# Compost Aeration Floors – *The Foundation of Aerated Compost System Design*

Inventive minds have come up with an amazing number of variations to channel air through a floor and into, or out of, a compost pile. Designs that have been based on sound engineering calculations and experience have generally worked. However, since all aeration floors are constrained by physics and Murphy, the floors that were less rigorously designed have not faired well.

The characteristics by which compost aeration floors should be evaluated are:

- Uniformity of air distribution
- Capital cost
- Durability
- Operational Cost
- Safety
- Functionality as a floor drain

## The Physics

Some *mal-distribution* of air flow in aeration floors is guaranteed since air flowing through any confined space loses pressure due to frictional losses. It turns out that the mechanisms of this frictional loss are non-linear, somewhat counter-intuitive, and, on close inspection, complicated; some very smart engineers with crew-cuts and slide rules have spent careers characterizing the physics of channeled air-flow. At the simplest level we can say that as air flows down a pipe it looses pressure. If that pipe is perforated, we can be assured that the pressure forcing the air through those orifices will vary along that length, and therefore the flow through the orifices will vary as well. The extent of the flow variations amongst the orifices is the mal-distribution.

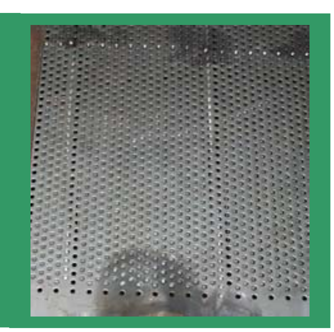
Broadly speaking, the only method the aeration floor designer has to minimize mal-distribution is to make the distribution frictional losses “small” in relationship to the combined frictional losses at the orifices and through the compost pile (compost pile frictional losses are notoriously overestimated). This means that a suspended aeration floor with tiny high speed orifices over a huge plenum volume of slow moving air would be great; except when it came time to pay for it.

In the spectrum of aeration floors designed from basic principles we see at one end the “sparger” type design that relies on very high orifice pressure (few holes spread far apart), and on the other end designs with very low speed air flows through the distribution channels and low orifice pressure loss. There are also designs that try to balance these two effects and operate at medium pressures. These designs can be classified as High, Medium, and Low Pressure; examples of each are shown below.

**High Pressure**

**Medium Pressure**

**Low Pressure**



## Cost, Durability, and Operational Considerations

Below is a table that attempts to evaluate and compare different aeration floor designs that are assumed to be competently designed to minimize mal-distribution. This analysis is by necessity generalized, but some helpful definitions and ranges can be given. For example: High pressure systems generally operate between 10-30 static inches; Low pressure systems often run between 1-4 static inches; Medium generally operate between those ranges. Energy costs follow pressure ranges. The O&M costs for above grade perforated pipe is considered high because it generally has to be handled each time a pile is built. High pressure aeration floors generally work well only in positive aeration since the orifices tend to plug in suction (negative); this also means they are not suitable for reversing aeration. **The right choice of aeration floor design will depend on your cost structure and your facility needs.**

| **Class** / Variation | Capital Cost | Durability | Energy Cost | O&M Cost# | Safety | Floor Drain Effectiveness | Negative Aeration |
|---|---|---|---|---|---|---|---|
| **High Pressure** | | | | | | | |
| Concrete In-Floor Sparger | High | High | High | Low | Excellent | Poor | Poor |
| Above-Grade Perforated Pipe (Long) | Medium | Low | High | High | Poor | None | Poor |
| **Low Pressure** | | | | | | | |
| Suspended Perforated Stainless Steel Floor | Very High | High | Low | Low | Good | Excellent | Excellent |
| ECS CompDog™ Pipe-less Floor | Low | Medium | Low | Medium | Good | None | Excellent |
| **Medium Pressure** | | | | | | | |
| ECS Standard Concrete In-Floor Trench | High | High | Medium | Low | Excellent | Excellent | Excellent |
| Above-Grade Perforated Pipe (Short) | Low | Low | Medium | High | Good | None | OK |

# Energy cost considerations not included