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**SowBridge**
Proper Management and Maintenance of Cool Cells

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**Evaporative Cooling**

One Of The Most Neglected / Abused / Forgotten Pieces of Equipment on the Farm

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**Maintenance Objectives**

- Know What You Are Buying
- Water Requirements For Cooling
- Flushing and Bleed-off
- Cleaning Agents
- Building Requirements
- Pump and Cool Cell Sizing
- Evaporative Cooling Take Home Message

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**Know What You Are Buying**

- Type of Material (Paper / Resin)
- Manufacturing Process (Cutting the Material)
- Design Angle (15 X 45 or 30 X 30)
- Edge Coating (Coated or Painted)
Pad Quality

Seven Years Old

Six Years Old

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Poor Construction Methods

Smooth edges are essential for proper water flow

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45 degrees/15 degrees

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Weak Glue Joints

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Pad Types – Edge Coating

- Increases pad life - typically on the order of 2-3 years with good quality edge coating.
- Reduces Tattering for given pad age.

Pad Types

- 30° x 30° Flute Angle
- 15° x 45° Flute Angle

Pad Types – Add Water

- 30° x 30° Flute Angle
- 15° x 45° Flute Angle

Pad Types – Add Water and Airflow

- 30° x 30° Flute Angle
- 15° x 45° Flute Angle

New Product From Big Dutchman

- All Plastic Construction
- Similar to the 6-inch 45/15 degree pad in cooling potential

Water Requirements

- Flow Over The Pad
- Distribution Of Water Over The Pad
- Checking The Flow (Hand Method)
Water Requirements
Flow Over Pad

Recommended Flow
- 0.75 GPM / linear foot of system
- Example 70 ft. long system
  70 ft. x 0.75 GPM/ft. = 52.5 GPM

We need 52.5 GPM delivered over the pad in a 70 ft. long system at all times.

Water Requirements
Flow Over Pad

- 0.75 GPM/ft. is about 10 times the water that evaporates
- Why so much water?
  - Prevents streaking ensuring pad is fully wet
  - Flushes dust, feed, grass clippings, and debris out
    to make the pad last longer
  - Decreases fans work load
  - Maintains proper static pressure

Water Requirements- Flow Over Pad

- Lack of Flow will cause streaking which results in less efficient pad (higher house temperatures)

Minimum Water Column Height

- 1/8” holes - 4” spacing  Munters Acme
- 1/8” holes - 2 3/4” spacing  CoolAir
- 1/8” holes - 3” spacing  Cumberland
- 1/8” holes - 2” spacing  Cumberland Hired Hand
- 5/32” holes - 4” spacing  Choretime Aerotech

Measure the Water Height

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Water Requirements - Flow Over Pad

• The Bottom Line – When you place your hand on the face of the pad water should dribble off

Not Enough Water

A Good Flow of Water Across The Pad

Water Requirements - Flow Over Pad

• Cool cells over 60' long should use a center feed distribution system

Water Requirements - Flow Over Pad

• For much longer systems, over 70-80' long, it is typically less expensive to use two pumps rather than one large pump
• This also provides other benefits
  – Safety factor since loosing 1 of 4 pumps is much less likely to result in animal loss than loosing 1 of 2 pumps in hot weather
  – Easier to transition into evaporative cooling mode since you can run 2 of the 4 pumps to provide partial cooling
Water Requirements - Pump Placement

Flushing / Bleed-off of the Cooling System
Poor Water Quality Equates to Poor Pads

Bleed Off
- Bleed off water continuously
- Start with 1 gallon per hour per linear foot
- Example: A 30 foot Cool Cell would need to bleed off 30 gallons per hour.
- Formula for calculating bleed off rate
  \[ \text{GPH needed (In Minutes)} = \frac{60 \text{ min.} \times 5 \text{ gal.}}{\text{time to fill 5 gal bucket}} \]

Check PH On A Regular Basis
PH Should Be Between 6 & 8

Pad Maintenance
Salt build up from lack of bleed off ** Extreme Case **
Pad Maintenance
Lack of Bleed off - Soft Pad from High PH (PH 10.7 in this system)

No Water or Air Can Pass Through This Pad

Automatic Bleed-off Valve

Potential Hidden Problems Due To Lack Of Bleed-Off
- Evaporation potential several thousand gallons per day (3,000 to 12,000 gal.)
- Contaminate potential increases 5 to 10 fold
- In one month contaminates could increase 100 fold
- Contaminates precipitate on the surface of the pad
- Maintain PH levels between 6 and 8
- Algae Growth on the pads

Potential Hidden Problems
- Calcium and Magnesium are linked to Alkalinity problems
- Cal and Mag settle out and clogg Flues

Cleaning Agents
Check Manufacture’s Recommendations
Chlorine (Not Recommended)
Cleaning Agents

• Chlorine (Not Recommended by most cool cell Manufacturers)
• Follow the Manufacture’s recommendations for proper treatment
• When Calculating Disinfectant Dosages, use the following Formula.

Calculating Disinfectant Dosages

Dose Size (Fluid Ounces) = Desired PPM x Sump Capacity (Gallons)
Percent Active Ingredient x 78
Example:
Dose Size = 2 PPM x 250 gallon
5.25% x 78
Dose Size = 1.22 fluid oz.

Maximum Recommended Dosages

• Quaternary Ammonia 30 – 50 ppm
• Oxidizing Biocides 1-2 ppm
• Coppers Not Recommended
• Manufactures may recommend a different amount, use the lesser amount

Pad Maintenance
- Do not use Harsh Chemicals for Algae control

Chlorine – Backpack Sprayer Applied

Building Requirements

Pad Rooms
Tight Curtains
Tunnel Curtains

Pad Rooms / Dog Houses

• Need to Seal tightly so that all the incoming air enters through the cooling pad
• Ceiling installed
• Poured or Gravel Floor
Pad Rooms / Dog Houses

- Ideally the tunnel window should be the same size as the cooling pad
- At a minimum the tunnel window should be at least 80% of the pad height

Tunnel Curtains

- Need to seal tightly
- Flap at closure to prevent leaks

Pump Cool Cell Sizing

Water Requirements Flow Over Pad

- Pump Sizing - 70 ft. system requires 52.5 GPM "over the pad"
- When sizing the pump we must consider the pressure losses of the piping system.

Water Requirements Flow Over Pad

- Losses Include
  - 6-8' elevation
  - 8-10' of pipe
  - Strainer
  - Elbow or Tee
- Typically these Losses run around 15 – 20 ft total head pressure

Water Requirements Flow Over Pad

- So look for a pump that delivers the required flow rate at 15 – 20 ft. of head pressure
- From our 70 ft system example.
- Pump should deliver a minimum:
  
  52.5 GPM @ 15-20 ft. of head pressure.
### System Sizing – 6" Pad – system on each side of house

<table>
<thead>
<tr>
<th>CFM @ 0.05&quot; w.c.</th>
<th>4' Pad</th>
<th>5' Pad</th>
<th>6' Pad</th>
</tr>
</thead>
<tbody>
<tr>
<td>180,000</td>
<td>60</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>200,000</td>
<td>70</td>
<td>55</td>
<td>45</td>
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<td>220,000</td>
<td>75</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>240,000</td>
<td>80</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>260,000</td>
<td>90</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>280,000</td>
<td>95</td>
<td>75</td>
<td>65</td>
</tr>
<tr>
<td>300,000</td>
<td>100</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>320,000</td>
<td>110</td>
<td>90</td>
<td>75</td>
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</tbody>
</table>

Tank Kit
* Rounded up to 5' increment

#### Water Requirements – System Supply

From our Example House:
Assume House is located in Alabama.
Peak Evaporation Rate = 0.78 GPM / 20,000 CFM

\[
246,400 \, \text{CFM} \times \frac{0.78 \, \text{GPM}}{20,000 \, \text{FPM}} = 9.6 \, \text{GPM}
\]

We need to ensure our Wells (Water Supply) and Piping can supply a minimum of 9.6 GPM / house to ensure we don't have an issue with the systems running out of water in extreme Hot / Dry weather.

#### Water Requirements – System Supply

• Supply water requirements for 6" pad vary depending on Climate / Weather conditions

<table>
<thead>
<tr>
<th>Pad Efficiency</th>
<th>75%</th>
<th>75%</th>
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<tbody>
<tr>
<td>Dry Bulb (F)</td>
<td>90</td>
<td>105</td>
</tr>
<tr>
<td>Wet Bulb (F)</td>
<td>78.5</td>
<td>66</td>
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<tr>
<td>RH %</td>
<td>50</td>
<td>10</td>
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</table>

<table>
<thead>
<tr>
<th>Tunnel CFM</th>
<th>GPM</th>
<th>GPM</th>
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<tr>
<td>180,000</td>
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<td>11.0</td>
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<td>220,000</td>
<td>4.0</td>
<td>13.4</td>
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<td>280,000</td>
<td>4.7</td>
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<td>420,000</td>
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<td>25.6</td>
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<tr>
<td>460,000</td>
<td>8.3</td>
<td>28.0</td>
</tr>
</tbody>
</table>

#### Evaporative Cooling Take Home Message

Proper Amount Of Water
Algae
Scale

#### Pad Maintenance Highlights

• Run the recommended amount of water over the Pads
• Reduce Algae Growth
• Clean Distribution Pipe Holes on a regular basis
• Maintain bleed-off 1 gal / hr / linear foot of system
• Reduce the number of on/off cycles
• Check for Air Leaks in Cool Cell room
• Change filter on a regular basis
Where to Get More Information

• Aerotech - A Munters Company – Isaac Singletary
  http://www.aerotech-inc.com
• Auburn University – Jim Donald
  http://www.poultryhouse.com
• University of Georgia – Mike Carick -Brian Fairchild /http://www.poultryventilation.com
• University of Illinois – Bess Labs
  http://www.bess.uiuc.edu