitric acid which wil corrode the equipment.

The relative strength of ozone is expressed as a percentage of concentration by weight; 0.5 to 1.7% for dried air and 1.0 to 6.0% for oxygen air. This percentage relates to the amount of ozone in the discharged air as this air is not 100% ozone.

Ozone is a much more powerful oxidizer than chlorine, and efficiently oxidizes organics that cause taste, odour and colour problems without leaving a high residual. Ozone oxidizes and precipitates many metals and destroys some pesticides without leaving a trace. It also functions as a preoxidiser of iron, manganese and sulfide compounds, allowing for their removal by direct filtration. Contact times are 1 to 6 minutes for common contaminants – ozone has a half life of 22 minutes in water.

EQUIPMENT TYPES

There are two type of system which use different feed gas, either dry air or PSA oxygen. A higher ozone output and concentration can be attained using PSA oxygen.

Feed gas air is dried using either replaceable or heat-regenerative desiccant. This can be either built in to the unit or as a separate module.

Oxygen concentrators producing oxygen enhanced air dry up to -80 degrees F dew point and remove nitrogen to improve ozone output and concentration. Again, they can be either built in to the unit or as a separate module.

MASS TRANSFER

Ozone is transferred into water either by venturi (vacuum) or diffusion. Diffusers are used when long term, passive contact is required e.g. water treatment. Venturi systems are used where smaller volumes of water are involved and precise dosages must be maintained e.g. bottle washing and bottled water.

SIZING OF OZONE EQUIPMENT

As with UV WTU, there is a minimum amount of information required to ensure a system is effective.

There are two distinct type of application – single pass and recirculating.

Single pass applications are bottling lines, discharge water, etc. where ozone is added once to the water.

Recirculating systems are fruit and veg. washing, cooling towers, etc. where extra ozone can be added so the ozone level remains constant.

Dissolved ozone monitors are used to analyse water inline and add ozone when required.

The basic information required is as follows:-

ozone demand (via water sample analysis)
ozone dosage
flowrate
inline pressure
volume of water (for recirculating systems)

DEMAND

The amount of ozone required is effected by ozone demand in the water. Contaminants in the water will consume ozone and effect the dosage level in the water. The ozone dosage required per mg/litre of contaminant is as follows – this figure must be added to the target dosage to ensure there is enough ozone to be effective:-

Iron	0.14 to 0.50 mg/L
Manganese	0.88 mg/L
Sulfide	2.2 mg/L
Colour	1.0 mg/L per 10 colour parts
Taste & Odour	0.05 mg/L
Phenol	2.0 mg/L
TOC	4.0 mg/L
BOD	2.0 mg/L
COD	2.0 mg/L
Tannins	1.5 mg/L
Nitrite	2.0 mg/L

A water sample is required for analysis to ensure the correct dosage is provided.

DOSAGE

Dosage is expressed in **mg/l** (milligrams per litre) or **p.p.m.** (parts per million). Either value is the same. Ozone output of the equipment is expressed in **grams per hour**.

There is a large range of applications requiring different dosage;-

Bottled water	0.05	-	0.3 p.p.m.
Cooling towers	0.05	-	0.3 p.p.m.
Reclaimed water	0.2	-	0.5 p.p.m.
Bacteria & Viruses	0.2	-	1.0 p.p.m.

Calculate ozone demand (grams per hour) by multiplying dosage required by contaminant level by flow rate.

For example, dosage required is 2 p.p.m. – contaminant level is 8 mg/l. - flowrate is 4000 litres per hour

= 2 mg / litre x 8 x 4000

= 64000 mg per hour + 25% safety factor

= 80000 mg per hour = 8 grams per hour

Calculations are based on water temperature of 16 degrees C. Add 25% for every extra 6 degrees.

1 litre	=	1 000 000 mg
1 ml	=	1 000 mg
1 gram	=	1 000 mg
1 mg	=	1 p.p.m.

CONTACT TIME – CT

Generally, 1 p.p.m. for 1 minute CT is sufficient to disinfect water. Where inline CT is not available, a Contact Vessel is required to retain water and provide sufficient mixing of ozone and water to provide disinfection. This is most common in single pass applications.