Equipment Preventative Maintenance In A Swine Operation

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Maintenance Outline
Ventilation
- Fans (Air Pump)
- Evaporative Cooling Systems
- Vents and Louvers
- Curtains and Curtain Control Systems
- Equipment / Tools
- Troubleshooting

Introduction
- Maintenance is approached
  - “If it ain’t broke, don’t fix it”
- Preventive maintenance
  - Key to a smoothly running swine operation
- Farm age
  - More emphasis focused on necessary repairs

Question
Can you afford to hire someone to do all of your farm maintenance?
Some farm owners enjoy fixing equipment
Some farmers hire a repairman
Some farmers do not think it is that important
Problem Areas/Overlooked

- Most solutions
  - Basic
  - Overlooked
- We walk past them every day
  - Until we trip over them
- Analogy
  - Do Workers feed animals, clean pens and look for mechanical problems?

Fans
Air Pumps

Ventilation Systems

Fan Efficiency???

Replacing Worn Fan Belts

- Most neglected machine on the farm is the FAN
  - Clean occasionally
  - Seldom inspected
- Replacement of worn belts and pulleys are essential
  - Cool the swine (reduce stress)
  - Reduce humidity

Example

- Every summer the ambient temperature in the barn increases
  - Install bigger fans?
    - Not Practical
  - Proper maintenance of existing fans
    - Most cost effective method

Winter Ventilation

- Minimal ventilation requirements
- Conserve Heat
- Removal of Moisture
  - Decrease disease load on the swine
- Reduce overhead cost
**Explanation**

- Worn belt on a 48” fan
  - Wear into the pulley resulting in a loss of fan blade speed of approx. 50 rpm
  - Fan moving approx. 20% less air
  - A 20 or 25% loss in air could equal one fan at the end of a finisher to be turned off.

**Ventilation Maintenance of Fan Shutters and Blades**

- Routine cleaning on fan shutters and blades
  - Simple process / overlooked
  - Use air pressure or low pressure water
- Routine cleaning should be a high priority especially in summer months
  - Dirty shutters and blades could reduce the air moving capacity by 20 to 30 percent

**Clean Fans are More Efficient**

**Dust Accumulation Reduces CFM**

- Small amounts of dust could make a big difference in CFM output

**Correct Belt Height Not Worn Down Into The Pulley Reduced RPM**

**Reduction in Air Flow 20% Or More**

- Clean after every group

- Bearing Life Can be increased by cleaning

- Dust and Moisture cause Maintenance issues
Worn Belt / Pulley

Notice the belt depth in the pulley

Belt is worn and needs replacement

Brush off or clean with blower

**Figure Fan CFM's**

<table>
<thead>
<tr>
<th>Formula Square Feet of Fan</th>
<th>Formula Quantity of Air Produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area = 3.14 * Radius²</td>
<td>Q = A * V</td>
</tr>
<tr>
<td></td>
<td>V = Fan Size * fpm * 60</td>
</tr>
<tr>
<td></td>
<td>Q = CU * fpm * 60</td>
</tr>
</tbody>
</table>

**Example**: Summer Cooling of Gestation Barn

**Typical Farm**

- Size: 4 – 48” inch belt drive fans
- Total cfm: 4 x 23,000 = 92,000 cfm
- Summer Requirement
- Total Building: 92,000 cfm

25% Reduction in 92,000 cfm = 23,000 cfm

**Example**: Summer Cooling of Gestation Barn

**Corrected by routine cleaning**

- Evaporative cooling process can be greatly reduced on hot days
- Example shows a 25% reduction in fan efficiency
- Problem could nullify the air movement from one of the 48” fans (See example 23,000 cfm)

**Worn or Broken Belts Decrease Total CFM’s**

- Extreme spikes in temperature
- Reduced fan performance
  - Creates stress in swine
    - Decrease in production
  - Fan maintenance is closely associated with stress management
  - Increase stress on swine increases disease potential
**Good Replacement Belt**

- Easy to adjust
- One size fits all
- Will not stretch
- Take one link out after 100 hours of use

**New Belt**

**Worn Belt**

**Difference In Pulley Size**

Resembles A Worn Pulley

Example

3 inch pulley CFM Rate

Compare to a 2.7 inch pulley CFM Rate (Slide 30)

<table>
<thead>
<tr>
<th>Static Pressure</th>
<th>Air Moving Capacity</th>
<th>Tunnel Air Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00&quot;</td>
<td>22,000</td>
<td>525</td>
</tr>
<tr>
<td>0.05&quot;</td>
<td>22,700</td>
<td>504</td>
</tr>
<tr>
<td>0.10&quot;</td>
<td>21,000</td>
<td>480</td>
</tr>
<tr>
<td>0.15&quot;</td>
<td>20,300</td>
<td>451</td>
</tr>
</tbody>
</table>

3 inch pulley = 22,700 cfm at .05 static pressure

**Table 2**

2.7 inches

A reduction of 4,200 cfm or 19%

<table>
<thead>
<tr>
<th>Static Pressure</th>
<th>Air Moving Capacity</th>
<th>Tunnel Air Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00&quot;</td>
<td>19,800</td>
<td>440</td>
</tr>
<tr>
<td>0.05&quot;</td>
<td>18,500</td>
<td>411</td>
</tr>
<tr>
<td>0.10&quot;</td>
<td>17,100</td>
<td>380</td>
</tr>
<tr>
<td>0.15&quot;</td>
<td>15,300</td>
<td>340</td>
</tr>
</tbody>
</table>

2.7 inch pulley = 18,500 cfm at .05 static pressure
**Things To Remember**

- Pulley Alignment
- RPM’s / CFM’s
- Belt Wear / Tension
- Clean fan louvers
- Grease Fan Shaft ??
- Static Pressure

**Pulley Alignment**

Align
all 4
edges

Reduces
wear on
edge of
belt

Check
often

**RPM’s**

Check
new belt
and
compare
to old fan

**Fan Tachometer**

- Find Fan RPM at Maximum Output
- Check with Chart to Determine if Fan is Functioning Properly

**Manometer**

- Exhaust Fans Create a Partial Vacuum. The Manometer Tells How Much Vacuum.
  - Static Pressure
  - Magnehelic

**CFM’s**

Ammeter
Checks fan
fpm
Belt Tension

One half inch deflection

Belt Tension

Belt should roll on and be tight at 9:00 position

Reduced CFM’s

Defective Inlet, Inlet cannot open fully

Clean Works Better

Grease Fan

Do Not over grease breaks bearing seal

Fan Will Not Run

- Check Power to the unit
  - Use Multi-Meters
- Check Environmental Control
  - Replace front board
- Check Motor Capacitor
  - Use meter
  - Does the motor try to start
  - Exchange capacitor
  - Easy / Quick / Cheap
Multi-Meter

Inexpensive

Necessary Troubleshooting Tool

Training Required

Check Control

Motor Capacitor

Cheap fix

90% of our problems

Check Capacitor

Curtains and Cables

- Are curtains straight and level?
- Scheduled maintenance time for adjusting curtains?
- Cables breaking?

Fact

- The Reason for most cable breaking is
  - Not due to insufficient cable strength
  - Improper matching of cables to pulleys causes most of cable breakage
  - Improper installation
**Fact**

- Some curtain machines adjust curtain openings 100 times/day
- Cable is more flexible than a single wire
- Outside wires in a cable receive the most wear
- See the attached picture (Slide 50)

**Cable Break**

- Rotation around small pulley

**Fact**

- Cable is more flexible than single wire
  - Bending around a small pulley can cause stress and wear
- Larger cable pulley
  - Less likely to break
- Outside strands of cable
  - Most stress and wear

**Cable life can be increased by up to 13 times**
- By doubling the pulley diameter
- Properly align cables and pulleys
- Excessive stress on wires when cable and pulley are not aligned

**Proper Pulley and Cable Alignment**

*Figure 1*

- Cable in the center of the pulley

**Cables**

- The 7 X 19 Cable is more flexible
  - Can make sharper bends
  - Recommended pulley size 25 times diameter
- The 7 X 7 Cable is made for straight runs
  - Not as strong
  - Recommended pulley size is 42 times the diameter of the cable
Types of Cables

Figure 2

Minimum Pulley Diameter for Various Cable Types and Sizes

Table 3

<table>
<thead>
<tr>
<th>Cable Diameter</th>
<th>Minimum Pulley Diameter (inside diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/32&quot;</td>
<td>3 1/8&quot;</td>
</tr>
<tr>
<td>1/8&quot;</td>
<td>4 3/8&quot;</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>6 5/8&quot;</td>
</tr>
<tr>
<td>7/32&quot;</td>
<td>7 7/8&quot;</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>9 1/4&quot;</td>
</tr>
<tr>
<td>5/16&quot;</td>
<td>10 1/4&quot;</td>
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</tr>
<tr>
<td>3/8&quot;</td>
<td>10 1/4&quot;</td>
</tr>
</tbody>
</table>

Importance of a Tight House

- Correct Static Pressure maintained
  - Tunnel curtain (Bottom up Hard to seal)
  - Top down (Easier to seal)
- Reduced LP usage
- Less stress on swine
- Reduction in humidity
  - Proper air removal throughout the house

Questions

- Is someone on your farm trained to adjust curtain height and level?
- Can someone on your farm properly tie a curtain rope/string to a curtain cable?
- Are the curtain wind ropes tight?

Simple Task Must Be Done Correctly

Use Proper Weight

Weight must be heavy enough to pull cable and string
Tight Pockets

Routine pocket checks are essential

Curtain Ropes Loose

Possible static pressure problem

Heat Loss

Reduce Curtain/Curtain Pocket Leakage

- Leaking side wall curtains affect production
  - Increase in feed consumption to stay warm
- Reduction in Swine production
  - Disease problems

Draft?

Curtain short for the pocket

High energy loss

Air Flow Restriction

Check for proper seal

Leakage

Maintenance and Servicing of Swine Facilities
Level and Pull up Tight

- Keep curtains tied up, level and tight
- Sagging curtains can cause cold spots
  - Result in extreme stress
- Minor adjustments can help alleviate future health problems

Unplanned Openings

Curtain Drops

- How often do you check your curtain drops
  - Do all of them work?
- Do you have them hanging on a nail?
- Safety, Crank can break your hand
- Adjust properly

Very Important Piece of Safety Equipment

Always check for proper usage

Width of a quarter between the two pieces of metal
**Evaporative Cool Cell Efficiency -- Summer Maintenance**

- Maintenance is essential
  - Achieve peak performance
- Maintaining the pad surface
  - Regular observation
  - Routine cleaning

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**What does Algae need to grow**

- Sunlight
  - Shade the pad (increase the overhang)
- Moisture
  - Dry pad once every 24 hours
- Food
  - Very hard to limit (It’s everywhere, feed dust)

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**A combination of the following items could cause 15 to 20 percent reduction in pad effectiveness**

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**Preventive Maintenance Checklist**

- Replace system filters
  - Cover the sump
  - Change the filter regularly
  - Keep filter covered (paint black)
  - Discharge holes

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**Restriction Airflow**

- Check bleed off
  - If you have mineral deposit buildup
    - Bad water
    - Reduce mineral deposits from collecting and limiting water flow
      - Recommended rate .75 to 1 gal./hr./liner foot of pad
  - Flush the entire system
  - Recirculation water gets heavy with Minerals
You Have A Problem

- Salt
- Mineral Deposit

Check distribution pipe holes
- Clogged holes cause dry spots
  - Greatly reduce the cooling potential
  - Make sure holes in distribution pipe are turned upward
  - Check drain at the end of the line regularly

Check Drain

Clean Wire

Reduces air flow by 30 to 40 %

Typical Evaporative Cooling Problems

- Swine Unit
- Cool cells near feed bins/dusty feed/road dust accumulation on pad.
- Filter not changed until system slows.
- Distribution line holes are half stopped.
- Pads have not been washed.
- One third of the pad has dry spots.
Cool Cell Efficiency??

Using the wrong algae cleaner

Check and Clean Sump

Check and Clean

Use Proper Cleaning Products

This Product Is Not Recommended

Melts the glue in the pad

Check Screen

Clogged Drip Holes

Dry strips on pad
Dirty Pad Face

Example:
Pads efficiency reduced by 20%

<table>
<thead>
<tr>
<th></th>
<th>90°</th>
<th>75°</th>
<th>15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Bulb Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet Bulb Temperature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Clean Pad</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75% Efficient</td>
<td>11.25°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly Maintained Pad</td>
<td>9°</td>
<td>20% Less Efficient</td>
<td></td>
</tr>
</tbody>
</table>

• Potential for cooling swine in this farm is reduced by 2.25 degrees F
• Every little decrease in temperature helps on extremely hot days
• Prevent cooling system problems by properly maintaining the system

How Many Electrical/Mechanical Components Does a Farm Have?

• Maintenance has become a very big issue
  – Maintain farm production standards
  – Equipment malfunctions
    • Production slows or stops
    • People and animals get hurt
• How many electrical motors do you have?
  Example: a 3,600 sow unit has about 180 electric motors

Farm Electrical/Mechanical Component

<table>
<thead>
<tr>
<th>Number of Electric Motors</th>
<th>Light Switches</th>
<th>All Types of Relays</th>
<th>Fans direct</th>
<th>Fans with Belts</th>
<th>Feed systems</th>
</tr>
</thead>
</table>

• Many equipment repairs are minor and take very little time to fix
• Need skill and knowledge to perform operations successfully and safely
• Employees can be trained to complete these tasks
• More to managing a farm than just managing the swine
Energy Usage Due to Improper House Set Up and Ventilation Leakage

- It is imperative that air leakage is minimized
  - Broken vents
  - Rat holes
  - Torn curtains
- These can result in high L. P. gas bills
- Increased disease loads on swine

Vent /Baffle Adjustment

Small cracks due to cable adjustment

Unplanned Inlet

Small Hole, Big Problem

Minimum ventilation requirements should be designed to remove moisture from the air
- Due to unwanted inlets, room ventilation rate (cfm’s) must be increased
  - Static pressure
- Increase in cfm’s create higher energy cost
  - Check for leaks
  - Smoke the building to detect leaks inside

Check Large Air Patterns In Buildings

- Propane Insect Foggers
- Fill with Mineral Oil
- Large Amount of Smoke

Read Instructions

Stop air leaks
Doubles in size
Other Maintenance Areas That Have A Negative Effect on Swine Production

Safety First
Demands a High Degree of Respect
Training!! Training!! Training!!

Which one of these devices are used as over-current protection?

Do not let this be the weakest link in your circuit
Knowledge of Amp Draw is important on all Farms

Could cause a FIRE
Happens on the weekend
Possible Moisture Problem

Safety Problem
Electrical shock
Exposed wires

Easy to Replace
Potential Safety Problem

Guard

Disease Inlet?

Electrical Safety

Water funnel = Safety Problem

Take Home Message

It makes no difference if your business is big or small, or if you are comparing one farm to another, the bottom line is...

Can You raise a Pig cheaper than anyone else?

Proper Maintenance Can Help You Achieve That Goal

The Cost Of Farm Maintenance

- Upfront costs associated with maintenance
  - Training
  - Equipment
  - Tools
- Benefits far outweigh the initial cost

Proper Maintenance Can Help You Achieve That Goal
Swine farms must commit to a total farm production package
- Reduction in farm maintenance costs
- Maintain steady production
- Maintain safety procedures

Don’t Run Your Business Like This

Thanks To Mark Daughtry For Presenting This Information

Maintenance Training
If you have any questions about maintenance issues, or would like information about Poly Com interactive internet training at your site
Contact
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