



EXCELLENCE IN PROCESS ANALYTICS

Application Note

Beverage No. 08

Accurate in-line dissolved ozone measurements in bottled water

- Assures the ability to maintain a 0.1 to 0.4 ppm residual ozone level at the time of bottling, as recommended by IBWA (International Bottled Water Association)
- Enables precise feedback control of ozone generator
- Unique air calibration method; no wet chemistry is required

Application description

Bottled water is regulated at the federal and state levels and by industry to ensure that it meets all applicable safe water standards. The FDA regulates bottled water as a food product, and bottled water companies must comply with the FDA's Quality Standards (*Section 165.110(b) of Title 21 of the Code of Federal Regulations*), labeling regulations, and Good Manufacturing Practices (GMPs). On a global level, the Codex Alimentarius Commission, the food standards body of the World Health Organization (WHO), also guides bottled water standards. To some degree, the bottled water industry is also self-regulating. The International Bottled Water Association (IBWA) whose 1,200 members produce about 85% of the bottled water available on the market has developed regulations to complement federal and state standards.

Ozone (O₃) is a preferred disinfectant for bottled water because it leaves no residual taste, color or odor. However, O₃ is relatively expensive to produce and if it is not accurately controlled it has the possibility of creating some undesirable disinfection byproducts. For these reasons, it is essential for bottled water plants to monitor and control their ozonation process at precise levels.

Mineral waters that contain bromides will oxidize to bromate when exposed to excess levels of ozone. The FDA has limited bromate to less than 10 µg/L (ppb). To ensure proper disinfection and limit bromate formation, the International Bottled Water Association (IBWA) recommends that ozone be applied in the 1.0 to 2.0 milligram per liter (mg/L) range for a period of 4 to 10 minutes contact time. Application at this level helps maintain a 0.1 to 0.4 ppm residual ozone level at the time of bottling and provides an additional safety factor as the bottles can be disinfected and sanitized while being filled with product.

Installation recommendations

Hach Ultra's Orbisphere brand ozone sensors are ideally suited to this application due to their excellent low level response (down to 5 ppb), high accuracy and minimal maintenance requirements. In addition, Orbisphere O₃ sensors can be calibrated either in air at atmospheric pressure or in-line using known ozone concentrations. During air calibration the sensor measures oxygen (O₂) in the air. The ozone calibration coefficient is calculated by using the ratio of membrane permeability of oxygen and ozone through the membrane. This air calibration option is patented and unique to Orbisphere O₃ sensors.

Orbisphere O₃ sensors can be used in two distinct sampling methods for ozone generator control or residual ozone measurements:

1. Directly in a pipe with a sensor socket (in-line) after the ozone tank or injector
2. In a sample drawn from the pipe with a flow chamber (on-line) after the ozone tank or injector



The Orbisphere sensor is waterproof, and uses materials of construction that are not affected by the presence of O₃. This permits the assembled components to be installed directly into the process pipe in-line using a sensor socket.

Where it is not practical to make measurements directly in-line, a sample can be drawn past the O₃ sensor mounted in a flow chamber on-line. Because O₃ continues to react in the sample tubing to the sensor, its length should be kept to a minimum. To monitor flow rates and prevent degassing, it is recommended to use a flow meter on the outlet of the flow chamber. A flow rate of 350 ml/min should be maintained otherwise lower readings not representative of process conditions will result.

Sampling points after the ozonator and before the filler can be monitored at the same time using a dual channel Orbisphere 510 analyzer (or two single channel Orbisphere 410 analyzers as an alternative).

For single point measurements, an Orbisphere 410 can be used. Orbisphere ozone analyzers are widely used in bottled waters plants throughout the world. The Orbisphere 510 and 410 offer precise, powerful process monitoring capability. These instruments provide accurate, repeatable trace level measurements and an impressive level of data management.

Installation options

 <p>50 mm (2") min. pipe Ø</p> <p>0 to 4 mm setback allowed from internal pipe Ø</p>	<p>In-line</p>
	<p>On-line</p> <p>For on-line measurements, the sample is taken from the production line and fed through a flow chamber with a sensor installed. The sample conditions can be precisely controlled to ensure more stable readings using this installation method.</p>

Recommended systems components

Model	Description
510/CC0/W1C00000	Orbisphere 510, two-channel O ₃ (EC), wall mount, 85-264 VAC, three 0/4-20mA analog outputs, RS485
410/C/W1C00000	Orbisphere 410 ozone (EC) instrument, wall mount, 85-264 VAC, three 0/4-20mA analog outputs, RS485
32501.03	10 wire cable to connect 31xxx sensors to Orbisphere 410/510 wall and panel instrument, length 3m.
31330.15	O ₃ sensor, parts in contact with sample in titanium, other parts metal, with platinum guard ring, ceramic valve seat, Viton O-ring, titanium protection cap
32001.151	Flow chamber, titanium, ¼" fittings, Viton "O" rings
32732	Maintenance kit for electrochemical ozone sensors.