

The Waterloo Emitter™ is based on the principle of diffusion (US Patent: 5,605,634), therefore groundwater gases (e.g. CO₂, CH₄, etc.) can back-diffuse across the tubing membrane. This lowers the partial pressure of the remediation gas (e.g. oxygen), causing the performance of the units to drop-off over time. To mitigate this effect, it is necessary to periodically purge the units of these groundwater gases.

Purging the units is simple and can be accomplished in either of the following ways. The gas line configuration can utilize an On/Off valve, to allow manual purging from time to time. This shut-off valve will need to be opened once per week to allow a flow of gas for 5-10 seconds to purge the units of any accumulated groundwater gases.

Alternatively, the system vent line can be configured utilizing an adjustable flow needle valve. This allows a small flow (1-2 ml/min) of remediation gas constantly through the units, to passively purge the system. A constant purge of gas at 1-2 ml/min does not significantly increase overall gas usage. (See Figure 1 for gas supply connection guidelines.)

A simulation calculator for the Waterloo Emitter is available in Microsoft Excel for downloading from www.solinst.com. The Calculator allows the input of your application's specifics and will estimate the output of oxygen through diffusion into the aquifer as well as the oxygen supply consumption rate.

Plan View of Oxygen Line Plumbing for a Row of 5 Waterloo Emitters

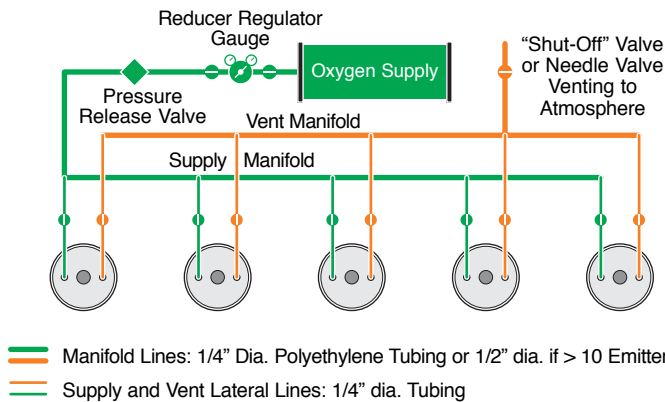


Figure 1

1. Visually inspect parts for any damage. Each container includes: 1 Waterloo Emitter unit, 4 x 1/4" brass compression fitting nuts with ferrules, 1 short length of red LDPE tubing loop and 4 spare plastic dura-clamps. Note that 5.8" Emitters and all Emitters using LDPE tubing do not use dura-clamps.
2. Select one end of Waterloo Emitter to be the "bottom end" (i.e. the end that will reside deepest in the treatment well).
3. Attach 1/4" LDPE tubing loop with supplied 1/4" brass compression fittings to be the "bottom end" of the unit. (See ③ Figure 2).



Figure 2

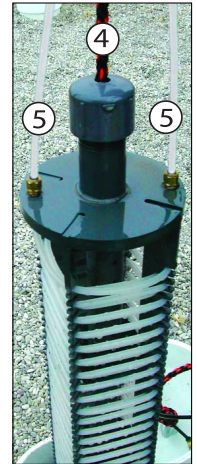


Figure 3

- 4a. If sampling within Emitter wells is required, attach lengths of PVC riser casing. Note that 1.8" and 3.8" Emitters use 1-1/4" NPT pipe; 6" Emitters use 1-1/4" NPT pipe.
- 4b. If sampling within the Waterloo Emitter well is NOT required, attach a lowering/retrieval cord to the unit by threading a cap over the top end of the NPT threaded central pipe (See ④ Figure 3).
5. Attach appropriate lengths of 1/4" O.D. polyethylene gas transfer line to extend from the top end 1/4" fittings on the Emitter (See ⑤ Figure 3) to the gas supply and vent manifolds.
6. Referring to Figure 1, make sure the vent line valve or needle valve is closed and make sure all other valves are open. Set pressure regulator to the appropriate operating pressure.

MAXIMUM PRESSURE
Set Pressure Relief Valve at:
LDPE Tubing: 100 psi, Silicone Tubing: 20 psi
DAMAGE TO TUBING WILL OCCUR IF
MAXIMUM PRESSURES ARE EXCEEDED.

7. Prior to submersing the units in the treatment wells, while the system is under pressure, leak test all fittings (either submerge the units in a water bath or soap test the connections). Adjust fittings as necessary to eliminate any leaks prior to installation.
8. Lower the unit to desired depth within the screened treatment well and secure retrieval cord or riser pipe at the well head.
9. While NOT exceeding above specified maximum pressures, adjust pressure regulator to desired operating pressure. For systems utilizing a constant purge of the vent line, adjust the needle-valve to allow 1-2 ml/min of flow.

Pressure Tested: **Serial No:**
Leak Tested:
Date: _____ **Signed:** _____

Installation Components Required

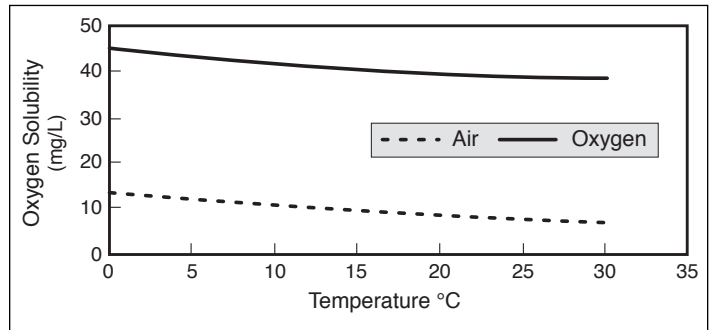
- Waterloo Emitter™
- NPT drop pipe or suspension line with plug
- 1/4" LDPE tubing to extend from Emitter to supply
- Oxygen Supply - Medical grade or Extra-dry oxygen
- Oxygen regulator for supply tank
- Reducer regulator and gauge to allow setting pressures at:
 - 2 - 20 psi (silicon tubing)
 - 10 - 100 psi (LDPE tubing)
- Tubing manifold if more than one Emitter is to be supplied from the same oxygen tank
- Shut-off valve or needle valve for system purging

Length of Tubing per Waterloo Emitter™

1.8" dia.	62 ft.
3.8" dia.	75 ft.
5.8" dia.	150 ft.

Waterloo Emitter Tubing Specs

Diffusion Coefficient (silicone)	6.67E-07 cm ² /s
Diffusion Coefficient (LDPE)	1.73E-08 cm ² /s



Oxygen Solubility in Water (Air vs. Pure Oxygen)

Oxygen Consumption Estimates

Waterloo Emitter Equipped with Silicone Diffusive Tubing Volume consumed (L/day/Emitter)

P (psi) (regulator)	1.8" x 51" Emitter	3.8" x 51" Emitter	5.8" x 51" Emitter
5	1.68	2.07	4.14
10	2.11	2.59	5.19
15	2.53	3.12	6.24
20	2.96	3.64	7.29

Waterloo Emitter Equipped with LDPE Diffusive Tubing Volume consumed (L/day/Emitter)

P (psi) (regulator)	1.8" x 51" Emitter	3.8" x 51" Emitter	5.8" x 51" Emitter
60	0.17	0.20	0.41
70	0.19	0.23	0.46
80	0.21	0.26	0.52
90	0.23	0.28	0.57
100	0.25	0.31	0.62
110	0.28	0.34	0.68

Typical Oxygen Tank Specifications

Old Designation	New Designation	Tank Size	Maximum Volume (litres)
B	M6	3" x 12"	164
C	M9	4" x 11"	248
D	M15	4.5" x 16"	400
E	M22	4.5" x 25"	680
G	M60	7.5" x 23"	1725
H		8" x 51"	6500
K		9" x 60"	8720

- Notes:**
- Tank volume may vary based on manufacturer and tank material
 - Tanks can be steel, aluminum or composite
 - Steel and aluminum tanks are typically 2/3 the volume of composite tanks
 - Depending on the output pressure required, the available oxygen volume may range from 70% - 90% of the maximum tank volume.