



# **MINIMUM VENTILATION**

## **3rd ROSS BREEDERS ANADOLU INFORMATION SHARING MEETING**

**October 2010**

**Bernard Green**



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# Discussion Topics

- Why we ventilate
- When do we use minimum ventilation?
- Bird requirements
- Effects of temperature on oxygen demand
- House sealing
- Problems with poorly sealed houses
- Potential solutions to managing “older” houses
- What is negative pressure
- Why it is important
- Minimum ventilation system
- Minimum ventilation rate
- Evaluating minimum ventilation



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# Why We Ventilate

We ventilate to:

- Create an air exchange
- Control moisture levels
- Control the heat load
- Control the **effective** temperature
  - (Temp + RH + air speed + bird age)
- Supply oxygen
- Remove harmful gases

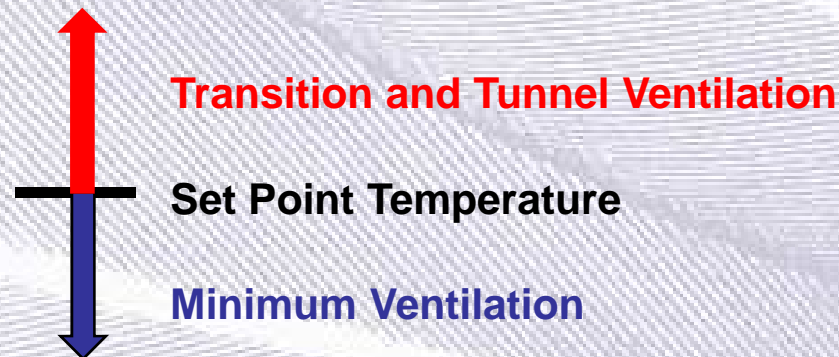


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## When Do We Use Min Vent?

- It can be used summer and winter
- It is used anytime the actual house temperature is below the required set point temperature for the birds
- It is used when trying to maintain temperature, but still putting the least amount of fresh air possible to maintain good air quality
- When the house temperature goes above the required set point temperature, then it is no longer in minimum ventilation mode



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# Bird Requirements

- Warm **floor** during brooding
- Good air quality (oxygen)
- No temperature fluctuations
- No drafts
- No environmental stresses
- **It doesn't matter what type of housing you have!**
- **These are the bird requirements**



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# Effects of Temperature on Oxygen Demand

- Oxygen demand is lowest when the environment allows the chick to be in its thermoneutral zone
- As environmental temperature decreases, oxygen demand increases
  - You cannot compromise ventilation for temperature
- When environmental temperature increases and the bird begins to pant, oxygen demand increases



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# House Sealing

- Regardless of the type of ventilation system, it is important to seal the house
- Reduces cold air leakage onto the birds
- Gives better control over what is happening in house
- Gives you more control over the incoming air
- Reduces the effect of outside conditions
- Increases the operating pressure of the **whole** house



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# Problems With Poorly Sealed Houses

- Cold floors due to drafts
- Cold drafts onto the chicks
- Can't maintain temperature in winter
- Can't ventilate effectively in winter

Stress, stocking density, uniformity, health, poor start

- Cold drafts onto the heater probe
- Heat loss through the cracks and openings
- No mixing of cold incoming air with warm inside air
- Unable to access the heat in the peak of the roof

High heating costs, can't maintain temperature

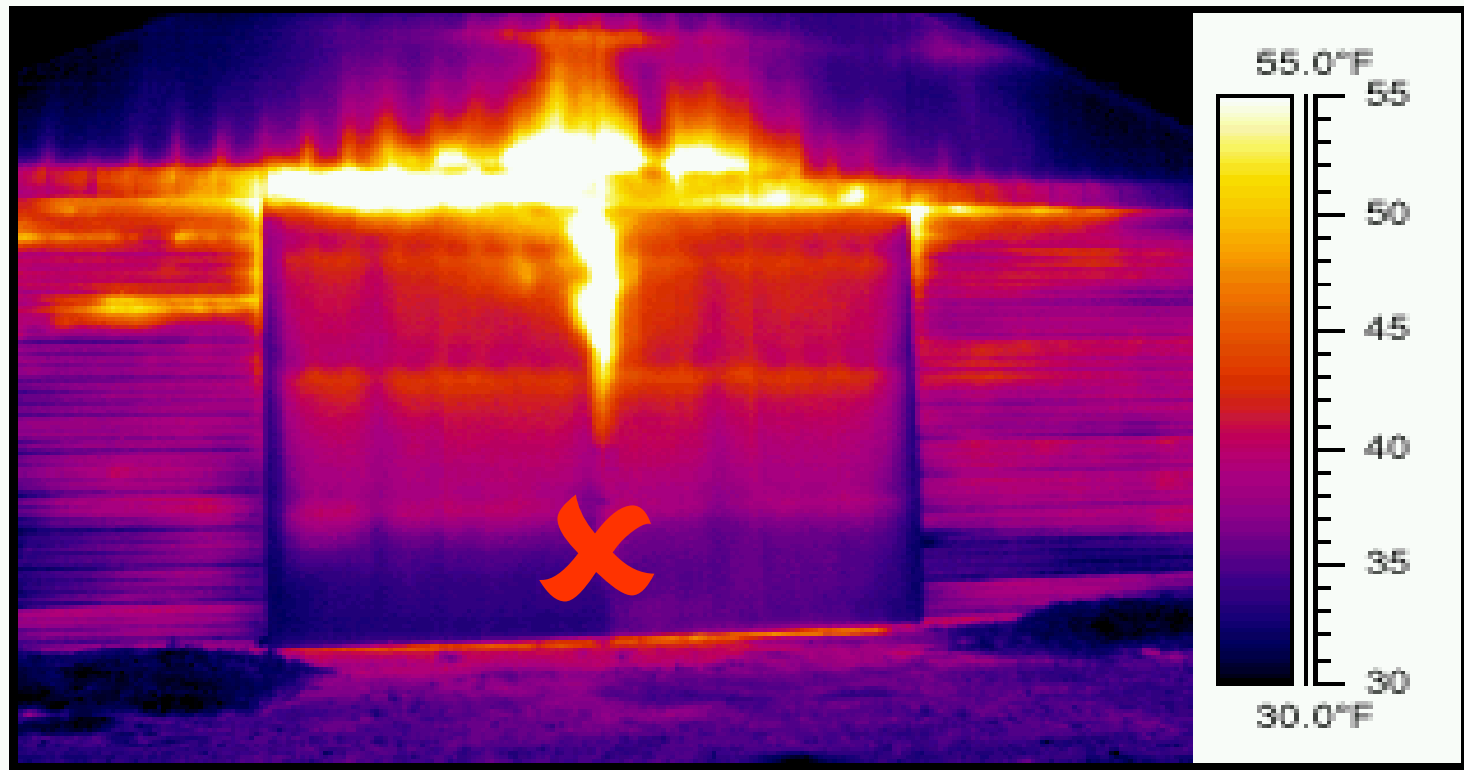


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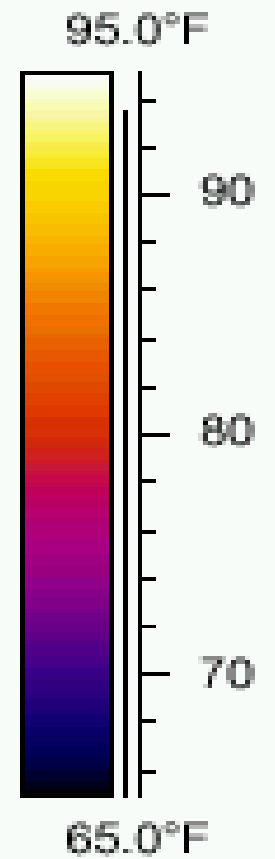
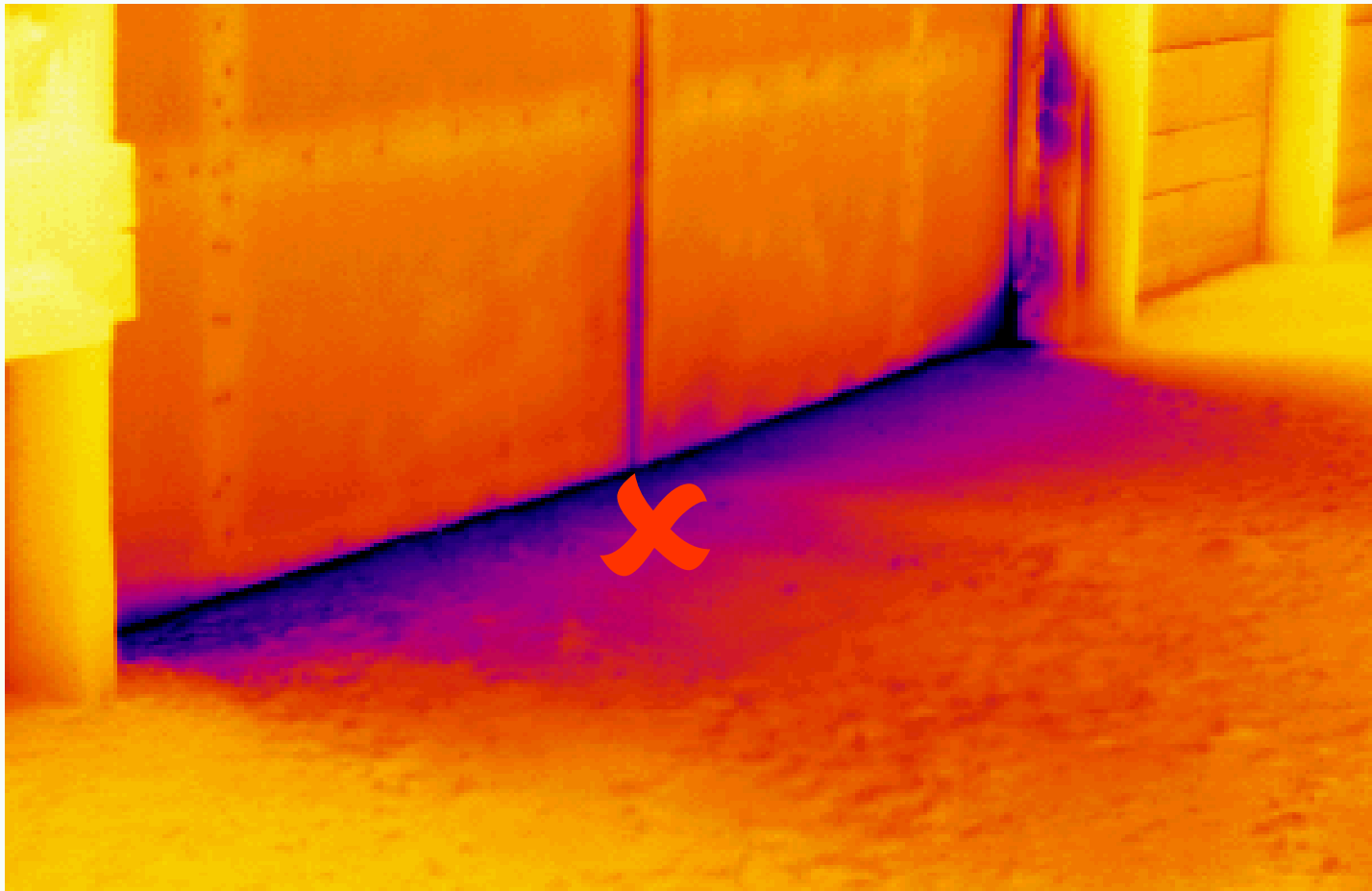


## Poorly Sealed Catching Door (University of Georgia)





## Cold Air Leakage at Catching Door (University of Georgia)



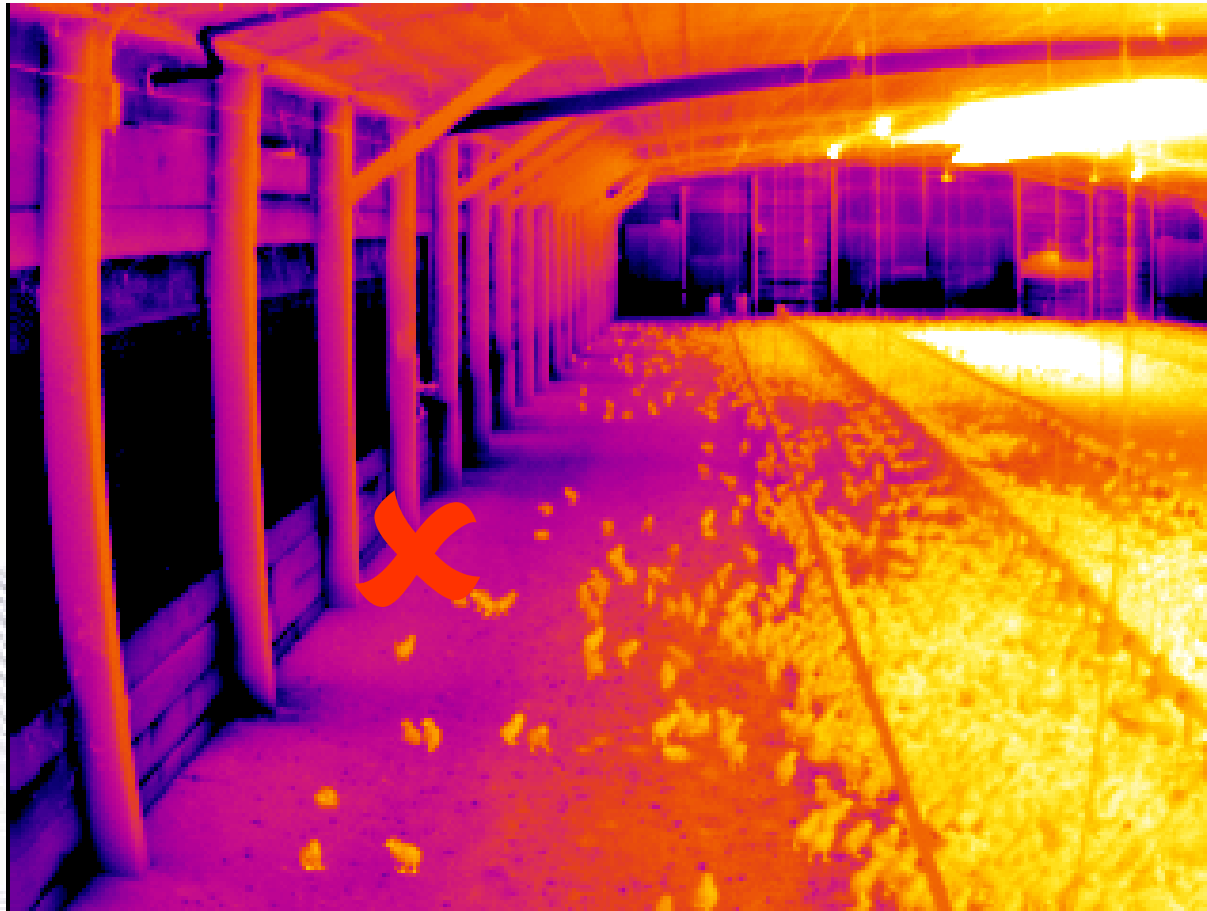


## Sealed vs. Unsealed Side Wall (University of Georgia)





## Chick Spread – Uninsulated, Poor Seal (University of Georgia)



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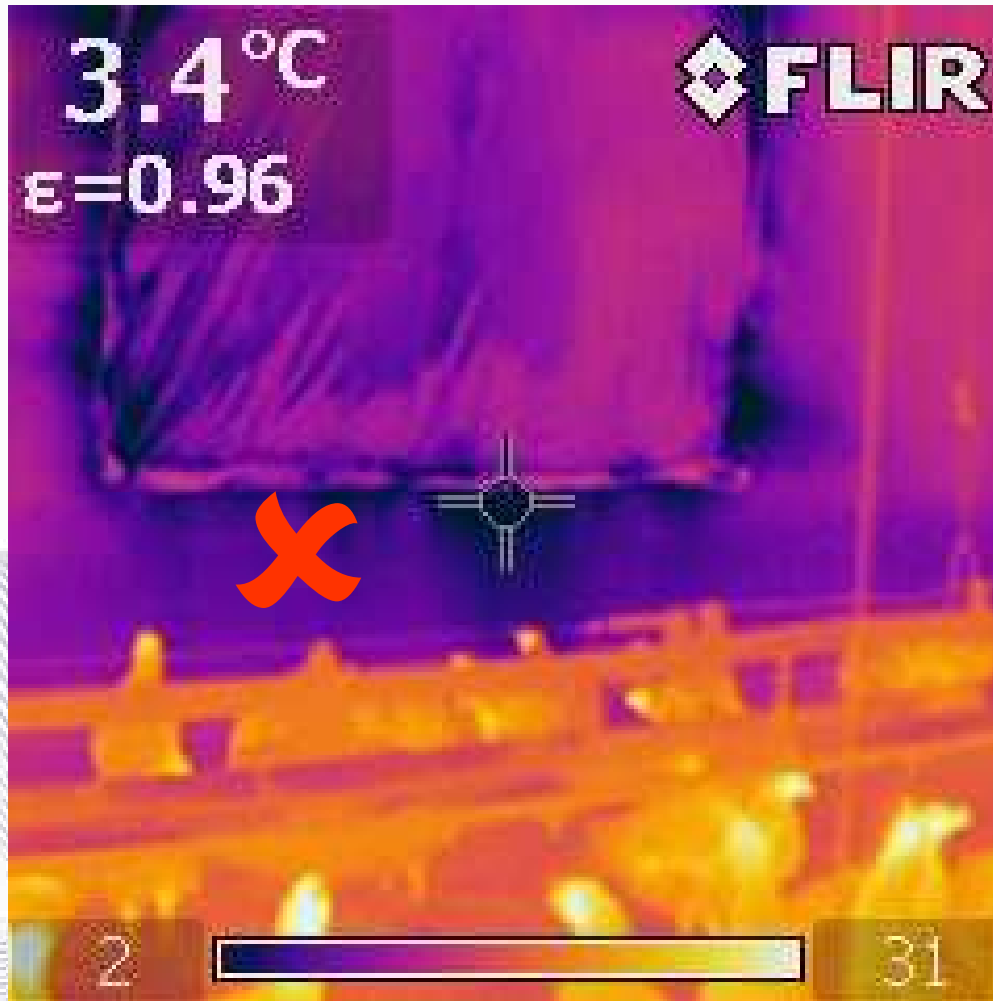
## Chick Spread – Insulated, Sealed (University of Georgia)



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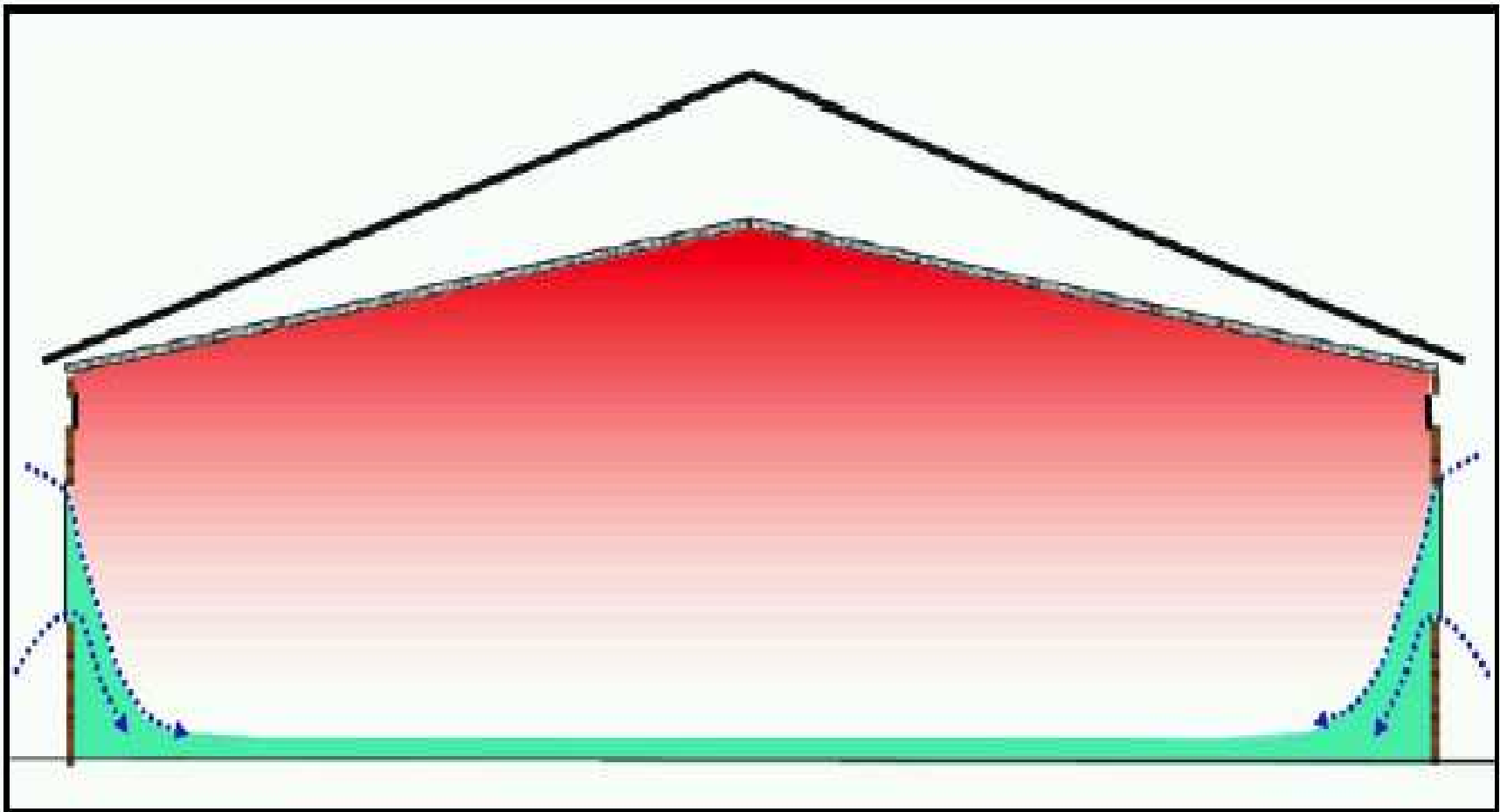


## Always Seal Fans From The Outside





## Curtain Leakage, Cold Floors (University of Georgia)





## Curtain Leakage on a Windy Day (University of Georgia)







## Air Leakage Through a Poorly Sealed Curtain (University of Georgia)



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# Potential Solutions to Managing “Older” Houses

- **SEAL THE HOUSE!!** (minimal cost, huge impact)
  - Make sure tunnel inlet/cooling pad seals well
  - Seal around doors, fans, windows
  - Seal eave of the roof
  - Seal all joints in the roof
- Roof insulation (summer and winter benefit)
- Review your heating system (type and capacity)
  - Radiant heaters put the heat where the chicks need it
- Review your heat distribution
- Preheat the house for at least 2-3 days
- Make sure floors are warm before chicks arrive



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# Potential Solutions to Managing “Older” Houses

Some ideas:

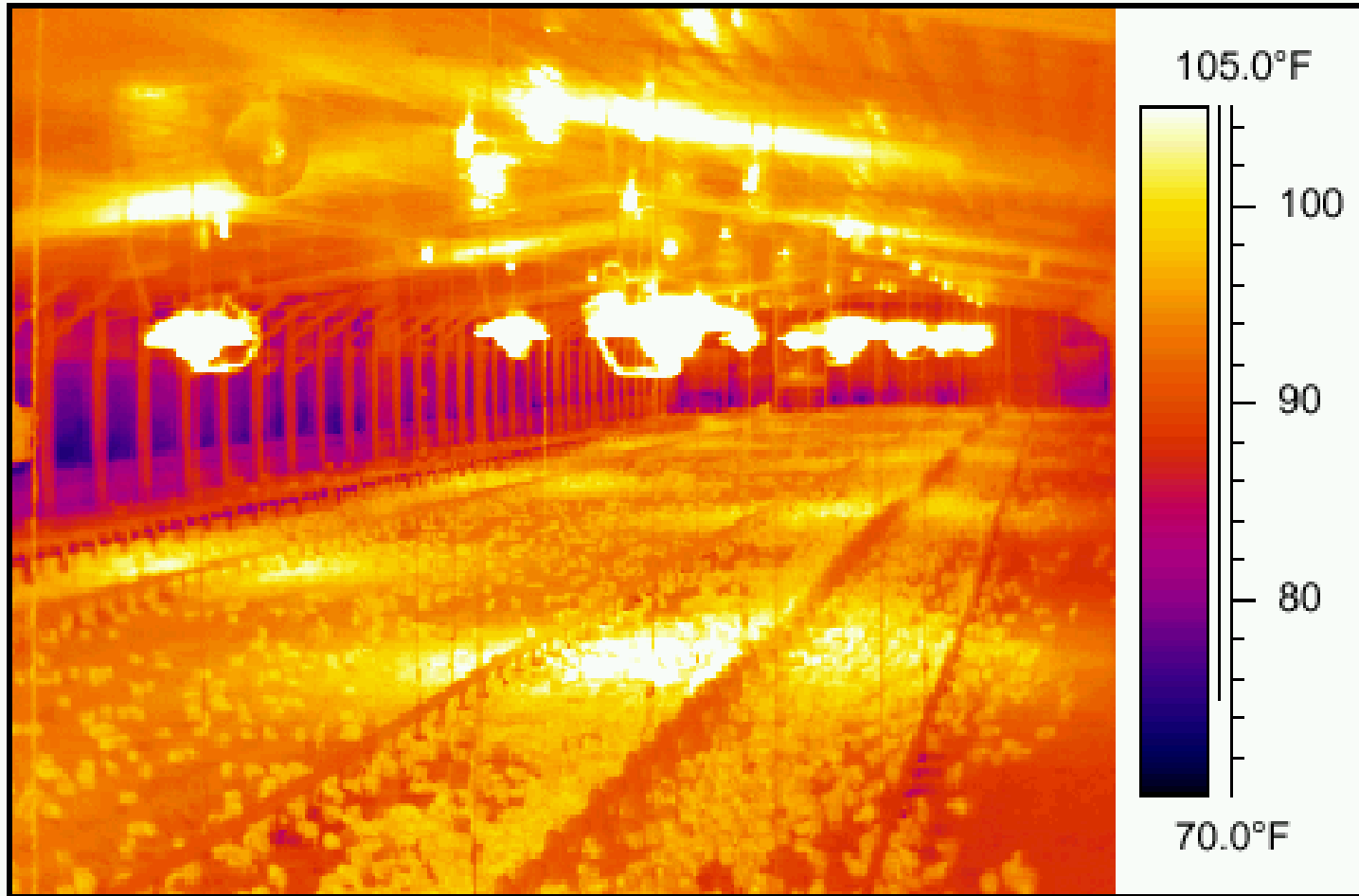
- Use secondary inner curtain to protect the birds from drafts
- Fan Jet system – explained below
- Install minimum ventilation – examples below
  - Air cannons
  - Inlets (pressure balanced, winch operated)
- Circulation fans can help to distribute heat (but they are NOT a substitute for minimum ventilation)



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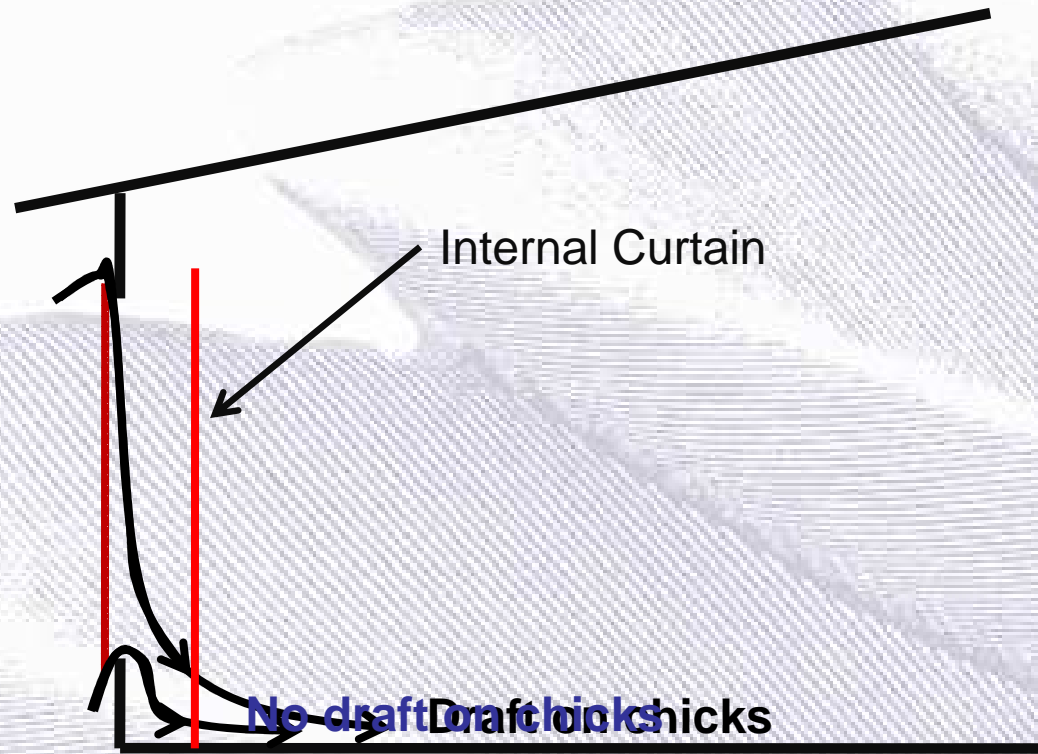
## Radiant Heating (University of Georgia)



Puts heat where needed, on the floor



# Internal Curtain



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# Fan Jet

Inlet  
Damper



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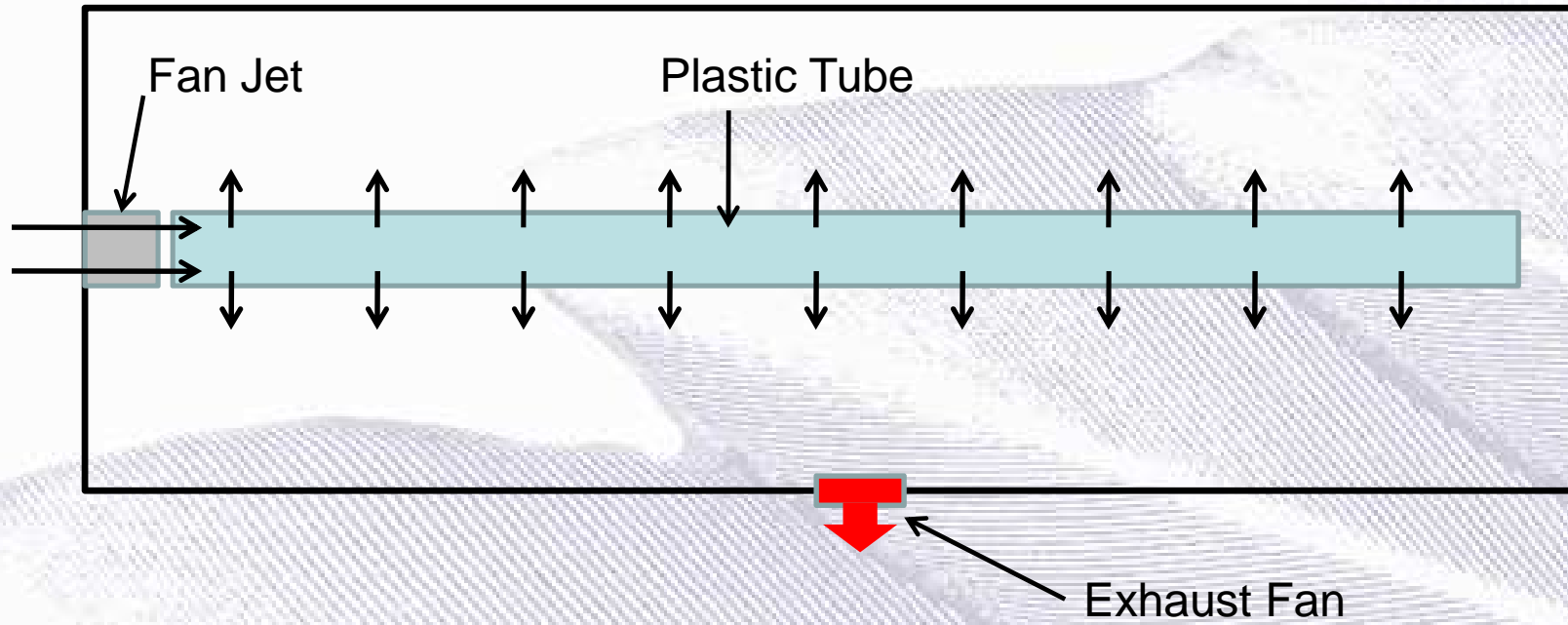
# Fan Jet



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# Fan Jet System







# Fan Jet System

## Advantages:

- “Positive pressure” system
- House does not have to be extremely well sealed
- Fan jet runs continuously → good mixing of air and heat
- Incoming air directed up away from birds
- Heating system can be located at FJ for distribution
- Relatively cheap system

## Disadvantages:

- May not be able to provide enough min vent for whole cycle
- Depends on stocking density, weight



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# Air Cannons



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# Pressure Balanced Inlet



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# Air Cannons, Pressure Inlets

## Advantages:

- Quite an effective minimum ventilation system
- Fairly cost effective – cheap “inlets” (Ø90mm pipe)
- Curtains stay closed
- Mixes incoming air with warm house air

## Disadvantages:

- System works on negative pressure, so...
- House must be well sealed, or else.....
- House may get colder than before, chicks more stressed
- Do not take this approach unless house can be well sealed
- Requires ventilation controller or cycle timer

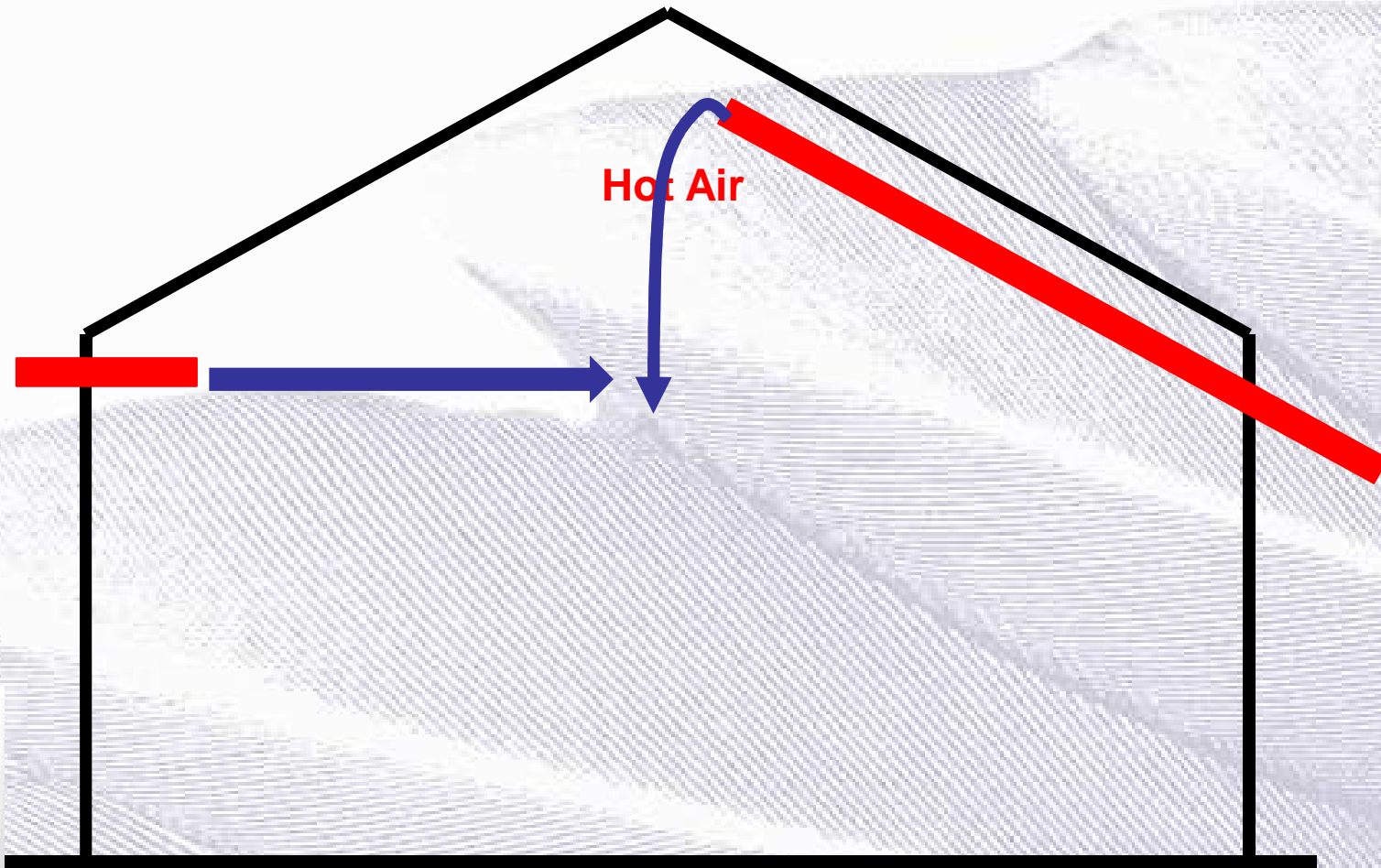


## How Many Air Cannons?

- First, remember that air cannons are only for **bare minimum ventilation**
- They are **not** there for transitional ventilation
- Don't try to calculate the number of air cannons
  - The number will usually be very big
- Suggestion:
  - Install one in each bay on both sides of the house
  - Install two in each corner of the house
  - Check the operating pressure
  - Decide if more air cannons are required



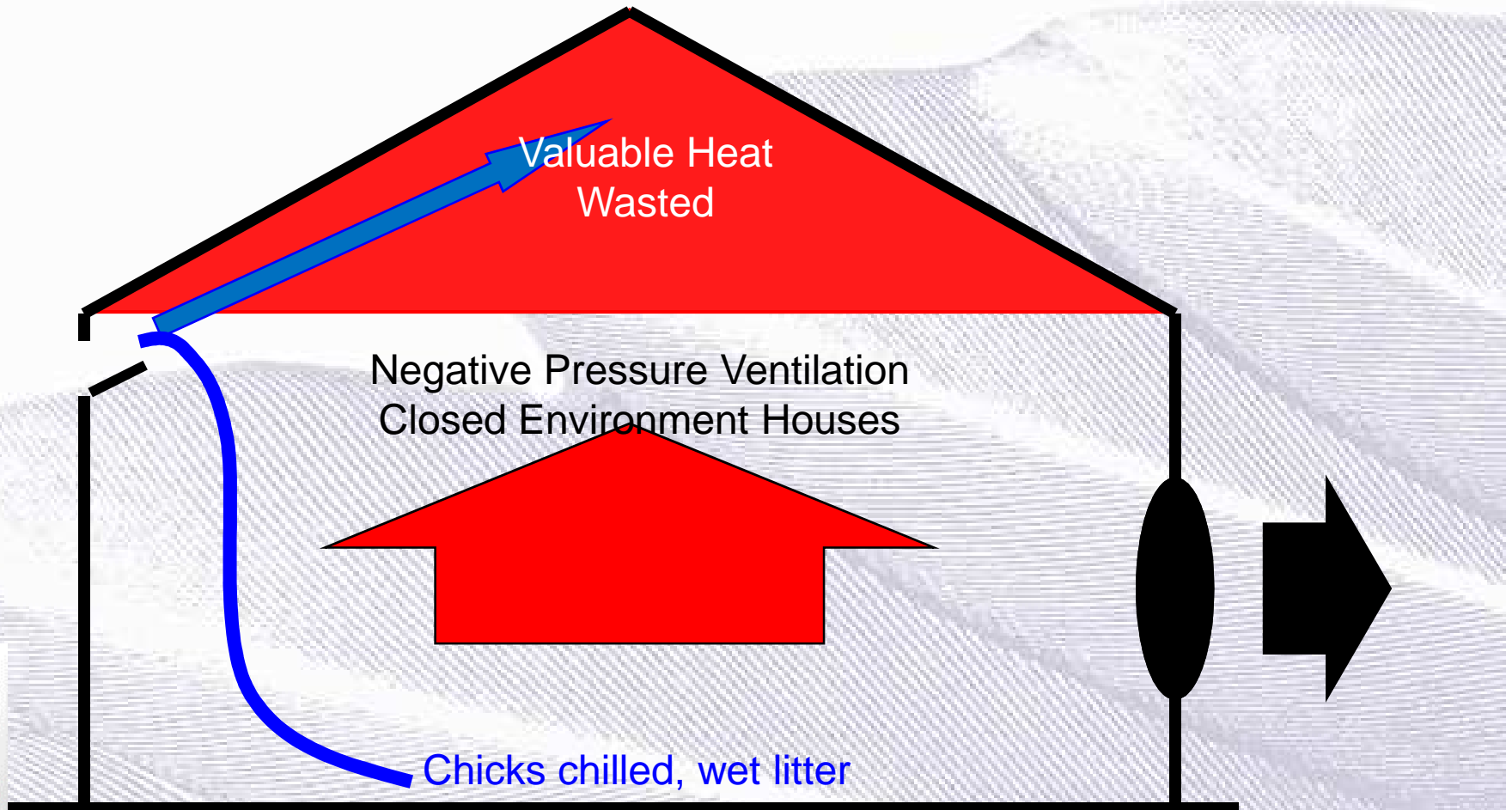
## Poor Air Cannon Installation Examples



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# Bringing in Cold Air

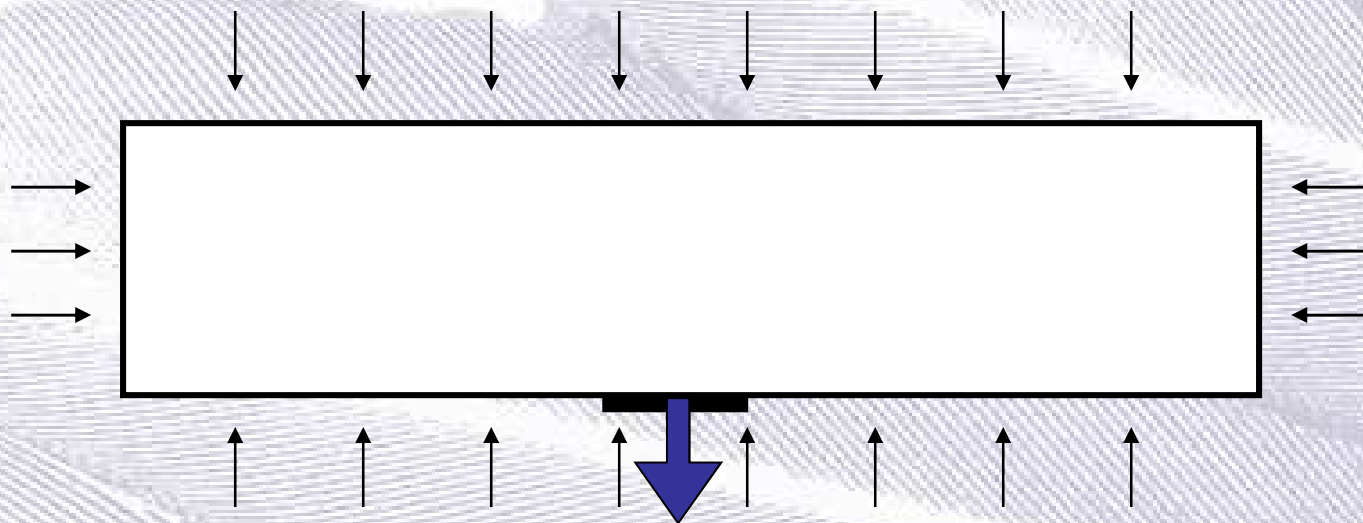


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## What is Negative Pressure?

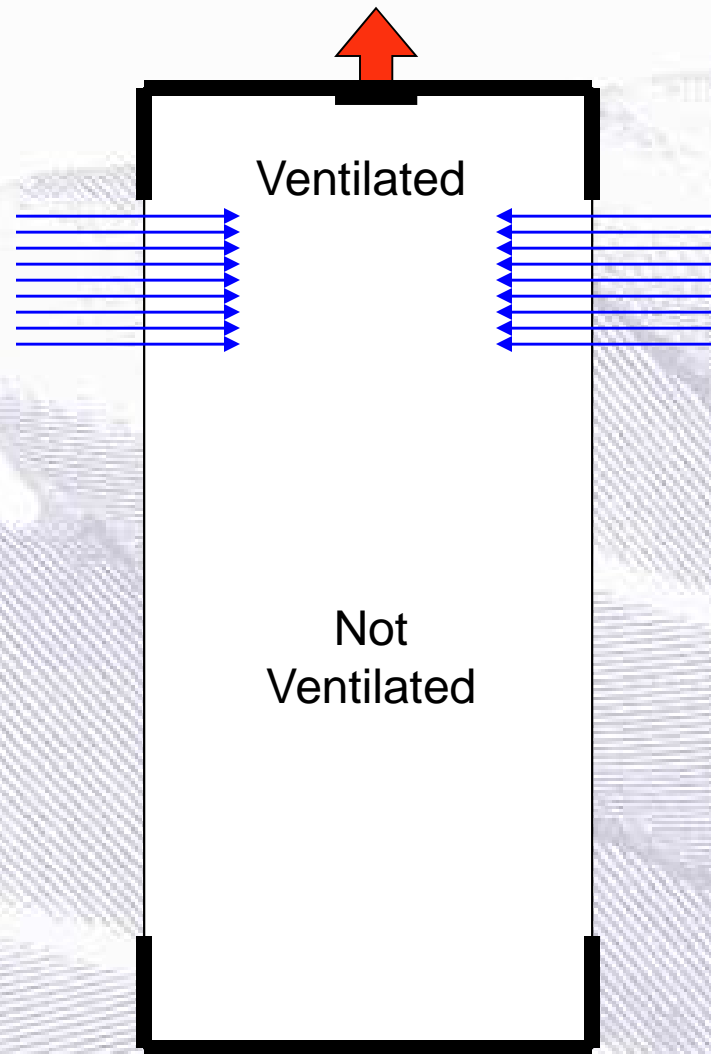
- When a fan tries to extract more air from a house than is allowed to enter the house
- When this happens air rushes in through inlets to replace the exhausted air
- **Just because a fan is running, doesn't mean there is a negative pressure**







Side curtain full open, air short-cuts to fans.



No Negative Pressure

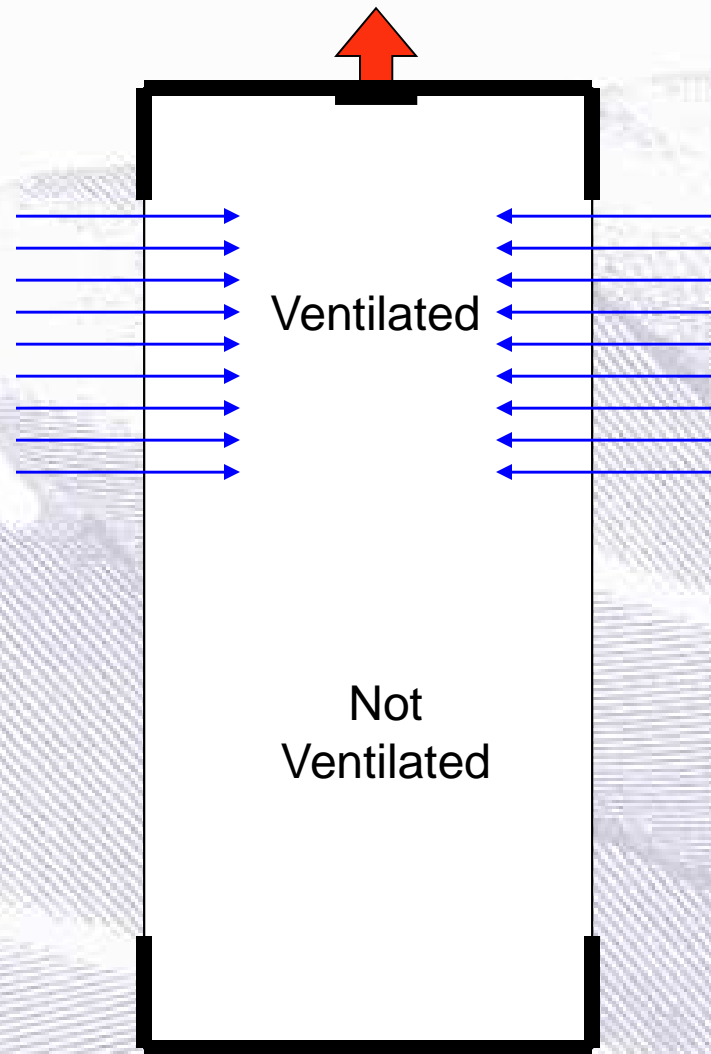


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Side curtain slightly closed.  
Air still short-cuts to fans.

No Negative Pressure



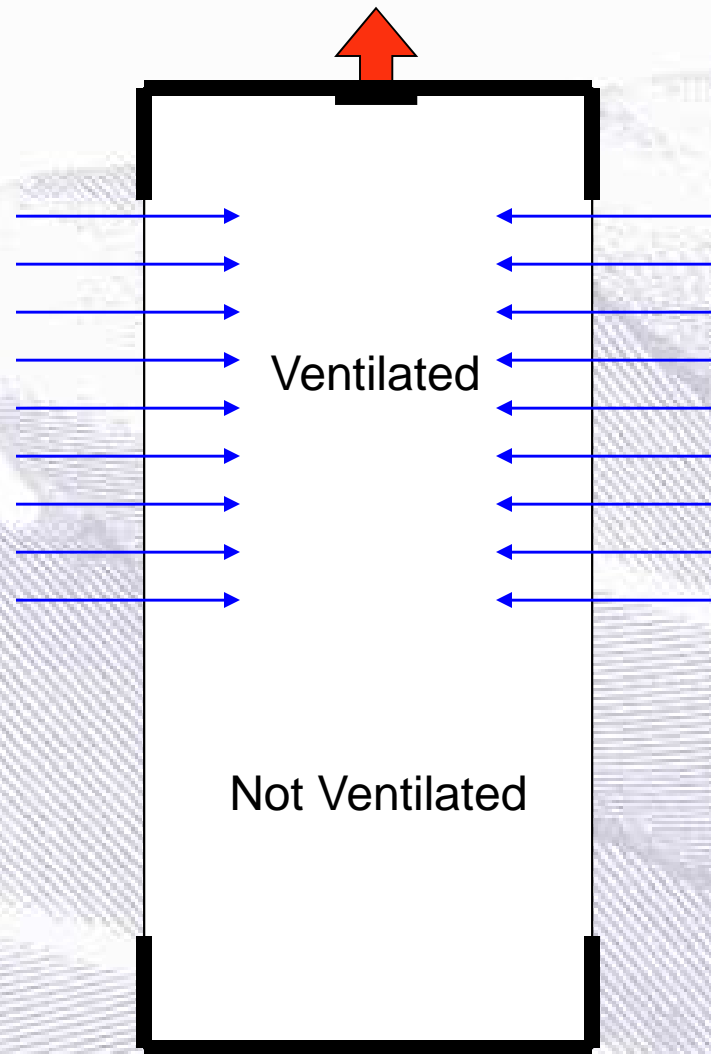
Not  
Ventilated



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Side curtain more closed.  
Air drawn from further down house.



No Negative Pressure

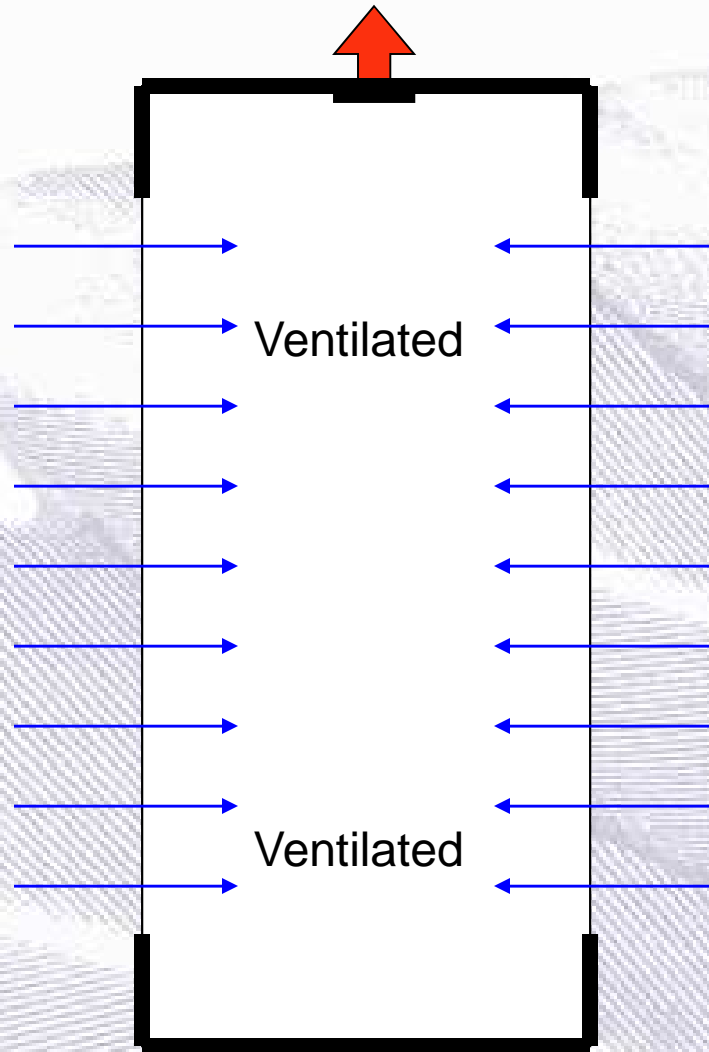


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Side curtain almost closed.  
Air drawn from entire length of house.

Negative Pressure in  
Whole House



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## Why Is It Important?

- With negative pressure, air enters **evenly** through every inlet (including areas of leakage)
- By spreading inlets evenly can get **even** fresh air
- By restricting inlet size, can regulate **incoming air speed**
- Control over **how far** the air goes into the house
- Air should go to the middle (peak) of the roof
- Higher incoming speed allows **better mixing**
- **Pressure determines the incoming air speed**
- **High P → high air speed, Low P → low air speed**
- **The wider the house → higher the pressure**

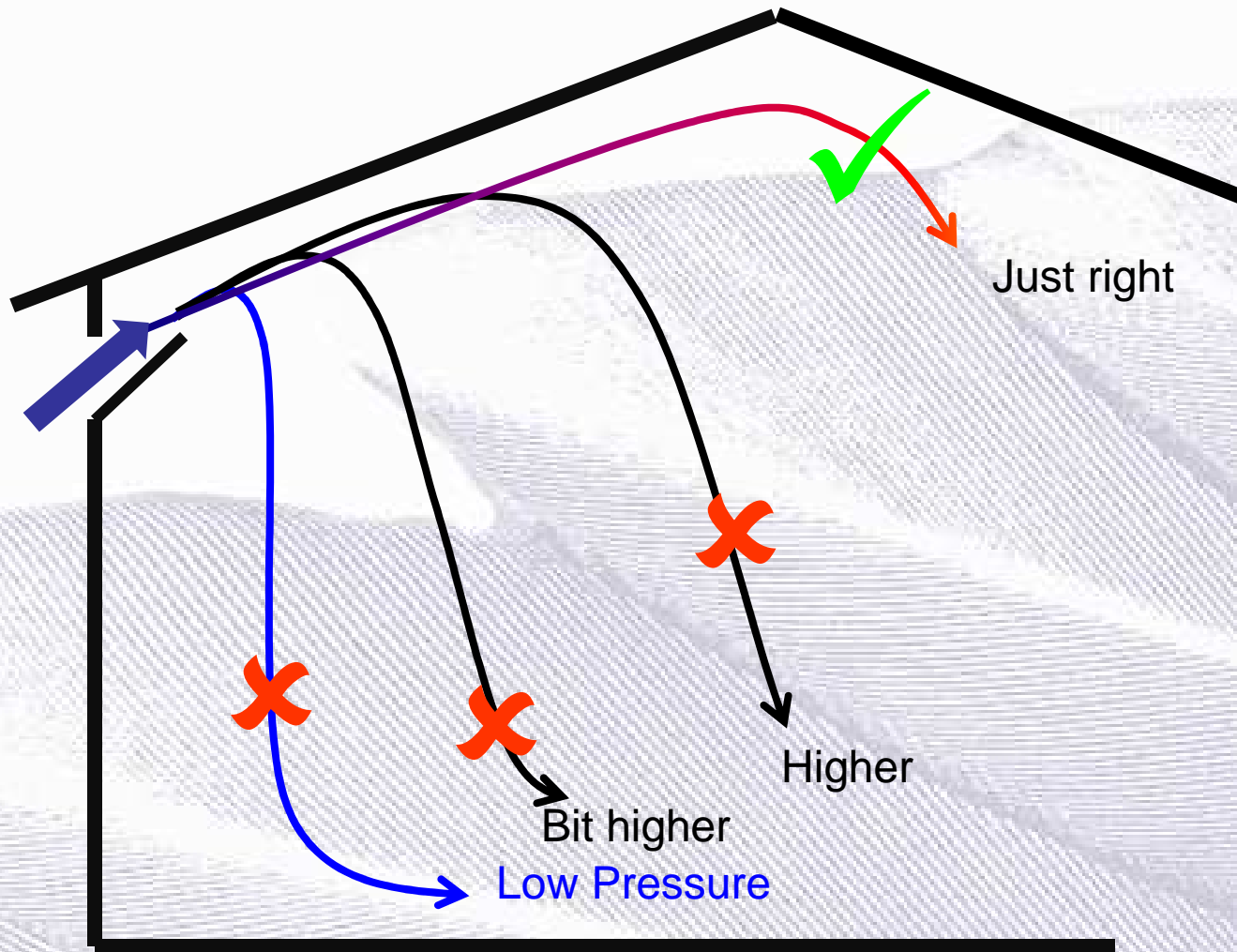


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- **By using pressure, we can put the air where we want it**



# Air Movement Based on Pressure



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# Minimum Ventilation System

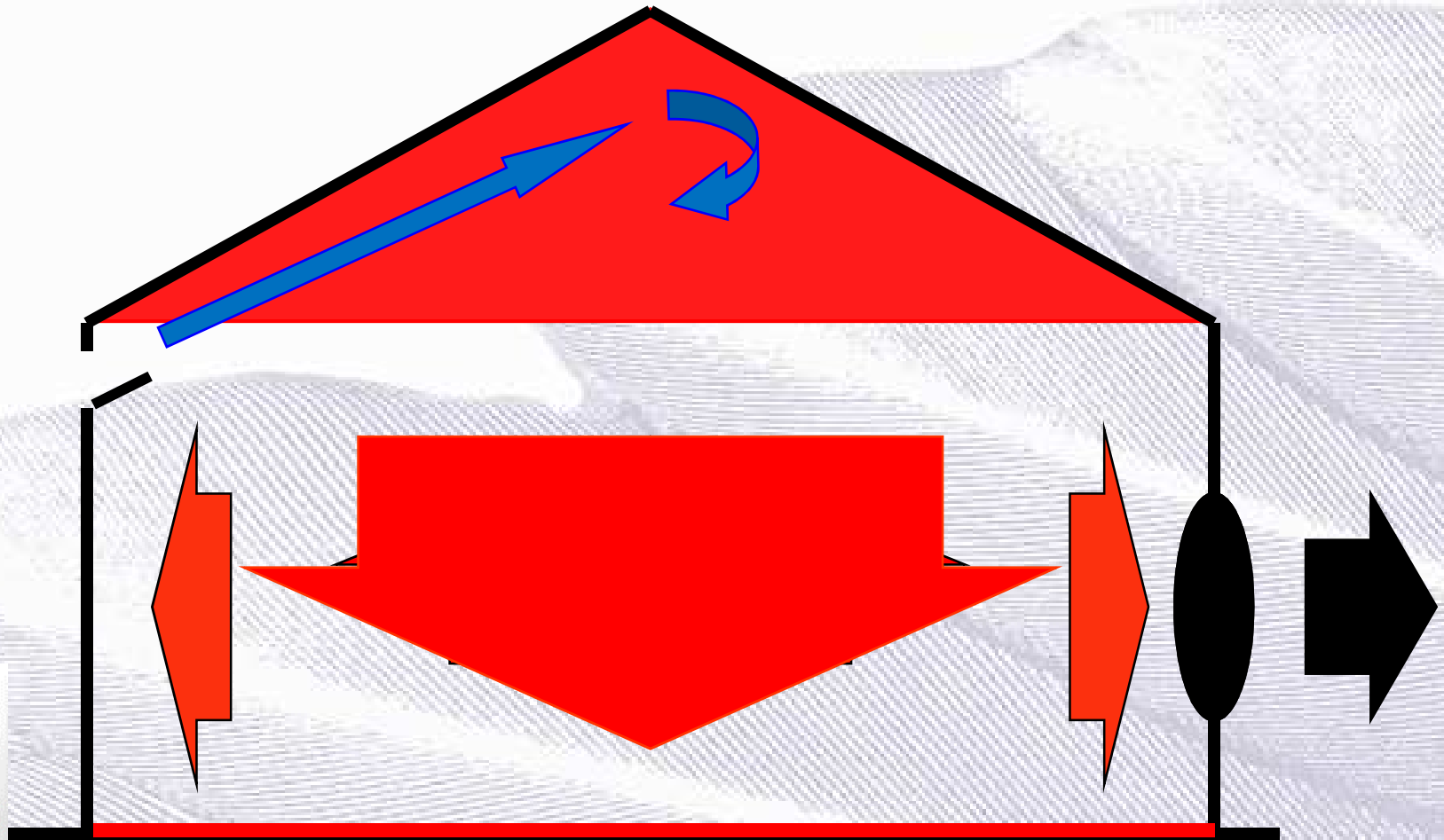
- Cross ventilation is most successful
- Fans and inlets located in the side walls
- Hot air gathers in the peak of the roof
- Fans operate on a **cycle timer (ON/OFF)**
- **Pressure controlled** side wall inlets direct cold air to peak
- Cold, moist air mixes and pushes hot, dry air down
- Distributes fresh, warm air
- Low air movement at bird level ( $<0,25\text{ms}^{-1}$ )



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# Cross Ventilation

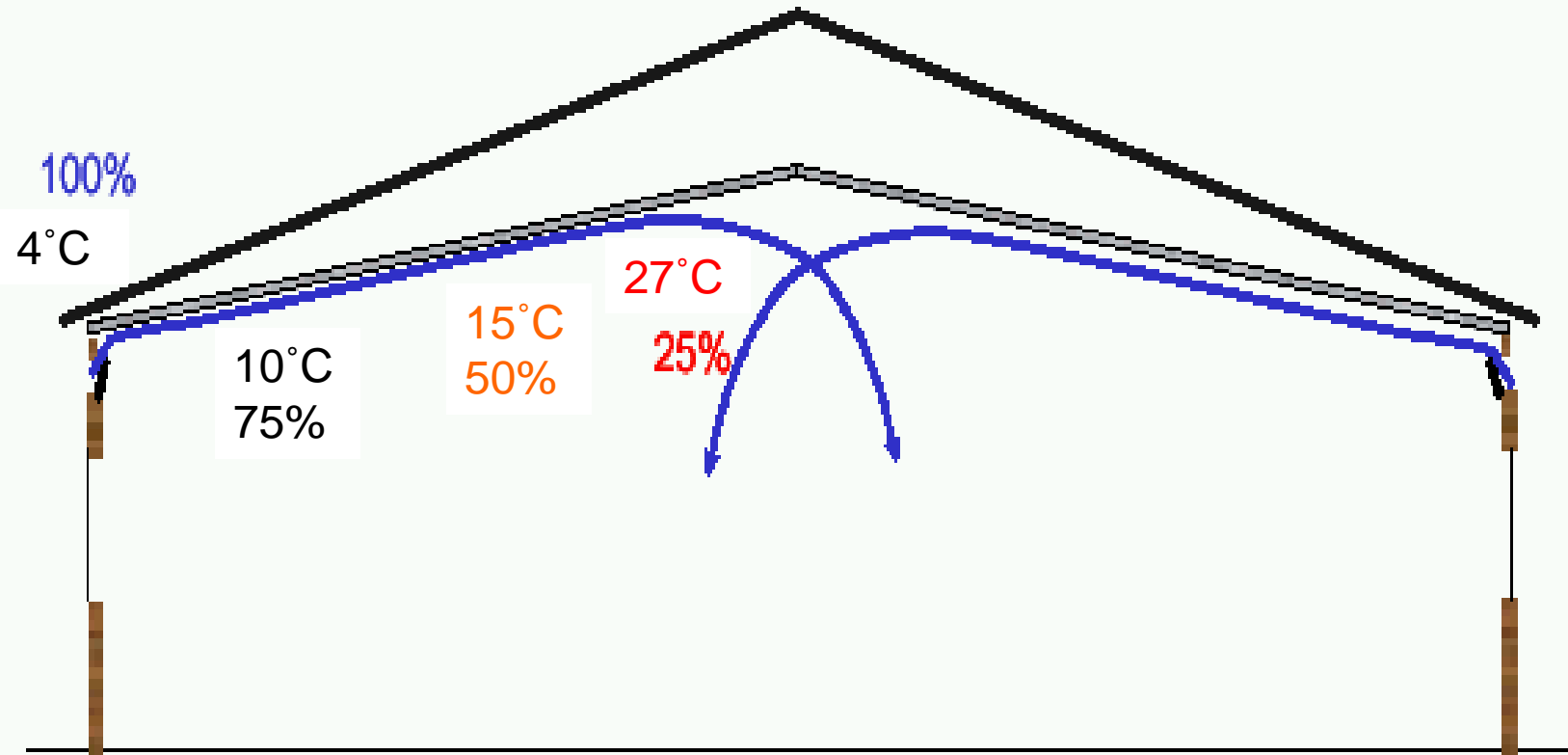


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## Proper Inlet Air Flow (University of Georgia)



Proper inlet air flow



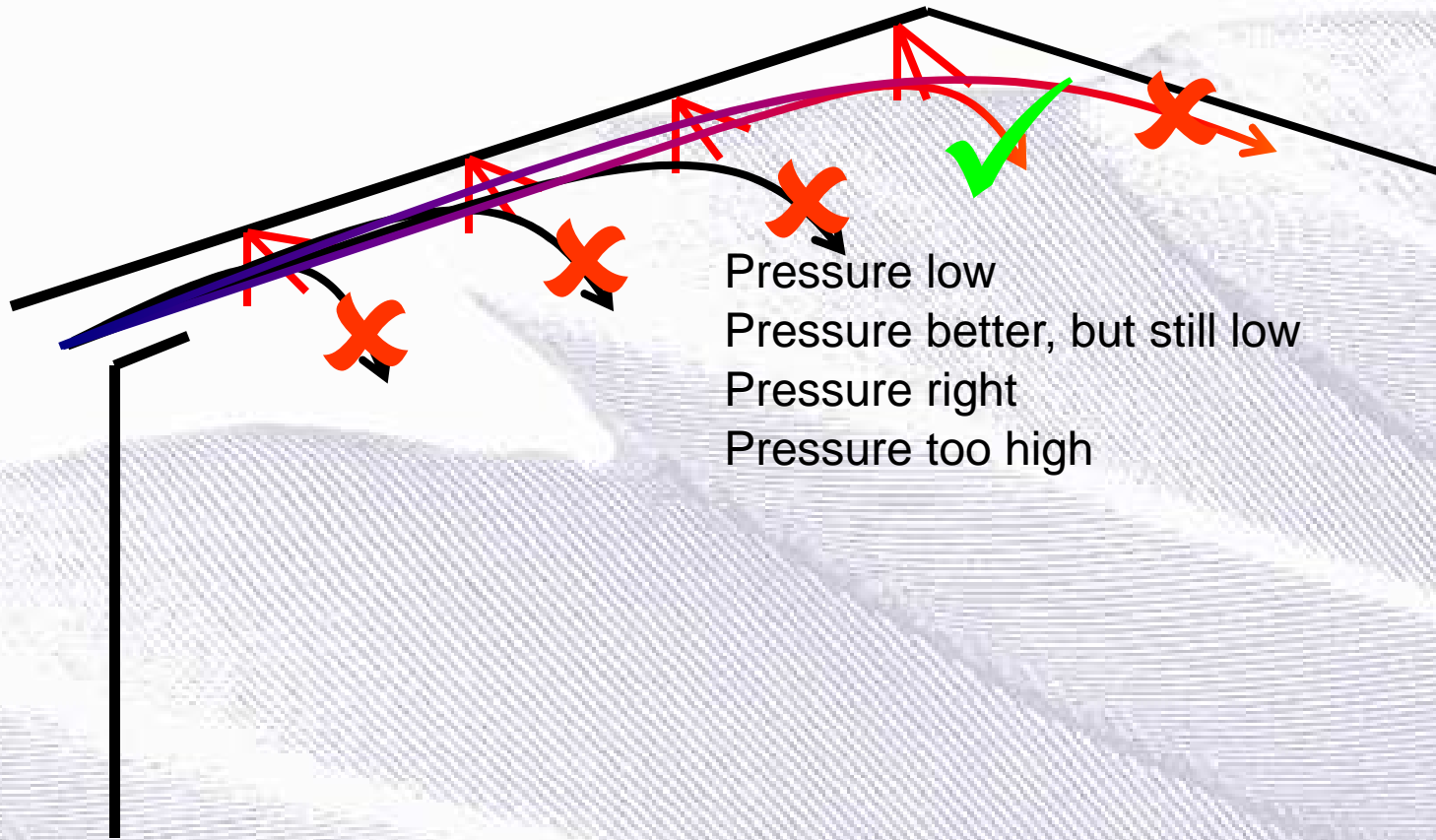
## Inlet Air Flow (University of Georgia)



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# “Seeing” Air Movement



Pressure low  
Pressure better, but still low  
Pressure right  
Pressure too high



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# Air Inlet Management

- Inlets should open at least **4-5cm** during minimum ventilation
- Having fewer inlets opening correct amount is better than too many opening only a little
- Inlets must open **equally**
- Inlets used must be **evenly distributed**
- Must operate on **static pressure**
- Air direction plate required if there are ceiling obstructions
- Good inlet management is **important!**
- Take care when choosing new inlets



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## System To Automatically Control Which Inlets Will Open



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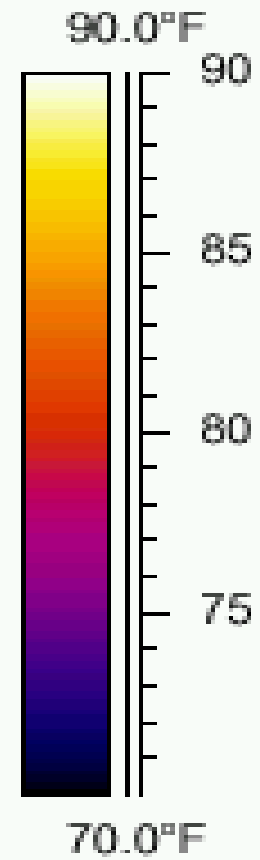
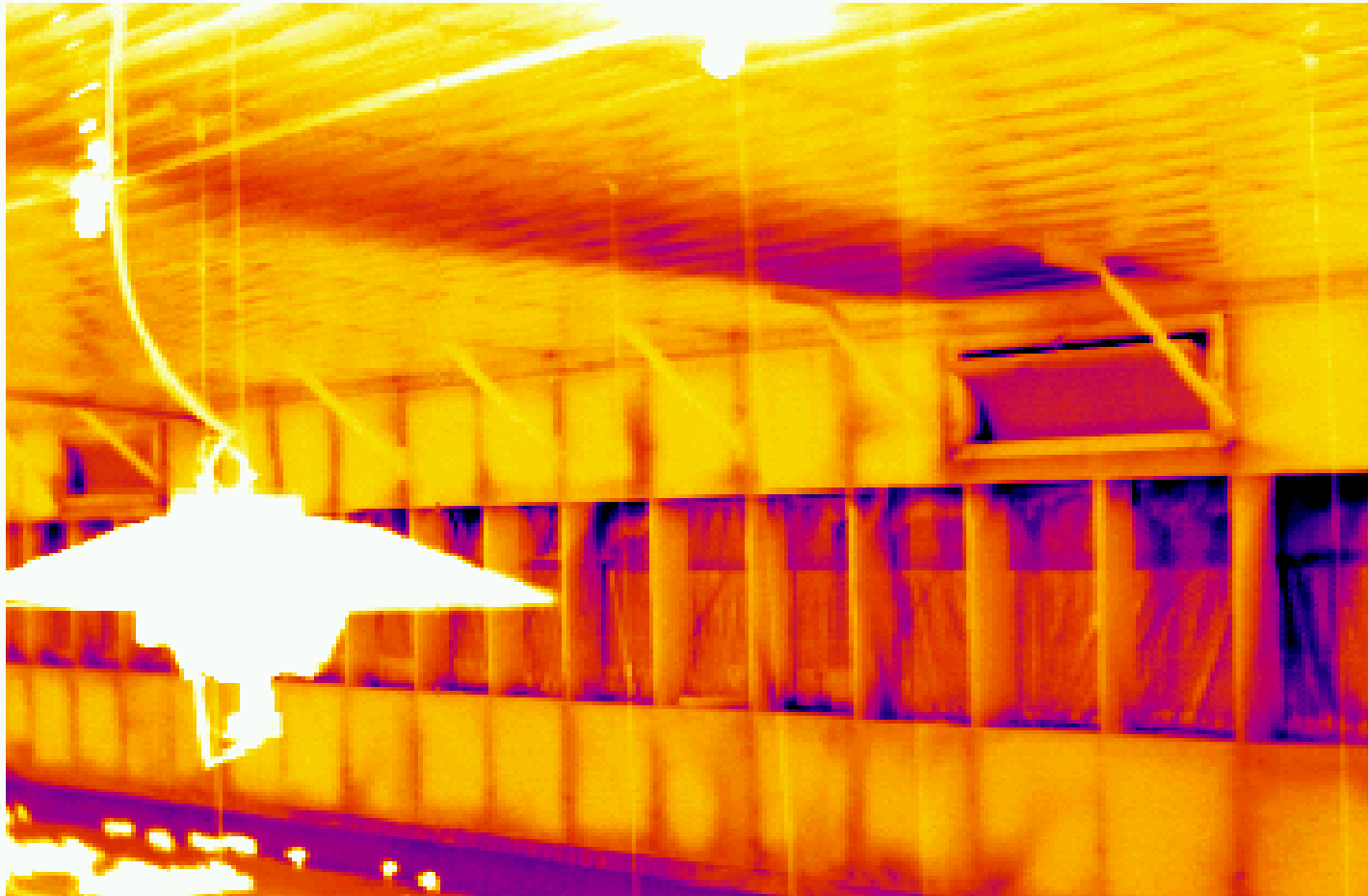
**This Inlet Type Must Be Manually “Locked” Closed**



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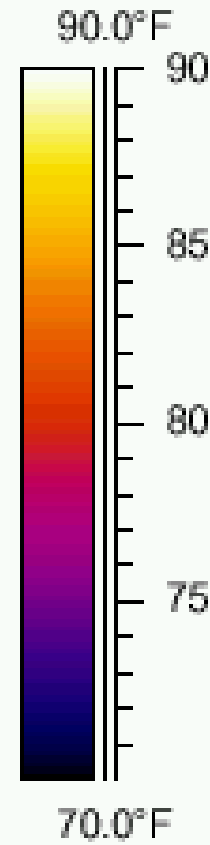
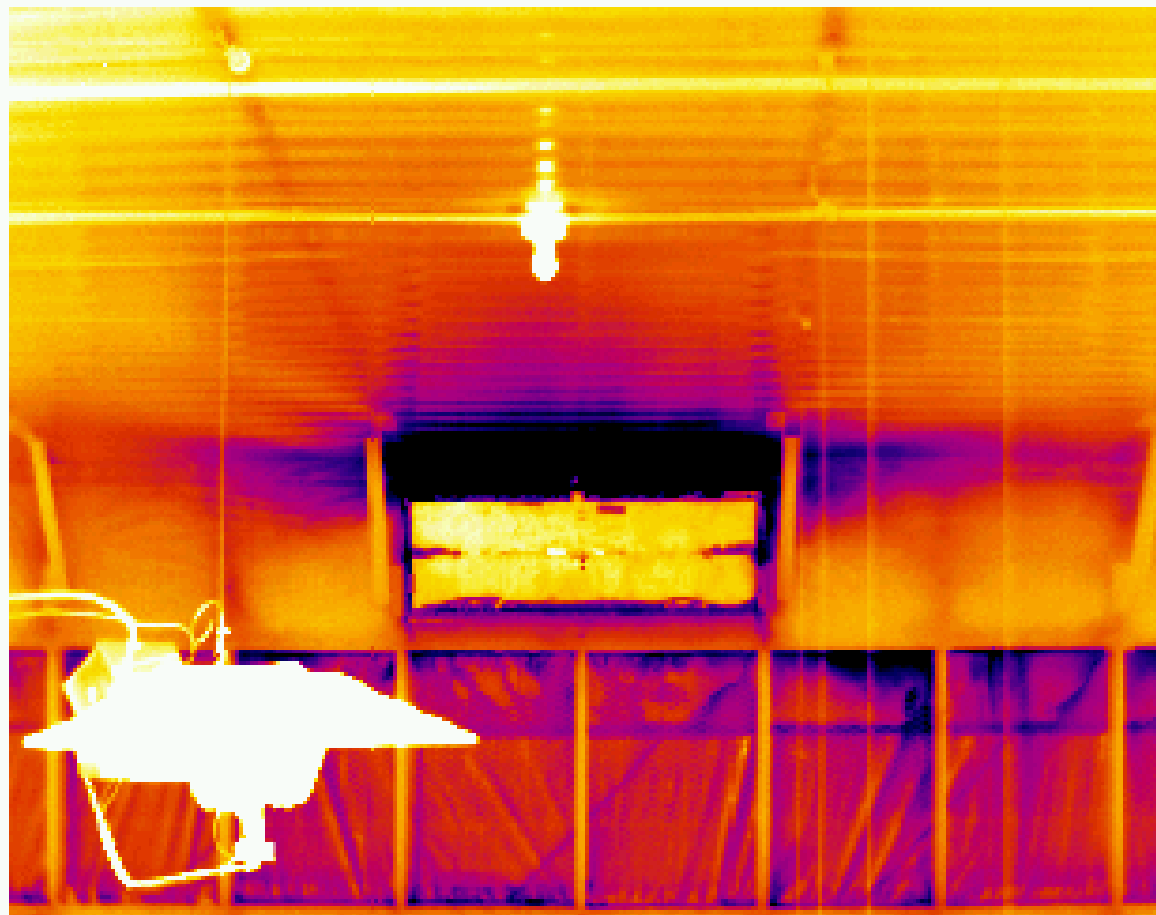


## Air Flow Through Modern Inlet (University of Georgia)





## Air Flow Through “Older” Type Inlet (University of Georgia)







# Controller

- There are simple, and complicated controllers available
- Choose one that you can **use with confidence!**
- A complicated controller is worth nothing if you can't use it!



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# Management/Stockmanship

- The above is not worth much without good management
- Manager is link between birds and ventilation system
- Must be able to “read” bird behaviour and other signs
- Must be able to adjust vent to satisfy bird requirement
- There is **no** ventilation system that does not require management



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# Minimum Ventilation Rate

- Theoretical/calculated rates ( $??m^3/hr/kg$ ) are only a **guide!**
- The right minimum rate is critical for bird performance and to minimise heat consumption
- Extremely fine line between under and over ventilating
- Evaluate your minimum ventilation setting **every day**
- Minimum ventilation fans should operate on a **cycle timer**



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## Example Calculation

Assume:

- Bird weight = 200g ; 30 000 birds
- Ventilation “factor” = 1,1m<sup>3</sup>/hr/kg

Calculation:

- **Ventilation = 30 000 x 0,2kg x 1,1m<sup>3</sup>/hr/kg = 6 600m<sup>3</sup>/hr**

Cycle Timer Setting:

- 5 minute cycle ; fan = 20 000m<sup>3</sup>/hr (at pressure)

$$\text{Time ON} = (6600 \times 5) \div (1 \times 20000) = 1,65 \text{ minutes}$$

Time ON = 1 min 39 sec

Time OFF = 3 min 21 sec



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# Evaluating Minimum Ventilation

- The **only** way is by visiting the house
- Done preferably first thing each morning
- Evaluate in the first 30 seconds:
  - stuffiness
  - ammonia
  - condensation (walls, drinker pipes, steelwork)
  - bird comfort
  - “AIR QUALITY”
  - What you feel in first 30 seconds is what the chicken lived with all night
- “Purging” the house is unacceptable



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## Remember!

- **Minimum ventilation** determines how much fresh air you bring into the house (air quality)
- **Pressure** is used to make the air go where you want it to when it enters the house



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**THANK YOU**



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