Ventilation Basics – How Do Your Pigs Feel?

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Purposes of Ventilation

- Control temperature and humidity
- Control dust and gas levels
- Provide adequate oxygen
- Provide optimal animal environment and worker comfort
The effective environmental temperature (EET) is the actual air temperature adjusted for effects of draft, flooring type, building insulation and supplemental cooling. The EET is what pigs really feel.

**Recommended Effective Environmental Temperature**

For Pigs

- **Too Cold**: Below 60°F
- **Comfort Zone**: 60°F to 85°F
- **Too Hot**: Above 85°F

*The effective environmental temperature (EET) is the actual air temperature adjusted for effects of draft, flooring type, building insulation and supplemental cooling. The EET is what pigs really feel.*
Factors Affecting *Effective* Environmental Temperature

<table>
<thead>
<tr>
<th>Environmental Factor</th>
<th>Change in EET (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft</td>
<td></td>
</tr>
<tr>
<td>30 ft/min (0.34 mph)</td>
<td>-7</td>
</tr>
<tr>
<td>90 ft/min (1.0 mph)</td>
<td>-13</td>
</tr>
<tr>
<td>300 ft/min (3.4 mph)</td>
<td>-18</td>
</tr>
<tr>
<td>Building insulation</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>-1</td>
</tr>
<tr>
<td>Moderate</td>
<td>-3</td>
</tr>
<tr>
<td>Poor</td>
<td>-13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Factor</th>
<th>Change in EET (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooring Type</td>
<td></td>
</tr>
<tr>
<td>Straw</td>
<td>+7</td>
</tr>
<tr>
<td>Lying mat</td>
<td>+5</td>
</tr>
<tr>
<td>Plastic coated wire</td>
<td>-7</td>
</tr>
<tr>
<td>Plastic slats</td>
<td>-7</td>
</tr>
<tr>
<td>Dry concrete</td>
<td>-9</td>
</tr>
<tr>
<td>Uncoated steel wire</td>
<td>-9</td>
</tr>
<tr>
<td>Wet concrete</td>
<td>-18</td>
</tr>
</tbody>
</table>

| Cooling Systems            |                    |
| Cool cells                 | -5                 |
| Fogger/mister              | -6                 |
| Drip coolers               | -10                |
| Sprinkler                  | -10                |
Measuring Temperature

- High/low thermometers
  - Know how to read!
  - Remember to reset!

Also remember to rely on the behavior of the pigs as an indicator of their comfort!!!
Temperature Probe Placement

- Temperature probes
  - Ensure proper placement
    - Near pig level
    - Not in front of inlet or heater
    - Not in PVC tube
Relative Humidity

- Goal: 50-70%
- Can be measured with a thermohydrometer
- Only measure when minimum ventilation is running
- May have probes attached to controllers
  - Probes do not last long in barn environments and are therefore inaccurate
Relative Humidity Effects

- RH too high
  - Condensation apparent on pipes, etc.
  - Increased bacterial load
  - Under-ventilation
- RH too low
  - Excess dust and gas levels
  - Increased LP costs due to over-ventilation
Ventilation Curve

- At lower temperatures, ventilation rate is based entirely on moisture control
  - This is when the minimum ventilation fans only are running
- After reaching the setpoint, ventilation is based on heat removal
  - Additional stages of fans turn on
Types of Ventilation

- Mechanical
  - Positive pressure
    - Force air into barn through distribution tube
  - Negative pressure/exhaust
    - Tunnel
    - Sidewall or attic inlets

- Natural
  - May also utilize circulation fans
Ventilation Changes With The Seasons

- Multiple ways to ventilate a single barn
  - Tunnel in hot weather
  - Natural in mild weather
  - Bring air through inlets in cold weather
- Minimum ventilation
  - Ventilate based on moisture removal
- Maximum ventilation
  - Ventilate based on heat removal
# cfm Requirements

<table>
<thead>
<tr>
<th></th>
<th>Cold Weather</th>
<th>Mild Weather</th>
<th>Hot Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sow &amp; Litter</td>
<td>20</td>
<td>80</td>
<td>500</td>
</tr>
<tr>
<td>Prenursery 12-30#</td>
<td>2</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Nursery 30-75#</td>
<td>3</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>Grower 75-150#</td>
<td>7</td>
<td>24</td>
<td>75</td>
</tr>
<tr>
<td>Finisher 150# +</td>
<td>10</td>
<td>35</td>
<td>120</td>
</tr>
<tr>
<td>Sows &amp; Boars</td>
<td>12</td>
<td>50</td>
<td>300</td>
</tr>
</tbody>
</table>
## Approximate Fan Capacity

<table>
<thead>
<tr>
<th>Fan Diameter</th>
<th>Approximate cfm</th>
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<tbody>
<tr>
<td>12”</td>
<td>2,000</td>
</tr>
<tr>
<td>18”</td>
<td>3,000</td>
</tr>
<tr>
<td>20”</td>
<td>4,000</td>
</tr>
<tr>
<td>24”</td>
<td>6,000</td>
</tr>
<tr>
<td>36”</td>
<td>10,000</td>
</tr>
<tr>
<td>48”</td>
<td>20,000</td>
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</tbody>
</table>
Fans Must Be Fully Operational

- Keep them clean
  - A layer of dust on the fan and louvers can decrease fan efficiency by 20%
- Keep motors and belts maintained
- Shield fans from prevailing winds
  - Decreased efficiency if fans must work against wind forces
Inlets Needed

- Place inlets no closer than 16 ft apart and no further than 24 ft apart
- Inlets should be no farther than 75 ft from the fan
- 1 ft² inlet for every ~800 cfm
- Ensure that airflow from inlets is not obstructed within the barn
- Airflow is dependant on inlet location, not fan location
Inlet Locations

- **Sidewall inlets**
  - OK for buildings up to 35-40 ft. wide

- **Ceiling inlets**
  - Required for sufficient air movement in wider barns
Effective Inlet Openings

- Remember that calculated inlet opening is often not equal to the effective inlet opening
  - Wire screens = 80%
  - Dirty soffits
  - Plugged soffits
Other Inlets

- Ridge vents
- Doors
- Holes in curtains
- Sagging curtains
- Cracks in walls
- Non-operational fans
- Pits
  - Especially if no dividers between rooms
Make Sure Natural Ventilation Is Not Obstructed

- Objects near a barn will block air movement for a distance of 3-4 times the obstacle’s height.
Inlet Air Velocity

- **Goal:** 800 – 1000 ft/min
- If too much inlet opening for current fan capacity, velocity will decrease
  - Air drops too soon and creates drafts on the pigs
- Want to have incoming air dump onto dunging areas in winter and sleeping areas in summer
Inadequate Inlet Openings

- Starved fans
  - Burn up fan motors
- Increased static pressure
  - Pressure difference between inside and outside the barn
  - Measured with a manometer
Static Pressure

- Goal: 0.04 - 0.1 in. water
- Static pressure directly related to inlet air velocity

<table>
<thead>
<tr>
<th>Static Pressure (in. H2O)</th>
<th>Air Velocity (fpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03</td>
<td>600</td>
</tr>
<tr>
<td>0.04</td>
<td>700</td>
</tr>
<tr>
<td>0.05</td>
<td>800</td>
</tr>
<tr>
<td>0.06</td>
<td>900</td>
</tr>
<tr>
<td>0.07</td>
<td>1000</td>
</tr>
</tbody>
</table>
Know Your Controller

- All are different
- Read the manual
- Variable stages
- Temperature curves
- Understand the settings
  - Bandwidth
  - Differential
  - Offset
Bandwidth

- Bandwidth = Temperature difference (in degrees) between minimum and maximum speed for variable speed fans
- Should always be at least 1°
- Set wider as pigs grow and cfm requirements increase
- Set higher in winter to allow barn time to respond to changes before activating next stage
Differential And Offset

- Used for single speed fans and heaters
- Differential = heater/fan run time (in degrees)
- Offset = # degrees heater goes off under setpoint or # degrees for fan to come on over setpoint
- Offset + differential = heater on or fan engages next stage
- Offset = heater turns off or fan turns on
Set point

Differential

Offset

Heat on

Heat off
Variable Stages

Temperature

Stage 1

Stage 2

Min.

Set Point

Bandwidth 1

Offset 2

Bandwidth 2

cfm
Preparing Barns For Winter

- **Cover fans**
  - Make sure to disconnect power supply first!
    - Unexpected warmer days may make the fan turn on and burn up the motor when covered.
- **Open baffles if changing from natural or tunnel ventilation to attic/sidewall inlets**
- **Clean all inlets**
- **Make sure heaters are working**
  and pilot lights are lit
Any Questions Or Comments?

THE END