

# Schematic Diagram for a Passive Bioventing / Barometric Pumping Valve

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The following schematic diagrams illustrate a type of valve used in conjunction with the passive bioventing technology. Passive bioventing, also known as barometric pumping, is a remedial technology that promotes aerobic biodegradation of contaminated vadose zone soils by introducing ambient air to oxygen-limited vadose zone soils through a series of vent wells. Barometric pressure oscillations are the driving force for passive bioventing, and create differential pressures between the atmosphere and subsurface that are used to deliver air to the subsurface. When atmospheric pressure is greater than the soil-gas pressure ambient air can enter the subsurface through a vent well, subsequently oxygenating contaminated vadose zone soils. One-way valves are installed in the vent wells to prevent oxygenated soil-gas from escaping when atmospheric pressure drops below soil-gas pressure. This is done to maximize biodegradation by maximizing the amount of oxygenated air sustained in the contaminant region.

The technology has been shown to deliver air at flow rates from 5 to 20 ft<sup>3</sup>/min in relatively deep wells (100-200 ft below ground surface) that exist in highly permeable soils. Use of the technology in shallow wells (4-60 ft below ground surface) has most often resulted in air flows less than 1 ft<sup>3</sup>/min. This is because differential pressures between the atmosphere and shallow vadose zone subsoils are too low to promote substantial airflow rates into vent wells (Zimmerman, et. al., 2003). However, it has been shown that specific lithologic features (permeable soils overlain by an impermeable lense or cap) can promote significant airflow rates (i.e. 5 to 15 ft<sup>3</sup>/min) in shallow soils. A typical data acquisition system used during a passive bioventing study is illustrated in Figure 1.

Although passive bioventing cannot provide air flows comparable to active bioventing systems which utilize electrical blowers to deliver air to the subsurface (one successful passive bioventing site only provided 7.5% of the airflow that a blower would have provided), it is a promising technology for remote sites with limited access to power or for sites that no longer require the volume of air input provided by active bioventing. The technology appears to be limited to sites where soil conditions include lower moisture content, a thick highly-permeable zone (with a deep water table), or a permeable region in the vadose zone which is capped by a low-permeability layer.

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## Reference

Zimmerman, C.T., C. Payne, A. Pollack, R. Hinchee, T. Wilk, R. Hoepfel, J. Costanza, and S. Larson. 2003. *Passive bioventing – a technology evaluation under varying geographical and lithologic conditions*. In Proceedings of In Situ and On-site Bioremediation, the 7<sup>th</sup> International Symposium, Orlando Florida, June 2-5, 2003. Battelle Press, Columbus Ohio.

## Relevant Web Sites:

<http://www.p2pays.org/ref/14/13958.htm>

This site describes passive soil vapor extraction and the use of the Baroball™ barometric valve developed by Westinghouse Savannah River Company. Information about the Baroball valve can be obtained from Joseph Rossabi at (803) 725-5220, [joseph.rossabi@srs.gov](mailto:joseph.rossabi@srs.gov) or Brian Riha at (803) 557-7807, [brian.riha@srs.gov](mailto:brian.riha@srs.gov).

## RELATED REFERENCES

Battelle. 1995. Final Report, *Passive Bioventing Driven by Natural Air Exchange at the Hill Air Force Base Site 280*. Prepared for Hill AFB under Contract No. DAAL03-91-C-0034, Task No. 92-445. October.

Costanza, J., and J. Rossabi. 2001. *Natural Pressure-Driven Passive Bioventing*. In Proceedings of the Fourth Tri-Service Environmental Technology Symposium.

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Zimmerman, C.T., B.M. Sass, T.C. Zwick, B.C. Alleman, C.A. Payne, R.E. Hoepfel, and L.J. Bowling. 1997. *Principles of Passive Aeration for Biodegradation of JP-5 Jet Fuel*. Bioventing Applications and Extensions. Battelle Press.

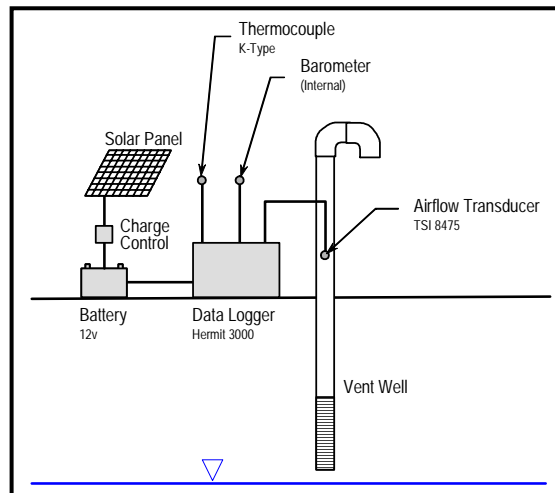
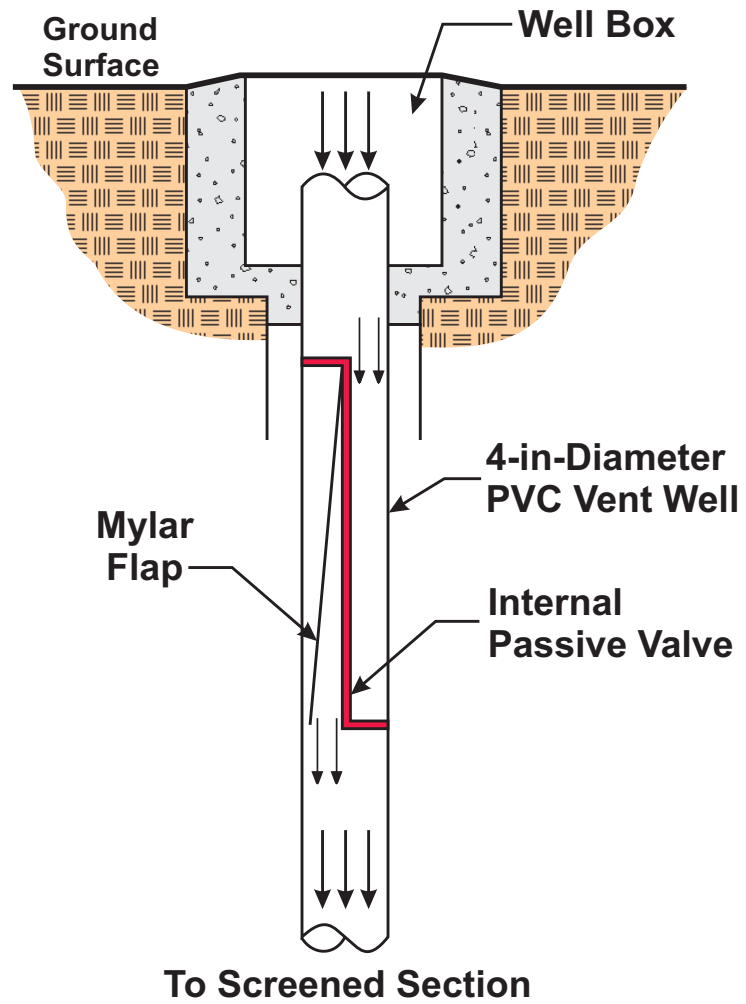
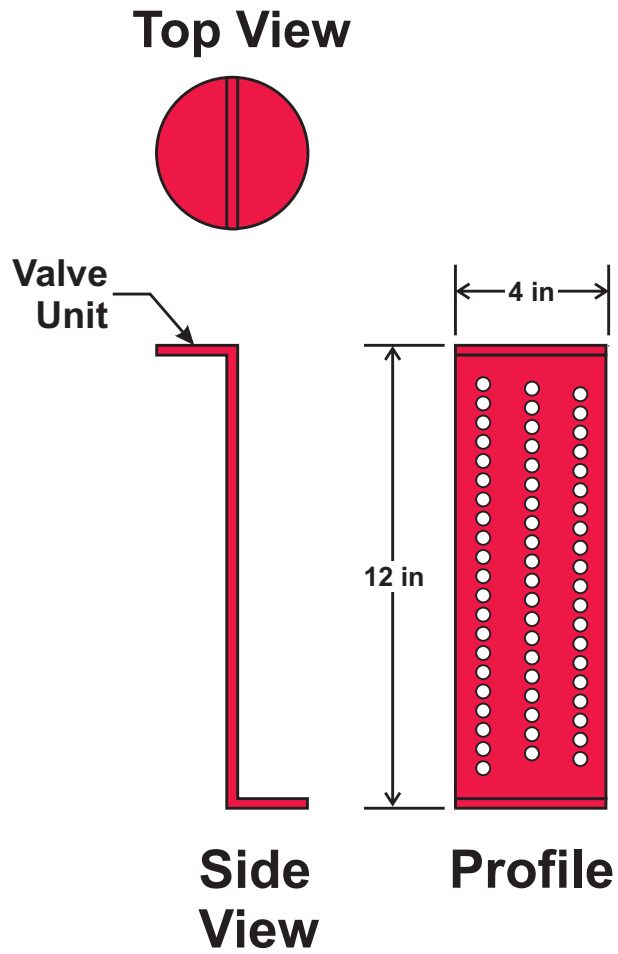
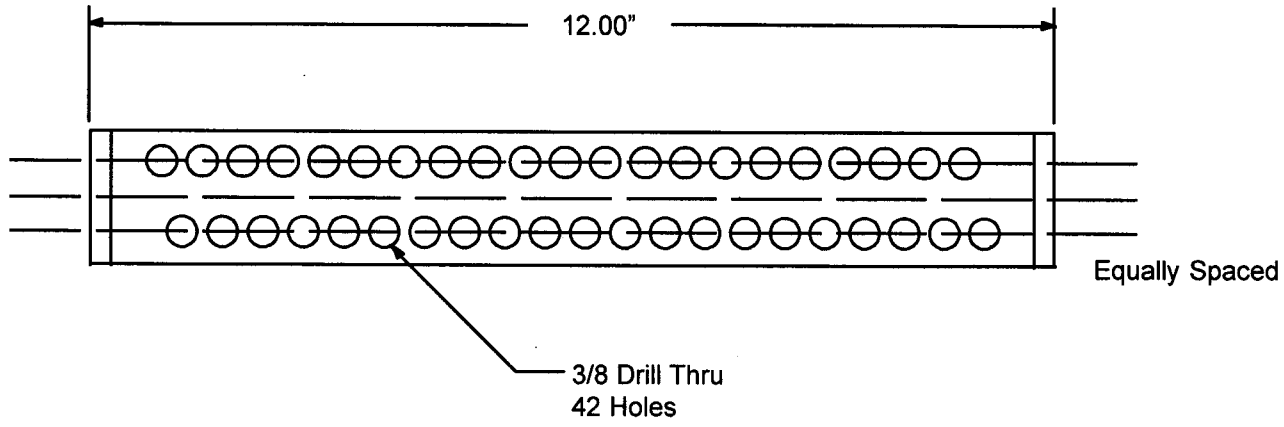
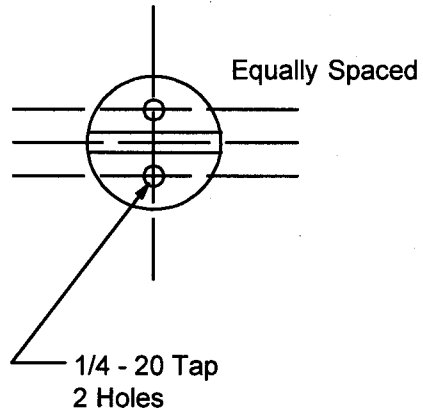
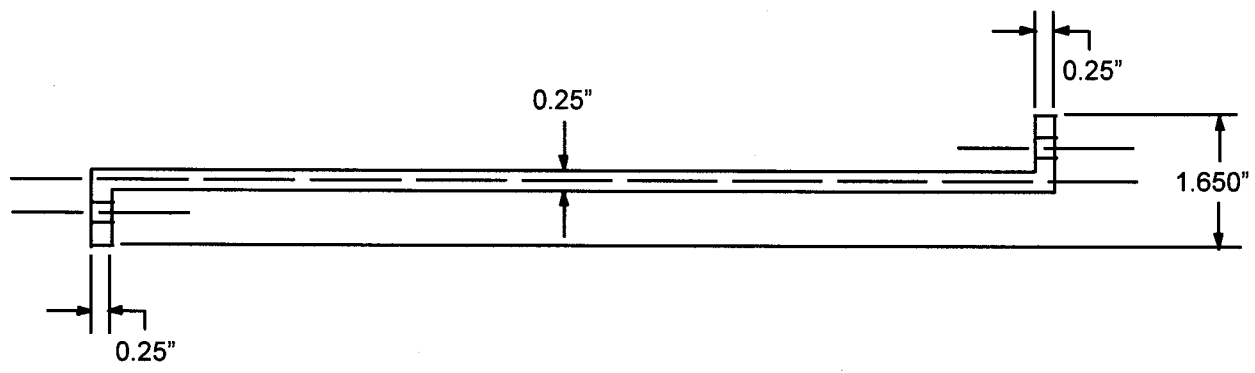


FIGURE 1. Schematic Diagram of Data Collection System





- Notes:**
- O.D. to Fit I.D. of 1 1/2" Pipe
  - 1 piece 2" pvc x 12" - 2 set screws thru one wall (top and bottom)
  - 1 piece 1 1/2" pvc x 12" - Bore to 1.650 for 1/4" one End

**Material Lucite**