美式猪舍环控的现场管理
On-site management of environ、mental control in American-style pigsties

10-18-2025

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一、环控系统的重要性
1. The importance of environmental control system

为什么环控通风是猪场的“生命线”
Why is environmental control and ventilation the "lifeline" of pig farmsFor the herd of pig

- 对猪群 "For the herd of pigs"
  I. 提供新鲜空气，排除有害气体 Provide fresh air and eliminate harmful gases
  II. 调节温度、湿度、减少热应激和冷应激 Adjust temperature and humidity, and reduce heat stress and cold stress
  III. 清除粉尘和病原微生物，保障动物健康 Eliminate dust and pathogenic microorganisms to ensure animal health
- 对生产 Regarding production
  I. 提高育肥猪日增重和饲料转化率 Improve the daily weight gain and feed conversion rate of fattening pigs
  II. 降低发病率和死亡率 Reduce the incidence rate and mortality rate
  III. 保障猪群生产性能的稳定 Ensure the stability of production performance of the pig herd
- 对投资 Investment
  I. 保护房舍结构，防止潮湿腐蚀；Protect the structure of the building to prevent moisture and corrosion;
  II. 是现代化猪场核心资产，直接影响投资回报率 It is a core asset of modern pig farms, directly affecting the return on investment

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二、环控系统的核心组成
II. Core Components of the Environmental Control System

1. 动力部分1. Power section
AC风机、EC风机 AC fan, EC fan
2. 进风部分2. Air intake section
顶进风小窗、侧墙进风板、幕帘、空滤器、行程开关
Top air intake small window, side wall air intake panel, curtain, air filter, travel switch
3. 控制部分3. Control part
环境控制器、温度/湿度探头Environmental controller, temperature/humidity probe
4. 降温/升温部分4. Cooling/heating section
水帘、滴水降温、地暖、空间加热器、加热伞、保温灯、热交换器
Water curtain, drip cooling, floor heating, space heater, heating umbrella, heat preservation lamp, heat exchanger

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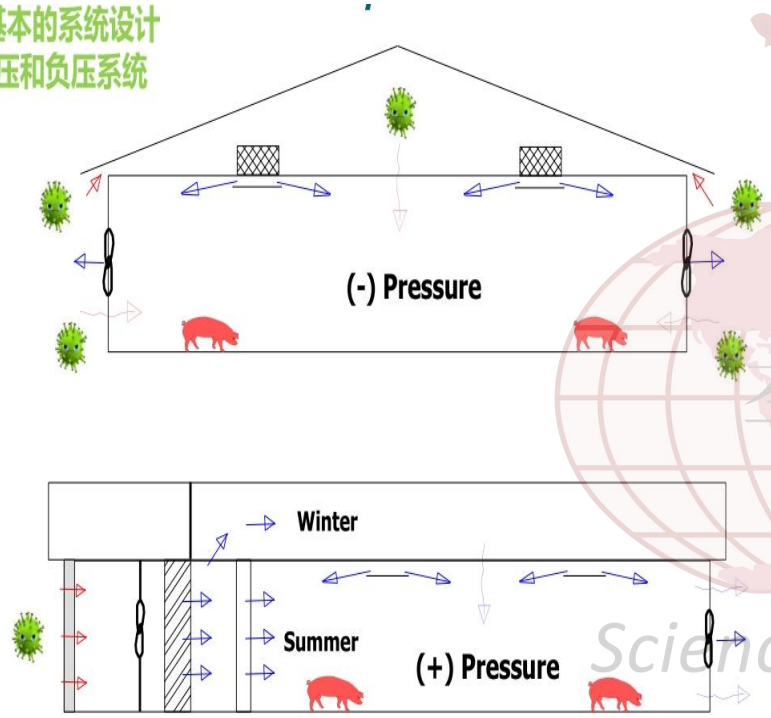
二、环控系统的核心组成
II. Core Components of the Environmental Control System

二、环控系统的核心组成
II. Core Components of the Environmental Control System

两种基本的系统设计
：正压和负压系统



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三、冬季和夏季猪舍环控运行策略
III. Operational strategies for environmental control in pigsties in winter and summer

季节	核心目标	通风模式	关键设备	管理要点
夏季	降温、除湿、最大通风 Cooling, dehumidification, and maximum ventilation	隧道通风、垂直通风 Tunnel ventilation, vertical ventilation	全部风机、水帘 All fans and water curtains	1.水帘水泵正常运行 2.检查水帘堵塞及漏水 3.确保风机百叶开启顺利、皮带紧绷 4.检查幕帘 1. The water curtain pump is operating normally 2. Check for blockage and leakage of the water curtain 3. Ensure that the fan louvers open smoothly and the belt is tight 4. Check the curtain
冬季	保温、保持空气清新、除湿 Heat preservation, maintaining fresh air, dehumidification	最小通风 Minimum ventilation	变频风机、进风口、加热器、局部保温设备 Variable frequency fan, air inlet, heater, local insulation equipment	1.应用环控器设置合适的最小通风级别 2.检查通风小窗的开口情况、测量出风口风速是否满足要求 3.设置加热器合理的启停温度 4.对温控探头及时检查 5.北方地区水帘测得密封保温 1. Set an appropriate minimum ventilation level using the environmental controller 2. Check the opening condition of the ventilation window and measure the air speed at the air outlet to see if it meets the requirements 3. Set reasonable start and stop temperatures for the heater 4. Conduct timely inspections on temperature control probes 5. The water curtain in the northern region is tested for sealing and insulation

四、日常巡检中常发现的问题
IV. Common problems found during routine inspections

1.温度	1. Temperature
2.静压	2. Static pressure
3.顶进风窗	3. Top inlet wind window
4.水帘	**4. Water curtain**
5.风机	**5. Fan**
6.随处可见的腐蚀	**6. Corrosion that can be seen everywhere**

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温度Temperature

温度并不仅仅是多少摄氏度的温度，而是“有效环境温度”，而是根据下列因素调整后的实际空气温度：

Temperature is not merely the temperature in degrees Celsius, but rather the "effective ambient temperature", which is the actual air temperature adjusted based on the following factors:

- 贼风 Harmful wind
- 地板类型 Floor type
- 湿度 Humidity

有效环境温度是猪在她所在层面实际感受到的温度，根据上述列出的因素上下调整的空气温度。

The effective ambient temperature is the temperature actually felt by the pigs on their respective levels, which is adjusted up or down based on the factors listed above.

温度探头应在猪的层面，但它们只告诉我们实际空气温度-而不是有效环境温度或猪的实际感觉。

Temperature probes should be placed at the level of the pigs, but they only tell us the actual air temperature - not the effective ambient temperature or how the pigs actually feel.

一个房间里至少应该有两个温度探头，大的房间里应该有多个探头。

A room should have at least two temperature probes, and larger rooms should have multiple probes.

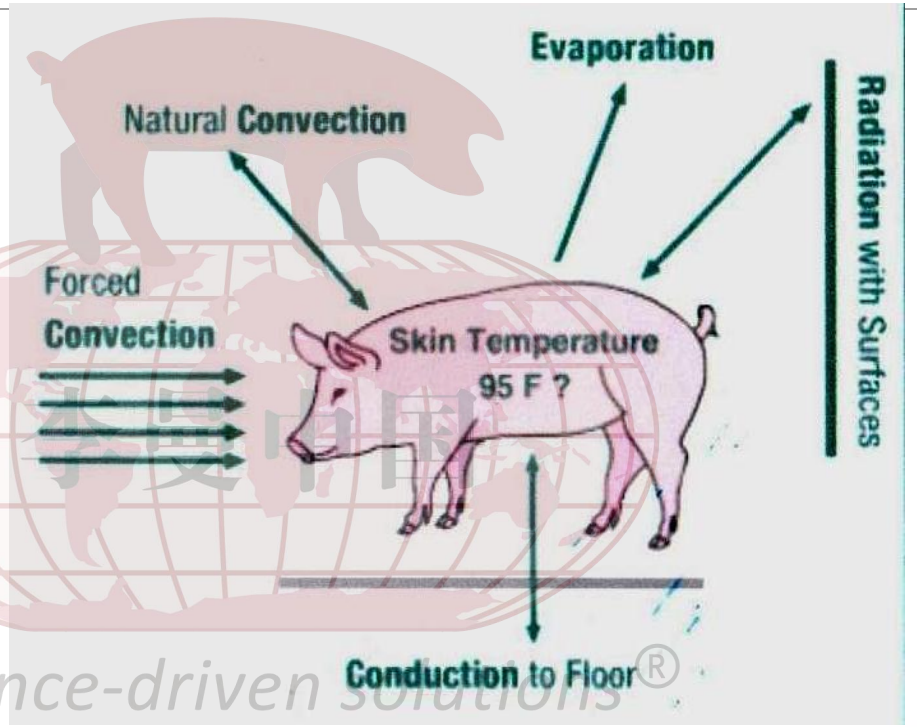
传热有四种基本形式There are four basic forms of heat transfer

传导 Conduction

对流 Convection

辐射 Radiation

蒸发 Evaporate



目标是在存在这些因素的情况下，最大限度地减少猪为维持其核心温度而消耗的能量。

The goal is to minimize the energy consumed by pigs to maintain their core temperature, given these factors.

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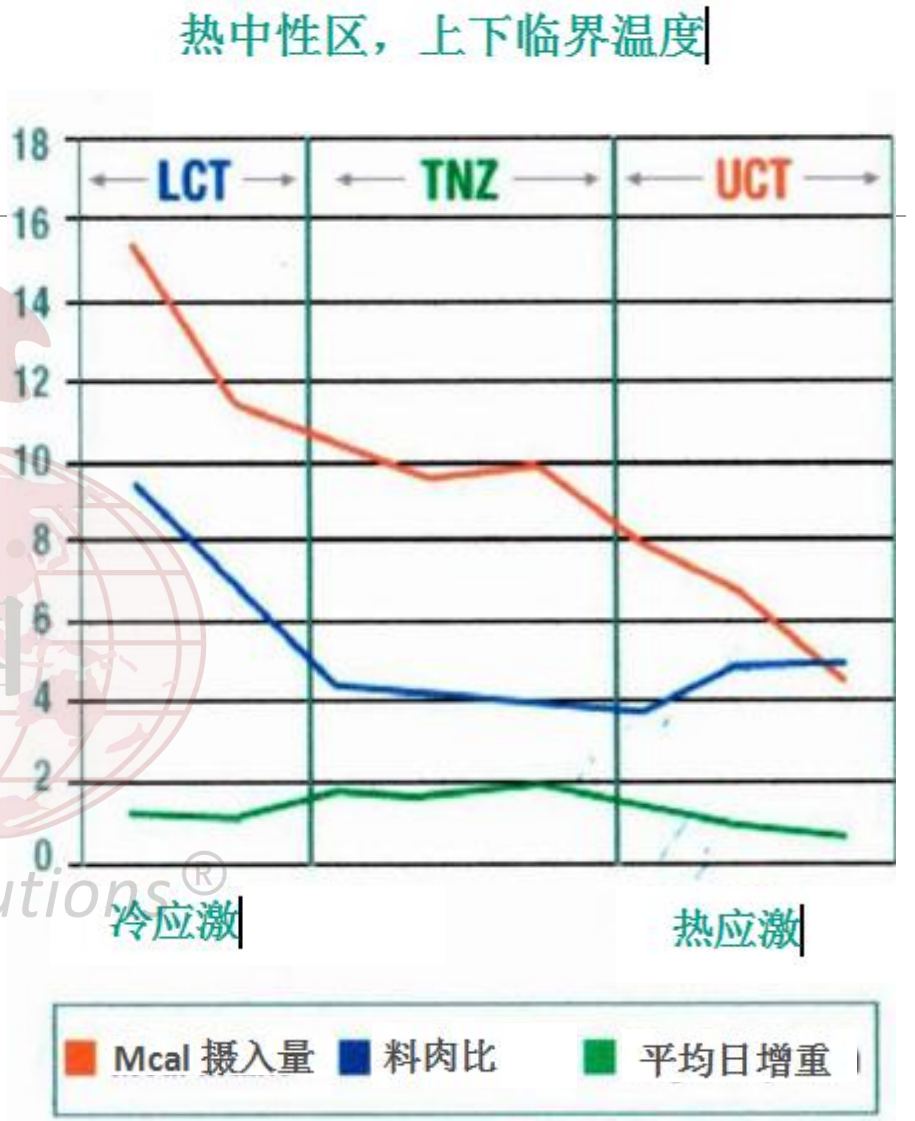
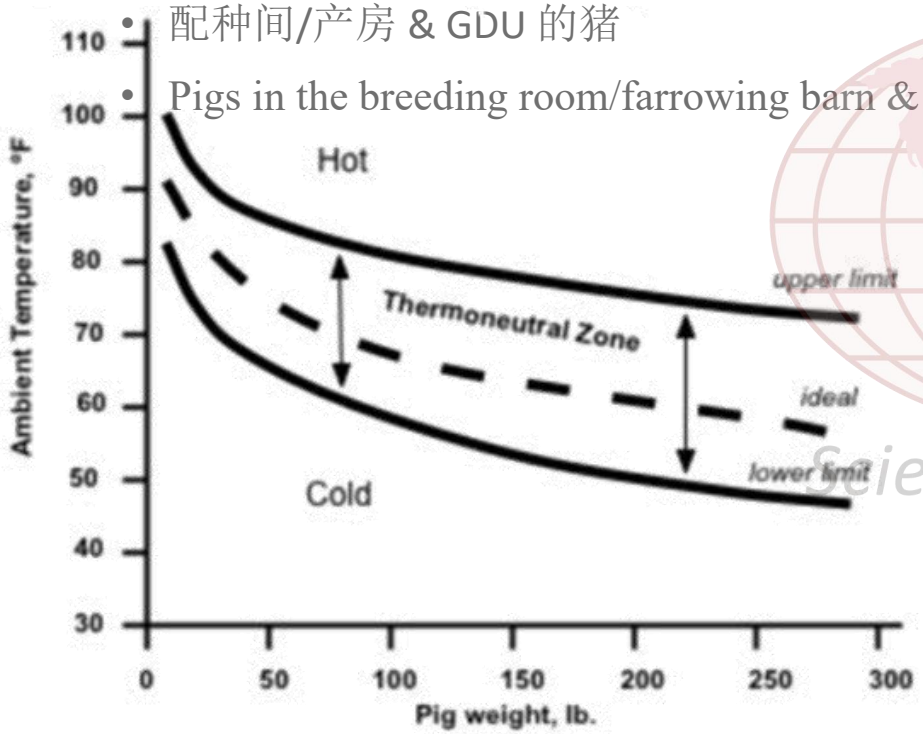
三个热量区域：Three thermal zones:

- 下临界温度区（LCT）Lower critical temperature region (LCT)
  增加饲料消耗，需要付出极大的努力来保持温度
  Increasing feed consumption requires great effort to maintain temperature
- 上临界温度区（UCT） Upper critical temperature region (UCT)
  抑制采食量，需要额外措施保持凉爽 To suppress feed intake, additional measures are needed to keep them cool
- 热中性区（TNZ）Thermal Neutral Zone (TNZ)
  生产效率最佳区 Optimal production efficiency zone



温度Temperature

- 根据不同生产要求，设定不同的温度/曲线
- Set different temperatures/curves according to different production requirements
- 配种间/产房 & GDU 的猪
- Pigs in the breeding room/farrowing barn & GDU



Adapted from Whittemore's Science and Practice of Pig Production 2006 Life Cycle Swine Production 1996

室温曲线指南			
建议设定值			
饲喂天数	断奶到育肥	双倍存栏	保育
0	27.8	27.8	27.8
7	26.7	26.7	26.1
14	25.6	25.6	25.0
28	23.9	23.9	23.4
67	19.5	18.4	20.0
105	17.3	17.3	N/A
133	16.7	16.7	N/A
155	16.7	16.7	N/A
165	18.4	18.4	N/A
175	19.5	19.5	N/A

静压Static pressure

- 静压是圈舍外的空气压力与圈舍内的空气压力之差，单位为英寸水柱。这是一种对风机运行带动空气穿过圈舍的困难程度的衡量， 也是对通过顶进风口进入舍内空气混合好坏的一个指示。在有风的日子，静压可能有波动，读数不准确。
- Static pressure refers to the difference between the air pressure outside the enclosure and the air pressure inside, measured in inches of water column. It serves as a measure of the difficulty level for fans to operate and drive air through the enclosure, as well as an indicator of the quality of air mixing entering the enclosure through the top air intake. On windy days, static pressure may fluctuate, leading to inaccurate readings.
- 在负压通风的圈舍，静压不应低于0.05英寸水柱（in.w.c），否则空气混合不良，风机幕罩将无法充分密封未运行的风机，从而会有未过滤得空气回流至圈舍的风险。
- In a barn with negative pressure ventilation, the static pressure should not be lower than 0.05 inches of water column (in.w.c), otherwise the air mixing will be poor, and the fan screen will not be able to fully seal the non-operating fan, thus posing a risk of unfiltered air flowing back into the barn.
- 达到良好空气混合的理想静压是0.10英寸水柱。
- The ideal static pressure for achieving good air mixing is 0.10 inches of water column.
- 当静压上升到0.20英寸水柱时，风机带出的空气减少，圈舍开始缺乏空气。
- When the static pressure rises to 0.20 inches of water column, the airflow generated by the fan decreases, and the enclosure begins to lack air.
- 造成高静压的常见原因：提供新鲜空气的阁楼空间或其他开口太小或太脏/被碎屑或绝缘挡块堵塞。进气口开的远远不够，无法匹配正在运行的风机数量。在过滤农场，初滤可能太脏限制了空气流动。
- Common causes of high static pressure: The attic space or other openings providing fresh air are too small or too dirty/blocked by debris or insulation blocks. The air intake is not open enough to match the number of fans in operation. In filtration farms, the initial filter may be too dirty, limiting air flow.

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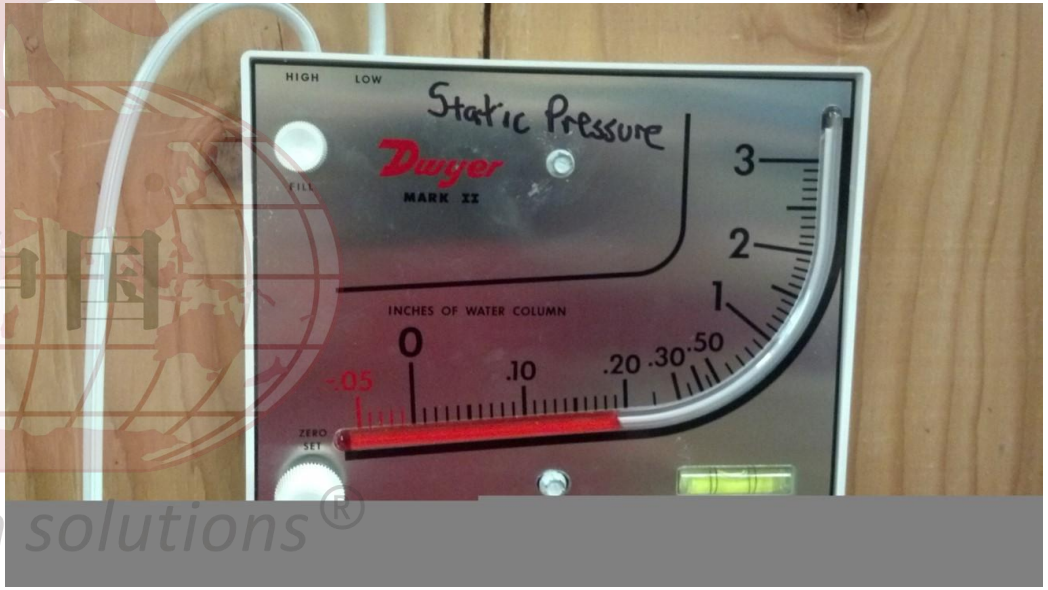
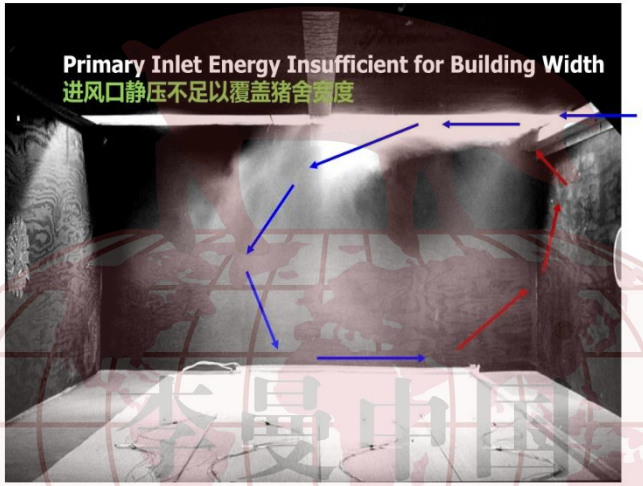
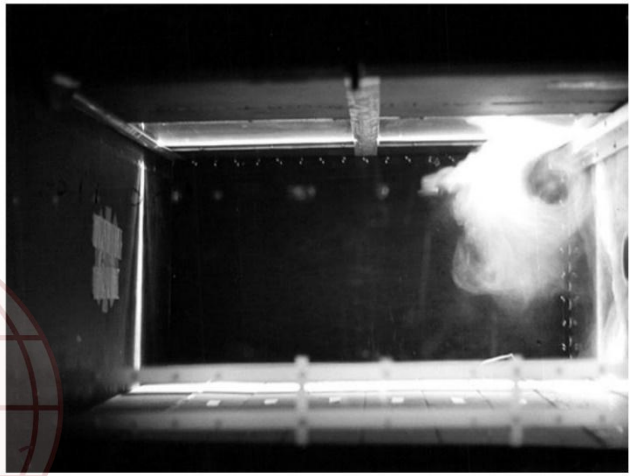
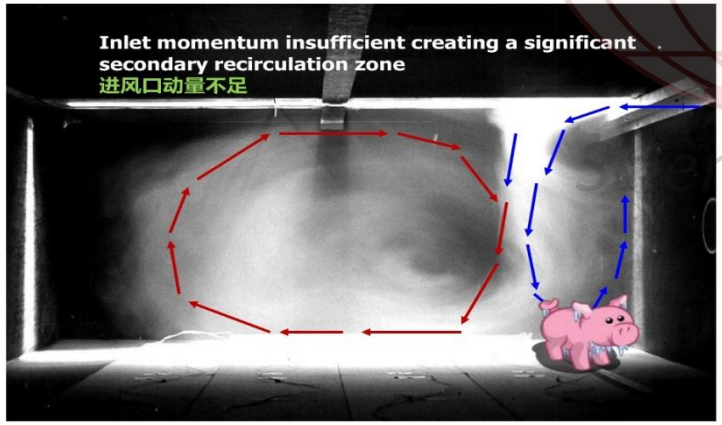
静压计（压差计）
Static pressure gauge (differential pressure gauge)

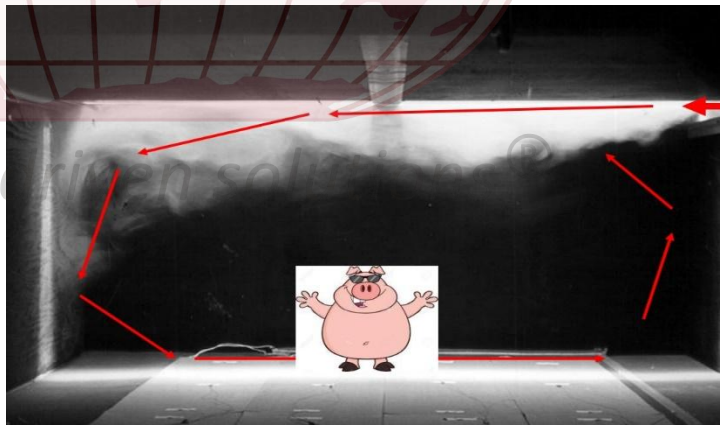


舍内静压的改变，对空气流的影响
The impact of changes in static pressure within the room on airflow









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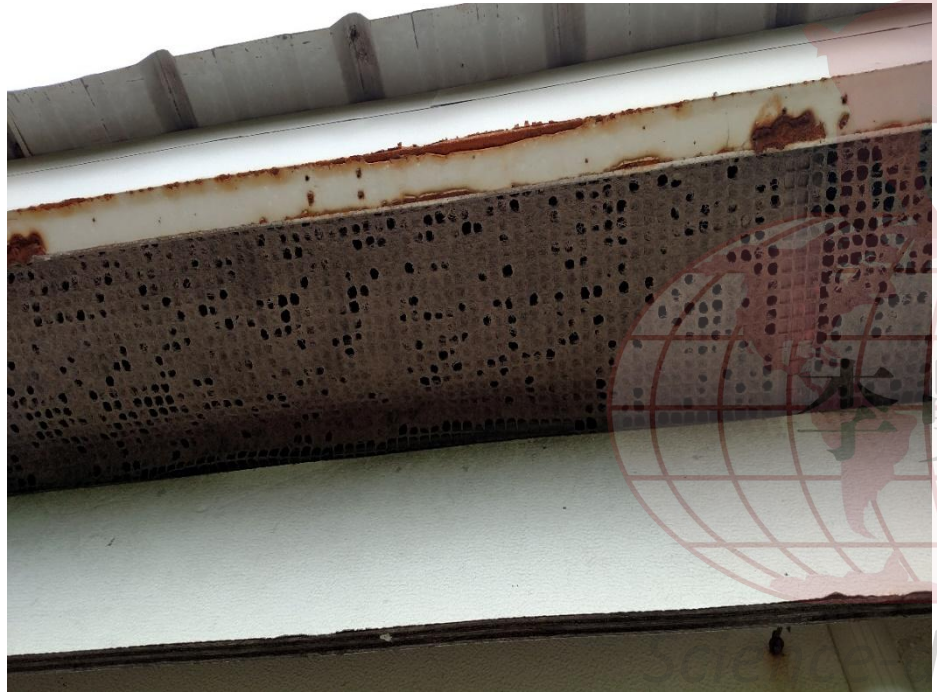

限制进风量的一些因素
Factors limiting the intake air volume

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顶进风口的管理
Management of top air inlets

1. 开口不一致
1. Inconsistent opening
2. 实际开口与环控器设置不符
2. The actual opening does not match the setting of the environmental controller
3. 行程开关损坏或弹簧变形
3. The travel switch is damaged or the spring is deformed
4. 小窗拉线断裂
4. The small window pull cord is broken
5. 夏季小窗闭合不严，热空气从顶直接进入猪舍
5. In summer, the small windows are not tightly closed, allowing hot air to enter the pigsty directly from the top

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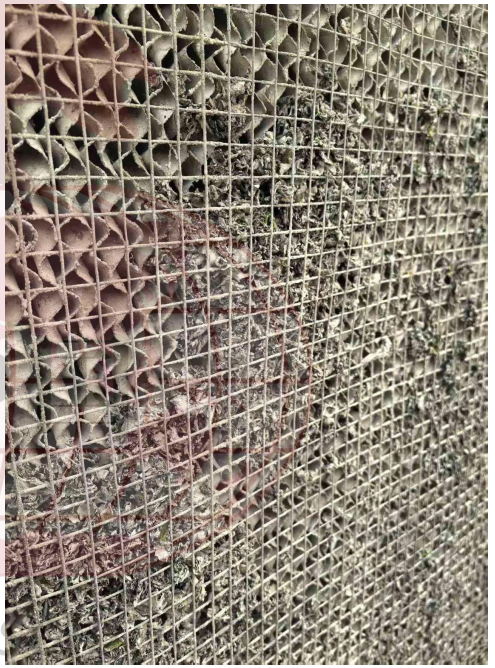
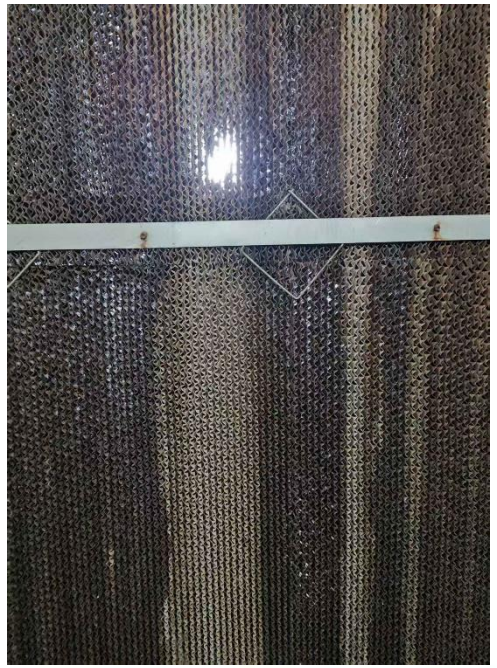
水帘的管理
Management of water curtain





1.水帘定期的清洗
1. Regular cleaning of the water curtain
2.幕帘无法完全下落，阻塞水帘的进风
2. The curtain cannot fully descend, blocking the air intake of the water curtain
3.水帘无法完全打湿
3. The water curtain cannot be fully wetted
4.水帘漏水
4. Water curtain leaking

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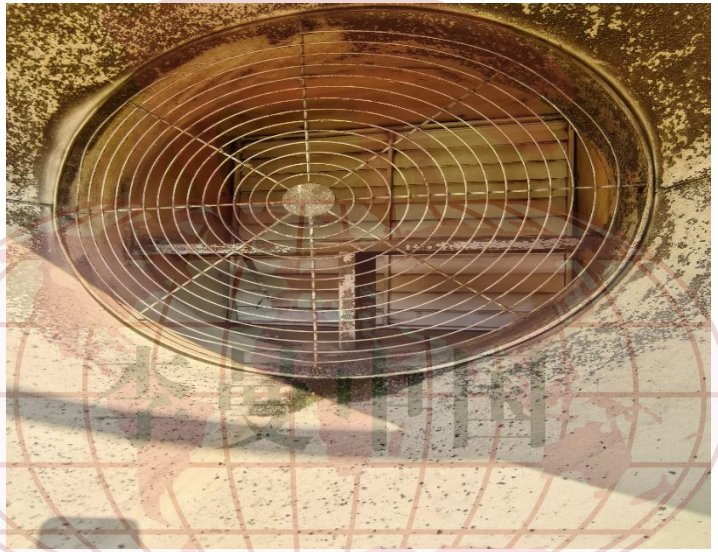
风机的管理
Management of fans



1. 风机皮带松动，风速值异常
1. The fan belt is loose, resulting in abnormal wind speed values
2. 风机异响，电机缺乏正常保养
2. The fan makes abnormal noise, and the motor lacks proper maintenance
3.百叶灰尘、百叶破损、百叶无法复位
3. Dust on the louvers, damaged louvers, and louvers that cannot be reset
4.变频风机异常工作
4. Abnormal operation of variable frequency fan

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随处可见的腐蚀
Corrosion can be seen everywhere

1. 出现生锈的情况，没有第一时间处理
2. The rusting issue was not addressed promptly upon its occurrence
3. 处置疫情，过度使用火碱等有强腐蚀性的产品消毒
4. In handling the epidemic, excessive use of strong corrosive products such as NaOH for disinfection
5. 圈舍没有定期进行清洗
6. The barn has not been cleaned regularly
7. 圈舍空置后没有进行定期通风
8. Regular ventilation was not carried out after the enclosure of barns

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五、冬季与夏季环控的要点总结
V. Summary of key points for environmental control in winter and summer

冬季环控的核心要素： **Core elements of winter environmental control:**

加热器供暖VS最小通风量

Heater heating vs. minimum ventilation

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事实上：我们必须在冬天开暖气来干燥室内的空气。
In fact, we have to turn on the heater in winter to dry the indoor air.
暖空气比冷空气具有更高的保湿能力。
Warm air has a higher ability to retain moisture than cold air.
温度每升高10℃，空气所能容纳和排出圈舍的水汽就会增加一倍。
For every 10℃ increase in temperature, the amount of water vapor that the air can hold and expel from the enclosure doubles.
我们通过运行加热器来加热空气。
We heat the air by operating the heater.
是的，你可以把圈舍关的足够紧，把风机调慢一些，这样加热器就不需要运转了。但是这样会造成环境恶劣、相对湿度高，并导致气体上升到阁楼，使屋顶钢和椽子修补板过早生锈。
Yes, you can close the enclosure tightly enough and slow down the fan, so that the heater doesn't need to operate. However, this will create a harsh environment with high relative humidity, and cause gases to rise to the attic, leading to premature rusting of the steel roof and rafter patching boards.

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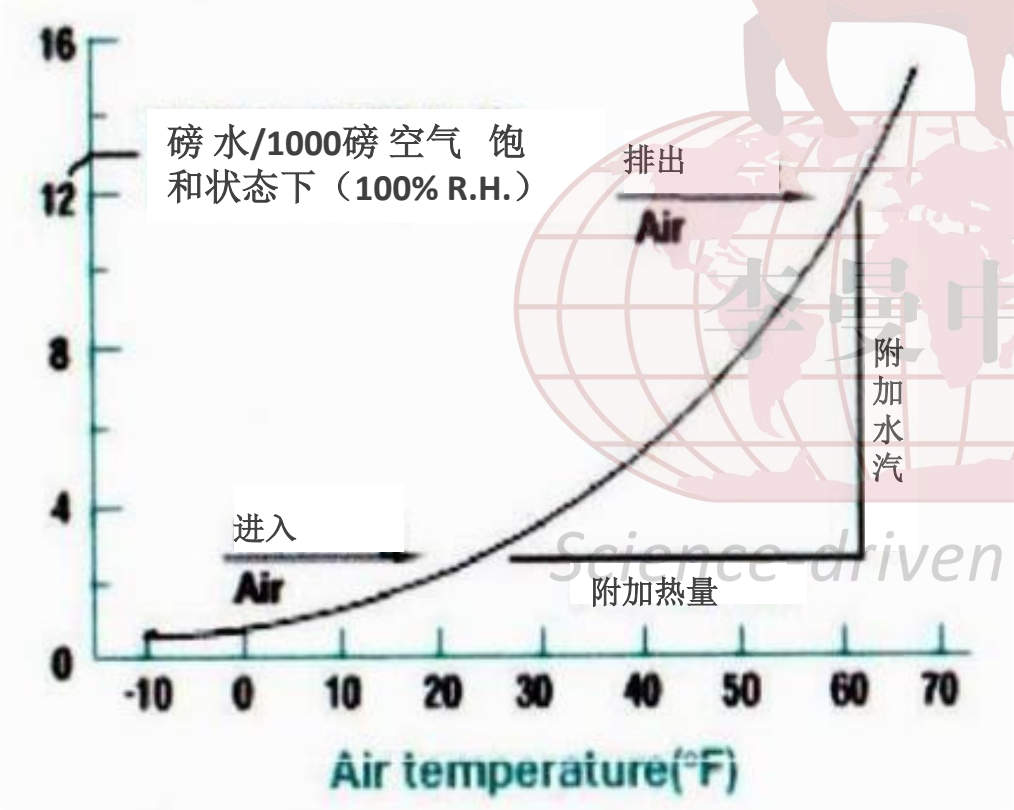
空气持水量

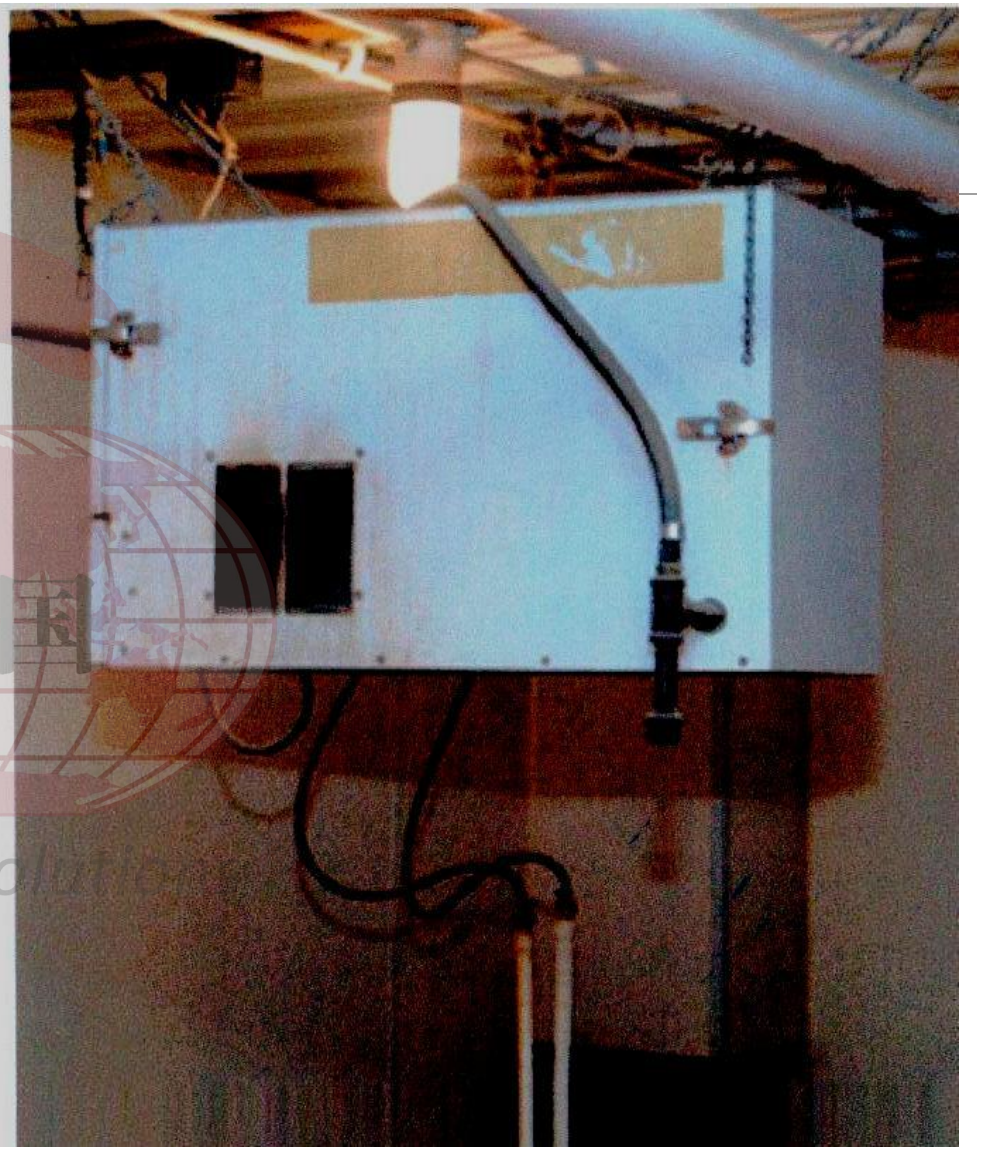


温度每升高 18℉，空气所能容纳的水汽就会增加一倍。进入的冷空气在被排出建筑物之前，经过升温并容纳更多的水汽。

For every 18°F increase in temperature, the amount of water vapor that the air can hold doubles. The incoming cold air is heated and can hold more water vapor before it is expelled from the building.

应调整加热器热量输出水平，使加热器“开启”多于“关闭”，从而减少温度波动并提高效率。
在一年中最冷的时间里，一个理想尺寸的加热器将持续运行，但能够保持理想的建筑温度。避免加热系统尺寸过大。

The heat output level of the heater should be adjusted so that the heater is "on" more than "off", thereby reducing temperature fluctuations and improving efficiency. During the coldest time of the year, a heater of an ideal size will operate continuously but still be able to maintain the desired building temperature. Avoid oversizing the heating system.



加热器设定目标Heater set target

1. 根据外界的温度设定不同的运行时间

1. Set different operating times based on the external temperature

2. 确保空间内每头猪都可以有适宜的CFM

2. Ensure that each pig in the space can have an appropriate CFM

3. 确保环境湿度不会太高

3. Ensure that the environmental humidity is not too high

加热器过量运行
Overload operation of heater

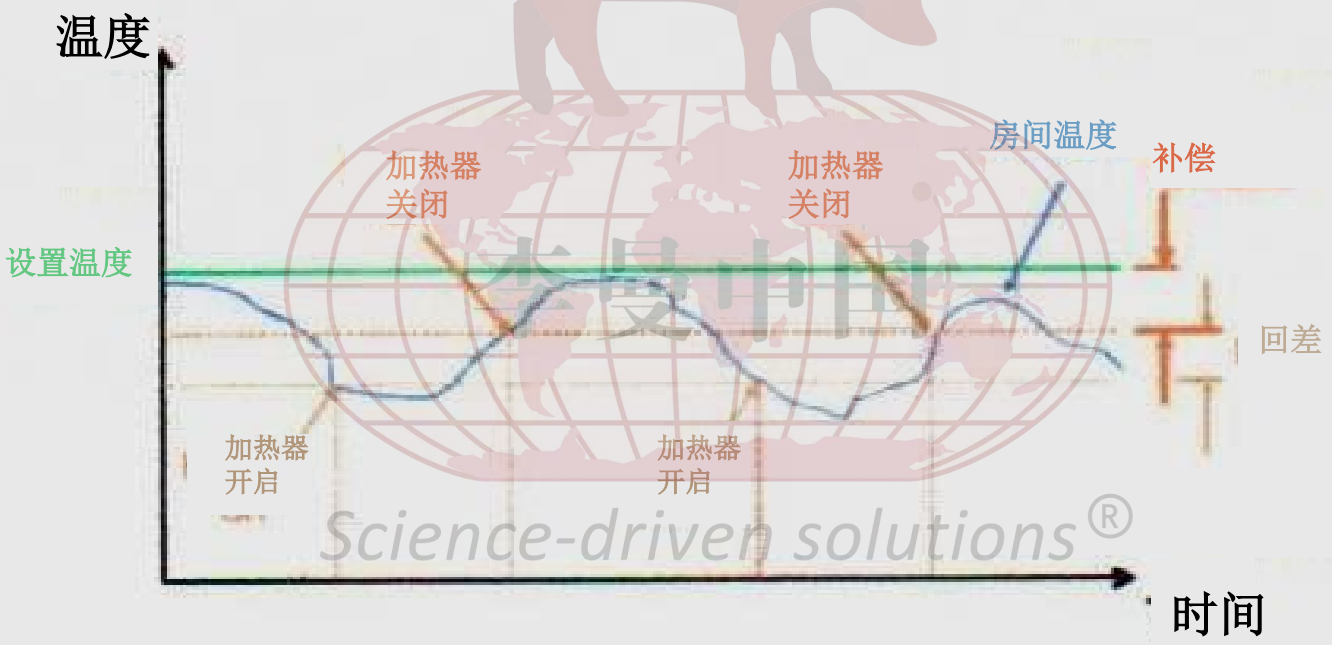
- 当加热器设置为关闭的温度太接近房间设定温度时，会出现加热器运行时间过长。
- When the temperature at which the heater is set to shut off is too close to the room's set temperature, the heater may run for an excessively long time.
- 加热器停止运行后，房间会继续升温。
- After the heater stops operating, the room will continue to heat up.
- 如果房间温度高于设定值，最小变频风机将加速运转冷却房间。
- If the room temperature exceeds the set value, the minimum frequency converter fan will accelerate its operation to cool the room.
- 当房间冷却并降至设定值以下时，加热器将再次启动并重复该循环。
- When the room cools down and falls below the set temperature, the heater will start up again and repeat the cycle.
- 这会导致房间内温度不均匀，寒冷天气下不必要的风机提速，冷风会使猪只受凉，还浪费燃气。
- This can lead to uneven temperature distribution in the room, unnecessary fan speed increases during cold weather, and cold air that can cause pigs to get chilled, all while wasting gas.
- 加热器通常应设置为低于设定值1.11℃关闭，但在某些情况下，如果加热器过大，则可能需要设置为低于设定值1.67℃或以上关闭。
- The heater should typically be set to shut off at 1.11°C below the set point, but in some cases, if the heater is oversized, it may need to be set to shut off at 1.67°C below the set point or even higher.
- 需要选择寒冷的一天，观察房间在加热器关闭后的升温程度，以正确评估加热器补偿需求。
- On a cold day, observe the temperature rise in the room after the heater is turned off to accurately assess the heater compensation requirements.

加热器补偿

Heater compensation

建立新的加热回差标准--通常2℉ （约1.11℃）

Establish a new heating return difference standard - typically 2°F (approximately 1.11°C)



最小通风Minimum ventilation

- 最小通风是指室温低于设定值时的通风量·
- Minimum ventilation refers to the amount of ventilation when the room temperature is lower than the set value
- 去除湿气、气体和提供氧气/新鲜空气需要最小通风。
- Minimum ventilation is required to remove moisture and gases, and to provide oxygen/fresh air.
- 最低通风太小=高湿度+空气闷热
- Insufficient ventilation = high humidity + stifling air
- 最低通风太大=通风过好，猪只受冷，浪费丙烷（燃气）。
- Too much ventilation = excessive ventilation, which can cause pigs to get cold and waste propane (gas).
- 东北地区的圈舍全年50%的时间以最小通风运行（冬季多，夏季少）。如果我们没有适当的最低通风量，我们有50%时间生产受影响。
- The livestock housing in the Northeast region operates with minimal ventilation for 50% of the year (more in winter and less in summer). If we do not have an appropriate minimum ventilation rate, our production will be affected for 50% of the time.

寒冷天气通风期间，适当的空气分布和混合至关重要。During ventilation in cold weather, proper air distribution and mixing are crucial.

目标是以4-5m/s风速通过进气口（(站在离进风窗2.3米的地方，可以感觉到风吹到脸上），进气口开太大有时是无法实现这个目标的。最好以0.10”的负压运行以得到最好的混合。

The goal is to achieve a wind speed of 4-5m/s through the air intake (standing 2.3 meters away from the air intake window, one can feel the wind blowing on their face). Sometimes, opening the air intake too wide makes it impossible to achieve this goal. It is best to operate with a negative pressure of 0.10" to achieve the best mixing.

实际上，试图达到4-5m/s可能会导致进气口处的空气阻塞，并且无法促使足够的空气进入房间。2.5-3m/s可能是我们能达到的最好的情况了。

Actually, attempting to achieve 4-5m/s may lead to air blockage at the air intake and prevent sufficient air from entering the room. 2.5-3m/s may be the best we can achieve.

在寒冷的天气里，每隔一个关闭一个进风口就可以帮助提高空气速度，并能够得到更好的混合。

In cold weather, closing one air inlet every other one can help increase air velocity and achieve better mixing.

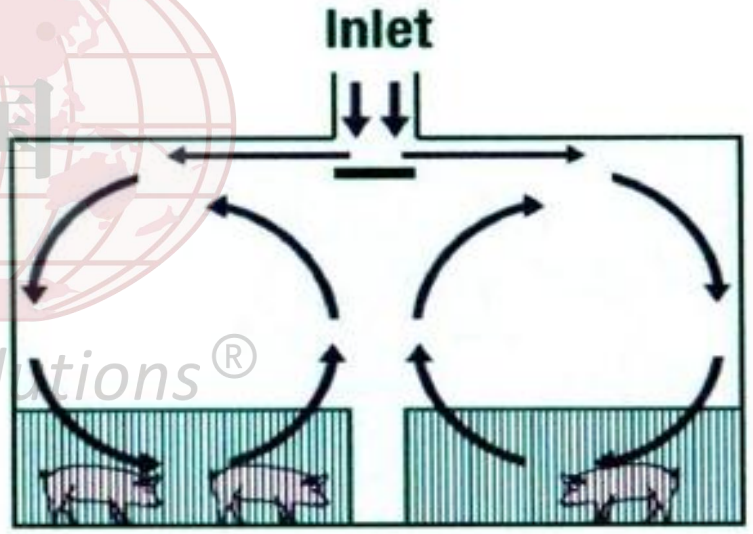
猪所在空间的适当空气分配：

Appropriate air distribution in the space where pigs are located:

- Form a uniform and planned air mixing 形成均匀有计划的空气混合
- Eliminate blind spots 消除死角
- Prevent thieves 防贼风

Appropriate airflow path: 适当的气流路径：

- Guide air to flow through the building along an appropriate route
  The airflow must be properly guided
- 引导空气沿适当的路线通过建筑物



气流必须适当引导

五、冬季与夏季环控的要点总结
V. Summary of key points for environmental control in winter and summer

夏季环控的核心要素：Core elements of environmental control in summer:

达到猪舍设计的最大风速+水帘/喷淋系统

Achieve the maximum wind speed specified in the pigsty design + water curtain/spray system

PIPESTONE SYSTEM

夏季通风Ventilation in summer

- 如果风机系统缺乏保养，风速的降低最高可达40%
- If the wind turbine system lacks maintenance, the reduction in wind speed can be as high as 40%

脏的风机风叶和百叶窗 Dirty fan blades and shutters

脏的房檐下部进气口 Dirty air intake at the lower part of the eaves

风机皮带松动 – 看起来风机比其他风机转的都慢 The fan belt is loose - it seems that the fan is rotating slower than the other fans

马达马力不足、异响 – 比其他风机都转的慢 Insufficient motor horsepower and abnormal noise - it runs slower than other fans

- 喷雾器和滴水器是通过蒸发作用起到给动物降温的目的。一般的循环时间设定为开2分钟/关20分钟（开启10%的时间，关闭90%的时间）
- The sprayer and dripper serve to cool down animals through evaporation. The general cycle time is set to be on for 2 minutes and off for 20 minutes (10% of the time is on and 90% of the time is off)
- 湿帘组件需要定期冲洗，用匀速的水冲洗组件，保证没有被矿物质沉积或脏物堵住
- The wet curtain components need to be periodically flushed with water at a constant speed to ensure they are not clogged by mineral deposits or dirt

夏季通风Ventilation in summer

- 在最大的通风条件下，通过进气口的空气混合仍然很关键-目标值每分钟0.10英寸水柱（in.w.c）的静压和进气口4-5m/s排出速度，尽管有时候你可能仅达到3m/s风速圈舍就不会缺乏空气。
- Under maximum ventilation conditions, air mixing through the air intake remains crucial - with a target static pressure of 0.10 inches of water column (in.w.c) per minute and an exhaust velocity of 4-5 m/s at the air intake. However, sometimes even if you only achieve a wind speed of 3 m/s, the enclosure will not lack air.
- 在夏季风机阶段或变频幅度通常会缩小，以便在炎热的一天到来之前更快地启动。
- During the summer wind turbine phase, or variable frequency range, the amplitude is usually reduced to facilitate faster startup before a hot day arrives.
- 无湿帘的圈舍的1.67℃规则：室内温度不得高于室外温度1.67℃。比如：室外29.44℃，室内不应超过31.11℃。
- The 1.67°C rule for barns without wet curtains: The indoor temperature should not exceed 1.67°C higher than the outdoor temperature. For example, if the outdoor temperature is 29.44°C, the indoor temperature should not exceed 31.11°C.
- 蒸发降温是我们用来给猪降温的一种方式，我们可以用喷雾器或滴水器湿润猪并蒸发干燥，或者通过使用湿帘来给进入的新鲜空气降温。
- Evaporative cooling is a method we use to cool down pigs. We can use a sprayer or a dripper to wet the pigs and allow the water to evaporate and dry them, or we can use a wet curtain to cool down the fresh air that enters.

PRINT

调整 EET

喷淋或滴水系统靠蒸发给猪降温。喷淋系统应：

使用大量水滴快速湿润猪只

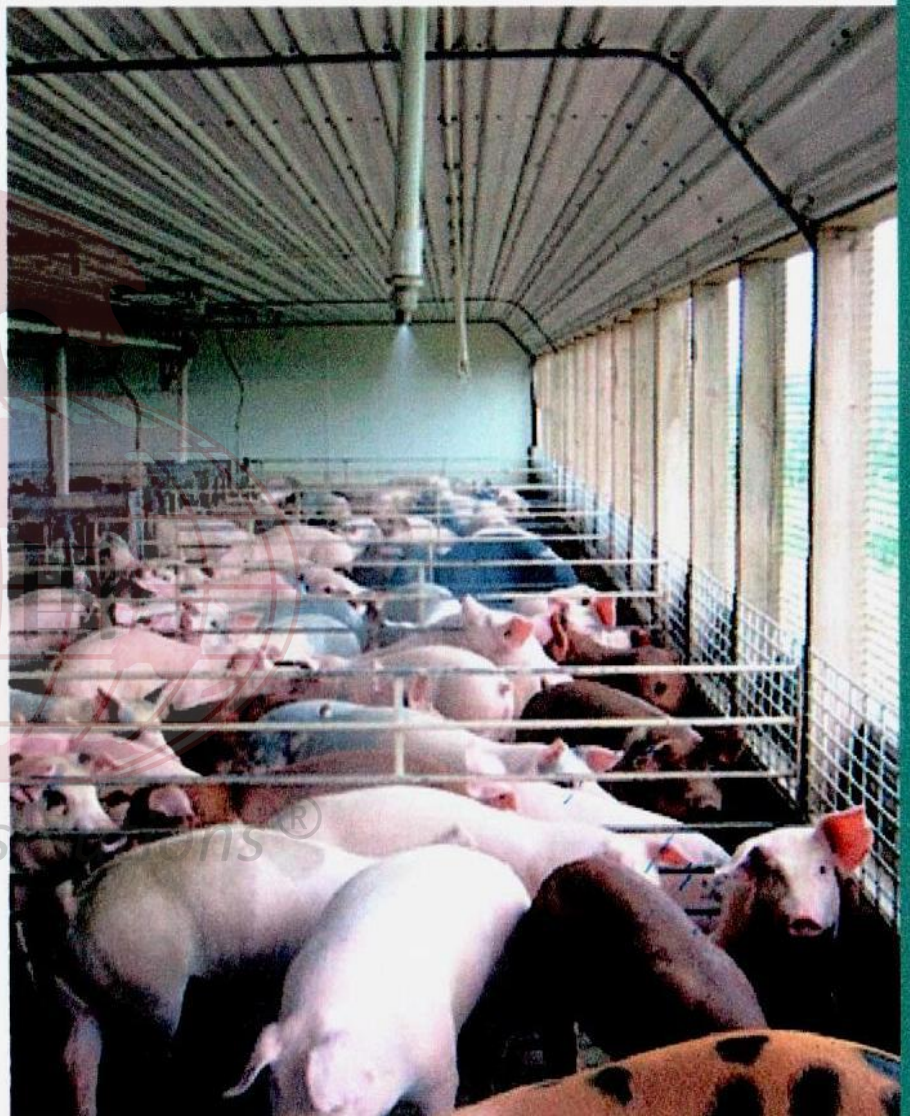
循环“开”足够长的时间，使猪湿润，

循环“关”足够长的时间，使猪干燥

增加空气流动以促进蒸发

蒸发的每磅水能带走大约 1050 BTUS 热量。

喷淋器应用于生长/育肥猪，滴水器应用于母猪。



不同相对湿度下湿帘的效率
Efficiency of wet curtain under different relative humidities

降温取决于进入空气的相对湿度，

如果进入空气的相对湿度超过

70% RH，则降低 5-10℉，如果

进入空气的相对湿度低于 55%

RH，则降低 15℉，

相对湿度对蒸发降温效率的影响

	Outside RH %		
	30	60	70
Outside Temp (°F)	Pad Exit Temp (°F) 80% efficiency		
76	62	66	70
84	67	73	78
92	73	79	85
100	79	87	93

湿帘指南Wet Curtain Guide

- 当外界相对湿度较低时，湿帘最有效。
- When the external relative humidity is relatively low, the wet curtain is most effective.
- 湿帘用水量大，必须加以管理。过多的水会限制空气流动，并会给供水系统带来压力。
- The water usage of wet curtains is significant and must be managed. Excessive water can restrict air flow and put pressure on the water supply system.
- 在所有的风机运行并达到完全通风后才应启动湿帘。通常，它们应该设置在25.56到26.67℃时启动。
- The wet curtain should only be activated after all fans have been operating and full ventilation has been achieved. Typically, it should be set to activate at temperatures ranging from 25.56 to 26.67℃.
- 除非湿帘配有旁通阀，能够允许你调节进入湿帘的水量，否则湿帘不该持续运行，而是应该循环开启和关闭。需要把湿帘打湿，然后在它们完全干涸前循环关闭并重新打开。好的起始设置是开启5分钟，关闭10分钟—观察并根据需要进行调整。
- Unless the wet curtain is equipped with a bypass valve that allows you to adjust the amount of water entering the wet curtain, the wet curtain should not be continuously operated, but should be cycled on and off. It is necessary to wet the wet curtain, then cycle it off and back on again before they are completely dry. A good starting setting is to turn it on for 5 minutes and turn it off for 10 minutes - observe and adjust as needed.
- 湿帘必须每天关闭1小时来完全干燥，以防止藻类在湿帘纸上生长。通常它们应该设置为每天早上5点到6点之间关闭。
- The wet curtain must be closed for 1 hour every day to fully dry, in order to prevent algae from growing on the wet curtain paper. Usually, they should be set to close between 5am and 6am every day.
- 每周冲洗顶部供水管以清除可能堵塞湿帘供水孔的碎屑，这点非常重要。注意水均匀地分布在湿帘墙上，直到最后。任何没有水的干燥区域都会让热空气进来。
- It is crucial to flush the top water supply pipe weekly to eliminate debris that might clog the water supply holes of the wet curtain. Ensure that the water is evenly distributed across the wet curtain wall until the end. Any dry areas without water will allow hot air to penetrate.

湿帘维护Wet curtain maintenance

- 每周冲洗一次顶部供水管—在炎热天气大量使用时更频繁。
- Flush the top water supply pipe once a week - more frequently during heavy usage in hot weather.
- 确保湿帘纸外表面没有草、杂草、污垢和藻类等碎屑。
- Ensure that the outer surface of the wet curtain paper is free of debris such as grass, weeds, dirt, and algae.
- 确保湿帘纸上没有干燥区域或条纹。如果有，冲洗并清理顶部供水管以确保均匀配水。
- Ensure that there are no dry areas or streaks on the wet curtain paper. If present, flush and clean the top water supply pipe to ensure even water distribution.
- 每周清空储水箱并重新注入干净的水（如果湿帘纸上堆积了矿物质，则更频繁）。
- Empty the water storage tank weekly and refill it with clean water (more frequently if minerals have accumulated on the wet curtain paper).
- 每周向每个储水箱添加1/4杯漂白剂（如果发现有藻类生长，则添加更多）。
- Add 1/4 cup of bleach to each storage tank every week (add more if algae growth is observed).
- 如果湿帘纸需要清洗，注意不要损坏它们。清洗后，清空并重新注满储水箱，以清除进入储水箱内的所有碎屑。
- If the wet curtain paper needs to be cleaned, be careful not to damage them. After cleaning, empty and refill the water storage tank to remove all debris that has entered the tank.
- 每天至少流出一个小时的时间不要让湿帘纸有水流过，以确保湿帘墙能干燥彻底，防止藻类生长。
- At least one hour per day should be set aside to prevent water from flowing through the wet curtain paper, ensuring that the wet curtain wall is completely dry and preventing algae growth.

夏季抱怨“空气流通不足”Complaining about "insufficient air circulation" in summer

提问：Question:

- 如果出问题的圈舍/房间有压力计，静压是多少？
- If the problematic enclosure/room has a pressure gauge, what is the static pressure?
- 是否所有的风机都在100%运行，所有的顶进风窗都打开，所有的拱腹门/幕帘打开后防鸟网干净？
- Are all fans operating at 100% capacity, are all top inlet windows open, and are all bird screens clean after the soffit doors/curtains are opened?
- 在最大通风条件下，室内空气温度与室外空气温度相比是多少？在炎热的天气里，一个通风良好的无湿帘圈舍不该比室外高出超过1.67℃的温度。比如：室外32.22℃—室内不应该超过33.89℃。
- Under maximum ventilation conditions, what is the temperature difference between indoor air and outdoor air? In hot weather, a well-ventilated enclosure without a wet curtain should not have a temperature higher than the outdoor temperature by more than 1.67°C. For example, if the outdoor temperature is 32.22°C, the indoor temperature should not exceed 33.89°C.
- 最大通风条件下通过进气口的气流是多少米/秒？应为4-5m/s，以实现良好的空气混合。
- What is the airflow rate through the air intake under maximum ventilation conditions? It should be 4-5 m/s to achieve good air mixing.
- 如果是过滤农场，预过滤器和主过滤器处于什么状态？
- If it is a filtration farm, what is the status of the pre-filter and main filter?

建议通风率Suggested ventilation rate

母猪和仔猪（分娩舍）=20 cfm冬季低温；80 cfm适中；500-700cfm夏季高温
Sows and piglets (parturition shed) = 20 cfm for low temperature in winter; 80 cfm for moderate temperature; 500-700 cfm for high temperature in summer

配种舍=15 cfm 冬季低温；50 cfm 适中；300 cfm 夏季高温
Breeding shed = 15 cfm for low temperature in winter; 50 cfm for moderate temperature; 300 cfm for high temperature in summer

保育猪=3 cfm 冬季低温；15 cfm 适中；35 cfm 夏季高温
Conservation pigs = 3 cfm for low temperature in winter; 15 cfm for moderate temperature; 35 cfm for high temperature in summer

生长猪=7 cfm 冬季低温；24 cfm 适中；75 cfm 夏季高温
Growing pigs = 7 cfm for low temperature in winter; 24 cfm for moderate temperature; 75 cfm for high temperature in summer

育肥猪=10 cfm 冬季低温；35 cfm 适中；120 cfm 夏季高温
Fattening pigs = 10 cfm for low temperatures in winter; 35 cfm for moderate temperatures; 120 cfm for high temperatures in summer

妊娠猪=12 cfm 冬季低温；40 cfm 适中；150 cfm 夏季高温
Pregnant pigs = 12 cfm for low temperature in winter; 40 cfm for moderate temperature; 150 cfm for high temperature in summer

注：对于过滤和双百叶窗墙，我们发现可能需要将最小通风比例提高2倍，来确保空气质量并防止倒流现象发生。
Note: For filtering and double louvered walls, we have found that it may be necessary to increase the minimum ventilation ratio by 2 times to ensure air quality and prevent backflow.

不同尺寸的风机通风量是多少？
What is the ventilation volume of fans of different sizes?

有各种类型的的风机，请参阅讲义-bess实验室数据。
There are various types of wind turbines. Please refer to the handout - BESS Lab Data.
一般规则：General rules:
14寸风机～2000 立方英尺/分钟
14-inch fan ~ 2000 cubic feet per minute
18寸风机～3500 立方英尺/分钟
18-inch fan ~ 3500 cubic feet per minute
24寸风机～6000 立方英尺/分钟
24-inch fan ~ 6000 cubic feet per minute
36寸风机～10000 立方英尺/分钟
36-inch fan ~ 10,000 cubic feet per minute
54寸风机～25000 立方英尺/分钟
54-inch fan - 25,000 cubic feet per minute

出入口气流计算
Airflow calculation for inlet and outlet

第一步：用风速计测量出入口的风速。
Step 1: Measure the wind speed at the inlet and outlet using an anemometer.
第二步：测量进风窗的长度（双流进风窗的两侧）
Step 2: Measure the length of the air intake window (both sides of the dual-flow air intake window)
第三步：测量进风窗开口（宽）。
Step 3: Measure the opening (width) of the air intake window.
第四步：计算进风窗开口面积（平方英尺）。
Step 4: Calculate the opening area of the air intake window (square feet).
第五步：通风量（cfm）=速度（fpm）*开口（sqr ft)
Step 5: Ventilation rate (cfm) = Velocity (fpm) * Open area (sqr ft)
示例：开口1.5英寸，18英寸长的进风窗，风速为1000fpm，
Example: An intake window with an opening of 1.5 inches and a length of 18 inches, with a wind speed of 1000 fpm,
进风窗通风量=1000 x ((18 x 2 x 1.5)/144) = 375 cfm
Ventilation volume of the intake window = 1000 x ((18 x 2 x 1.5)/144) = 375 cfm

报警测试和设置
Alarm testing and setting

- 按照“每周报警测试日志”上的说明每周测试报警系统，至关重要。
- It is crucial to test the alarm system weekly according to the instructions on the "Weekly Alarm Test Log".
- 每周测试农场的不同区域。每月应该通过断开警报电源进行一次电源故障测试。
- Test different areas of the farm weekly. Conduct a power failure test by disconnecting the alarm power supply once a month.
- 确保测试运行，直到警报成功打出电话—这是确保电话系统正常工作的唯一方法。
- Ensure that the test runs until the alarm successfully makes a call - this is the only way to ensure the phone system is functioning properly.
- 低温报警应设为低于设定温度3.89℃。
- The low temperature alarm should be set to 3.89°C below the set temperature.
- 高温报警设置将随季节而变化：在冬季应设置为高于设定温度5.55℃；在夏季，设置需要提高到高于设定温度11.10-13.88℃。
- The high temperature alarm setting will vary with the seasons: in winter, it should be set to be 5.55°C higher than the set temperature; in summer, the setting needs to be increased to be 11.10-13.88°C higher than the set temperature.
- 在冬季，降低高温警报是非常重要的，因为在室内温度达到设定值以上11.10或13.88℃之前，可能会发生窒息。
- In winter, it is crucial to lower the high temperature alarm, as asphyxiation may occur before the indoor temperature reaches 11.10 or 13.88°C above the set value.
- 每个圈舍/房间应该至少有一个备用调节器（温度自动调节器），以便在通风控制器故障时开启风机。应至少每月对其进行一次测试，以确保其正常运行。
- Each enclosure/room should have at least one backup regulator (automatic temperature regulator) to activate the fan in case of a ventilation controller malfunction. It should be tested at least once a month to ensure its proper functioning.

环控管理的心得体会

Insights and reflections on environmental control management

- 实际上计算出的设置值并不总是等于实际通风。
- In fact, the calculated setting value does not always equal the actual ventilation.
- 必须始终看和感受以确保良好的通风/空气质量。看分娩舍的仔猪，看小窗实际开口与风机阶段，感受空气，不止是过道的空气，还有猪所在区域的空气。保证良好空气混合的4-5米/秒进气口风速目标，然而依据进气口的大小（型号），可能无法实现这一点，尤其是在最小通风条件下。3米/秒可能是你能达到的最好风速了。关键是让流经天花板的空气尽可能多的混合。最小通风条件下的静压应该在0.05英寸水柱和0.10英寸水柱之间。cfm=风速*小窗开口面积
- It is essential to constantly observe and feel to ensure good ventilation/air quality. Observe the piglets in the farrowing shed, check the actual opening of the small windows and fan stages, and feel the air, not just the air in the aisles, but also in the area where the pigs are located. Ensure a target air inlet velocity of 4-5 m/s for good air mixing. However, depending on the size (model) of the air inlet, this may not be achievable, especially under minimum ventilation conditions. 3 m/s may be the best velocity you can achieve. The key is to allow as much mixing of air flowing through the ceiling as possible. The static pressure under minimum ventilation conditions should be between 0.05 inches of water column and 0.10 inches of water column. cfm = velocity * small window opening area
- 相同房间中相同的风机、进风口和控制器设置可能会因进气口的设置而造成空气质量的变化。3%的最小开口可能=一个房间开口5cm，而另一个房间进风口仍未打开。需要确保基本的实际进风口正确运转并保证房间之间一致。
- The same fan, air intake, and controller settings in the same room may cause variations in air quality due to the setting of the air intake. A minimum opening of 3% may mean that one room has an opening of 5cm, while the air intake of another room remains closed. It is necessary to ensure that the basic actual air intake is functioning correctly and consistent between rooms.
- 不要认为一个圈舍正好用与之匹配的风机和进风窗设计。
- Don't assume that a shed will perfectly match the fan and inlet window design.
- 温度探头是否刚好位于能读到猪所在空间实际温度的地方？它是否远离屋顶进风窗、加热器等？
- Is the temperature probe positioned just where it can read the actual temperature of the space where the pigs are? Is it far away from the roof air intake window, heater, etc?
- 仅仅增加更多的风机不一定等同于能增加通风。需要查看进风口和过滤器规格，以及空气进入阁楼（最常被忽略的一项）
- Merely adding more fans does not necessarily equate to increased ventilation. It is necessary to examine the specifications of the air intake and filters, as well as the airflow into the attic (a commonly overlooked aspect)
- 深坑房间需要比浅坑更高的最小通风量。（例如，一个浅坑分娩舍可能20cfm就很好，但深坑分娩可能需要40cfm）。
- Rooms with deep pits require a higher minimum ventilation rate than those with shallow pits. (For example, a shallow pit birthing house may be well-served with 20 cfm, but a deep pit birthing may require 40 cfm).
- 如果一个圈舍气流严重受阻，静压可能不会超过0.10英尺水柱，因为风机严重缺乏以至于它们无法保证足够的静压？
- If the airflow in a livestock enclosure is severely obstructed, the static pressure may not exceed 0.10 inches of water column, due to a severe lack of fans, which prevents them from ensuring sufficient static pressure?

- 由于风机或百叶窗太脏、皮带打滑或阁楼不够用，炎热天气下的通风量可减少40%。
- Due to dirty fans or louvers, slipping belts, or insufficient attic space, the ventilation volume during hot weather can be reduced by 40%.
- 在所有季节，通过进风口的风速目标为4-5m/s，但是，在最小通风条件下，你或许仅能够达到2.5-3m/s，而且不会“堵塞”进气口并使圈舍/房间缺乏空气。
- In all seasons, the target wind speed through the air intake is 4-5m/s. However, under minimum ventilation conditions, you may only be able to achieve 2.5-3m/s without "blocking" the air intake and causing a lack of air in the enclosure/room.
- 需要了解通过进气口的空气速度、静压、内部温度与外部温度。
- It is necessary to understand the air velocity, static pressure, internal temperature, and external temperature passing through the air intake.
- 加热器需要在冬天运行以除去水汽。
- The heater needs to be operated in winter to remove moisture.
- 可以计算风机容量和设置，但需要现场验证。
- The fan capacity and settings can be calculated, but on-site verification is required.
- 重要的是看和感受，以评估实际的通风性能。计算设置是一个很好的起点，但必须评估实际情况，然后调整设置。
- It is important to observe and feel in order to assess the actual ventilation performance. The calculation settings are a good starting point, but the actual situation must be evaluated and then the settings adjusted.