The importance of minimum ventilation and how to calculate it

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The importance of providing the birds with the correct environment is becoming overlooked due to the rapidly increasing cost in energy/heating costs. Trying to limit the amount of heat units used is in most cases false economy.

With more heat recovery units on the market, energy savings are possible, but trying to save equal energy amounts without a recovery unit is detrimental to final performance and therefore profit.

Fig. 1 shows what can happen if gas usage is reduced in the first week. It is possible for the flock to achieve, or possibly as in this case exceed, the targets set.

However, the damage made by this sub-standard environment did not show its effects until after 21 days of age as reduced air quality impaired cardiovascular development. When paying attention to the early ventilation rates, the outcome can be very different.

This article outlines the recommendations we find most beneficial for performance and also final cost.

Minimum ventilation

This is the minimum amount of ventilation (air volume) required to maintain full genetic potential by ensuring an adequate supply of oxygen while removing the waste products of growth and combustion from the environment.

This system should be independent of any temperature control system and works best if operated by a cycle timer and temperature override. The timer cycle should be a five minute period, with minimum run time of at least 20% of this time (five minutes = cycle of one minute on, four minutes off).

Whenever the air quality begins to deteriorate, there must be run time added to the 'on time' and the 'off time' reduced to maintain the same total cycle length, because to add 'off time' as well, the percentage of run time would not change and the air quality results will not be improved.

The minimum run time should be about one minute and this setting is dictated by the width of the house or the length of time needed to move the air from the inlet to the peak of the house where the incoming air is heated, expands and relative humidity reduced.

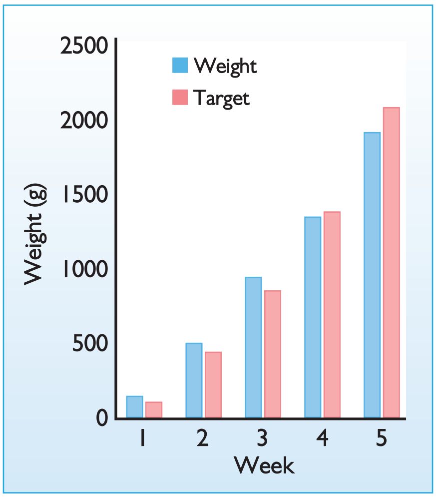

Fig. 1. Results of reducing gas usage in the first week.

Then this air must fall to the floor bringing oxygen to the birds and removing waste gases and moisture produced from the litter, the birds and heating system.

This air needs to move from the middle of the house all the way back to the side walls, ensuring the house floor is correctly ventilated, before returning to the top of the house and being removed by the fans.

The minimum ventilation system should have a fan capacity equal to 12.5-20% of the capacity of the house (air exchange every eight to five minutes) and operate on a timer. The system runs whenever the house is at or below set point temperature.

Inlets

Important points about inlets:

- All minimum ventilation inlets should direct the air into the peak of the house and close when the fans are off, with no pressure drop inside the house.
- Baffle type minimum inlets with the ends open will direct cold air down to the floor and create chills on the birds and condensation on the litter when there is a pressure drop inside the house. The bottom of all minimum ventilation inlets should be sealed air tight to prevent the cold air being directed down to the floor.
- All inlets should open from the top – never from the bottom of the inlet except when cooling.
- In open truss constructed houses the angle of the inlet opening must be such that the air is not directed into a purlin and then redirected straight down to the floor.
- Inlets need to open enough to achieve the required static pressure and the airflow throw needed. For side wall inlets a minimum opening of 5cm is needed.
- Obstructions (electrical conduit/concrete or wooden beams) should be avoided because they interrupt the air flow, forcing air to the floor.
- Inlets driven with motors should be installed in the centre of the side wall to reduce inlet opening variation.
- When using a negative pressure ventilation system, it is not the placement of the fan which dictates uniformity of air distribution but the placement of the inlets. To achieve uniform air distribution in your house, inlets should be evenly spread throughout the house and open the same amount.
- Inlets with cables often stretch, giving different inlet openings through the house and poor airflow; aircraft cable stretches a lot more than high tensile fence wire. Solid rods of 8mm stretch even less and are the best option for long houses.
- A well-sealed house should, with the inlets closed and one 1.2m fan in operation, achieve a static pressure of at least 37.5 pascal (Pa). If the static pressure is less than 25Pa, the house is leaking too much and this must be addressed immediately.
- The inlet should be pressure controlled to maintain a constant air speed throughout the ventilation stages and not controlled by temperature.
- All air inlets must be wind proofed on the outside.
- Inlets should be installed at least 60cm from the house eves as long as there is no interruption to the air flow.
- Heaters should not be placed directly at the inlet because forced air heaters are not

able to heat the air when it is moving too fast; instead they should be placed where the air speed is less than one metre/second

- Inlet capacity should always match fan capacity at the actual working pressure.

Air should enter the building at a pressure drop that allows the air to get half way across the house before falling. This is the function of the inlet area combined with the fan capacity at the actual working pressure drop. The total inlet area must be adjusted to provide the correct pressure drop dependent on the house width. Table 1 gives guidelines on recommended pressure at different house widths.

- How to work out the volume of a house:

House volume (m^3) = Average height (side wall height + ridge height ÷ 2) x length x width.
Example: Width 23m, length 110m, side wall height 1.5m, ridge height 4m
1.5 + 4 ÷ 2 = 2.75m
2.75 x 23 x 110 = 6,958m^3

- How to work out the heater capacity per m^3:

We recommend that the heater capacity should be a minimum of 0.05Kw/m^3. As the heater capacity increases, the performance usually increases. New houses should be designed with a heater capacity of 0.07Kw/m^3. In countries such as Russia and Canada with a hard winter this should be raised to 0.1Kw/m^3.
Heater capacity per m^3 = number of heaters x heater output (Kw) ÷ house volume (m^3)
Example: 6 heaters at 80 Kw each
6 x 80 = 480 ÷ 6958 = 0.069Kw/m^3

- How to work out how much a fan moves per minute:

Fan capacity in hours ÷ 60 = fan capacity in minutes.
Example: 18,000 m^3/hr ÷ 60 = 300m^3/min

- How many fans to put on for minimum ventilation:

Volume m^3 ÷ air exchange time ÷ fan capacity m^3/min.
Example: 6,958 m^3 ÷ 8 min ÷ 300 m^3/min = 2.9 fans. Always round fans up = 3 fans.

- How much inlet to open with the minimum ventilation:

We need to work out the fan volume per second.
Number of fans turned on for minimum ventilation x volume of fan per hour (m^3) ÷ seconds in a hour (3,600)
Example: 3 x 18,000 ÷ 3,600 = 15
Next you need to work out the air speed required through the inlets, so that the air will reach the ridge of the house before dropping to the floor. The width in this example is 23 metres, so the air speed required through the inlet is 8m/sec.
Fan volume ÷ air speed = amount of ventilation required to run with the fans for minimum ventilation (m^2).
Example: 15 ÷ 8 = 1.875m^2.

Summary

- Heater capacity per m^3 = 0.069m^3.
- Number of fans required for minimum ventilation = 3.
- Amount of inlet to work with fans = 1.875m^2.

All figures should be adjusted to suit an individual house but the calculations remain the same.

These figures are our recommendations in the field, based on unlocking the genetic potential while balancing the costs to achieve high performance, high welfare and the best financial reward.

Ventilation figures are always a topic of conversation, with different experts giving different answers. However, this point-by-point guide has been practised in all parts of the world giving excellent results. ■

House width (m)	Pascal unit (Pa)	Air speed (m/sec)	Distance before air drops (m)
10	8	3.5	5.0
12	10	4.0	6.0
15	17	5.0	7.5
18	26	6.3	9.0
21	37	7.5	10.5
24	42	8.0	12.0

Table 1. Calculations for minimum ventilation.