Section 5

Calf house
Ventilation

Introduction

Adequate calf house ventilation is vital to promote the growth of healthy calves. Successful calf house ventilation helps to reduce the risk of pneumonia outbreaks and increases overall calf comfort. In Ireland, naturally ventilated housing predominates.

1. **Housing factors associated with calf respiratory health.**
2. **The importance of good ventilation.**
3. **Natural ventilation in calf houses.**
4. **Building dimensions for effective ventilation.**
5. **Calf house designs that work well.**
6. **Design problems.**
7. **Space boarding.**
8. **Mechanical ventilation.**

Calf house **Ventilation**

1 Housing factors associated with calf respiratory health.

A significant factor associated with respiratory disease is the total airborne bacteria counts in pen air, with increased counts indicating poor ventilation. In order to reduce the bacterial counts, some practical changes can be made:

I. Increase the area within a pen. Moving from 2.3 to 4.1m^2 can reduce the total airborne bacterial count by half.
II. Improve house ventilation to dilute the concentration of organisms within the pens, e.g. through the use of supplementary ventilation systems.

2 The importance of good ventilation.

The eight primary functions of ventilation are to:

1. Eliminate noxious gases.
2. Eliminate draughts.
3. Eliminate areas of stagnant air.
4. Maintain optimum ambient temperature.
5. Maintain optimum environmental humidity levels.
6. Decrease airborne dust contamination.
7. Decrease airborne endotoxin levels.
8. Decrease airborne pathogen concentration.

Dust and gas can have adverse effects on the health of the calf. Not only does dust irritate the respiratory tract and mucous membranes it leads to permanent damage to the lungs and encourages micro-organisms.

Ammonia at levels of 25ppm irritates the mucous membranes and makes the animal more vulnerable to respiratory diseases.

Although carbon dioxide is not poisonous at elevated levels (>3,000ppm) it adversely affects cattle as less oxygen is present. In addition, hydrogen sulphide is highly toxic with levels above 50ppm known to kill cattle - the main cause of this problem is agitation of below-ground slurry stores.

If air speed within the shed is greater than 0.5m/s, changes will need to be made to the ventilation in the calf shed.

KEY FACTS:

Each calf respires about one litre of water vapour into its environment every day.

Indoor housing which is well ventilated and bedded will reduce the risk of a pneumonia outbreak.

KEY TIPS:

To ensure adequate ventilation, it is important that the building is designed to:

- **Remove excess heat.**
- **Remove excess water vapour.**
- **Remove micro-organisms, dust and gases.**
- **Provide a uniform distribution of air.**
- **Provide correct air speed for stock**

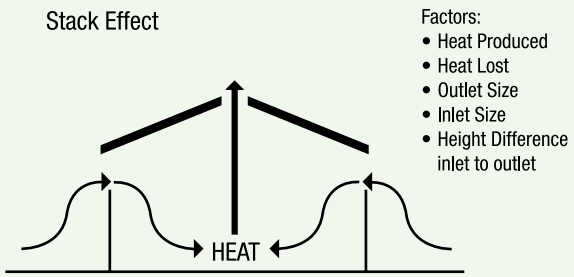
3 Natural ventilation in calf houses.

Natural ventilation is the most efficient and least expensive system for providing an optimum environment within a building. The objective is to provide a continuous stream of fresh air to every housed animal at all times of the day and night.

In Ireland, there is a predominance of natural ventilation in calf housing, which means that ventilation is provided by a combination of wind and stack effect. Natural ventilation works best when the building is positioned at right angles to the prevailing wind.

The stack effect is the same principle by which smoke is drawn up a chimney. In the building, the air that is heated by the livestock rises, escapes through the outlet area (highest point of the house) and is replaced by fresh air through the inlet area.

Adequate ventilation in sheds where young calves are housed can be difficult to achieve on still, damp days, since these animals are not generating sufficient heat to create a stack effect. In addition, sheds for young calves are more difficult to ventilate properly if the width of the building is greater than 10 metres.



4 Building dimensions for effective ventilation.

- The inlet/outlet size should be 0.08m² on sheltered sites and 0.05m² on exposed sites.
- The outlet should be at least 1.5m above the ventilation inlet.
- Roof profiles of 1:4 and 1:3 are ideal.
- There should be 5cm of ridge opening for every 3m of building width.

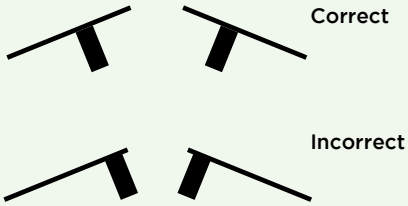
KEY TIPS:

Check ventilation in pens by crouching to calf level. If there is a smell of ammonia, it is not well ventilated.

Air outlet options include:

1. Simple ridge outlet.
2. Ridge upstands.
3. Ridge capping.

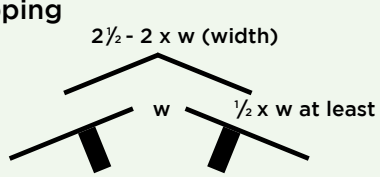
Simple ridge outlet



Ridge upstands

Upstands should not restrict the opening or interfere with air flow

Ridge capping

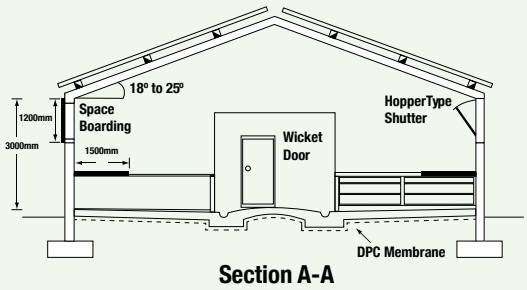


Calf house
Ventilation

5 Calf house designs that work well.

There are two commonly recommended shapes for a naturally ventilated calf house – mono-pitch or duo-pitch. Purpose built calf houses help to provide efficient calf rearing of calves up to eight weeks of age, at which stage weaned calves can be housed in larger groups or put out to grass.

a) Individual and group pens bucket fed



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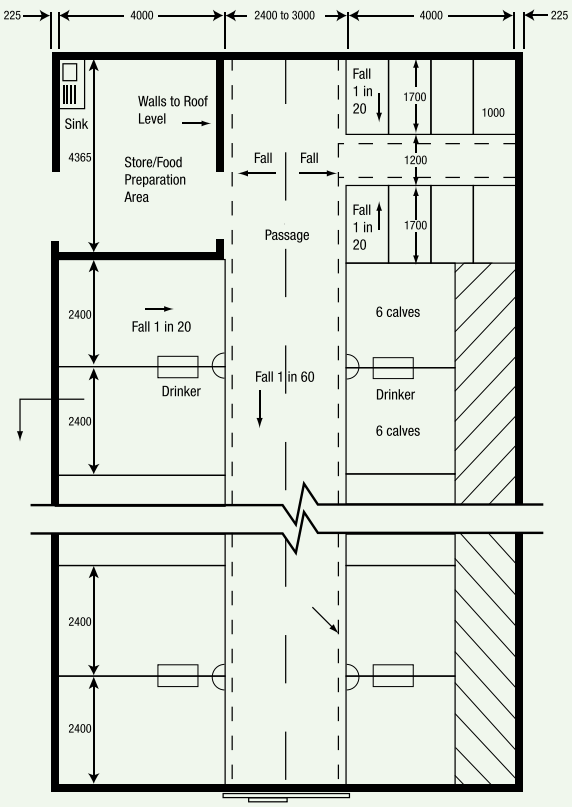
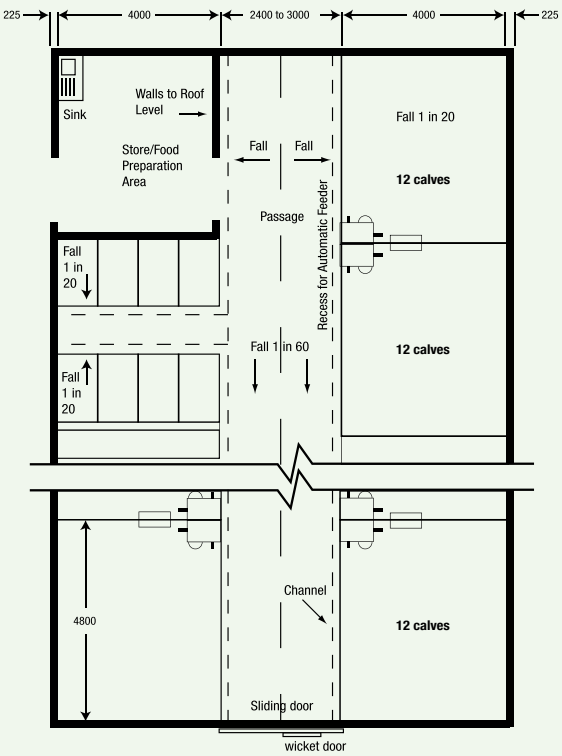


This type of house is ideal for bucket or nipple rearing 50-60 calves (three bay shed). It can be scaled up with each extra 4.8m bay catering for 24 additional calves. The advantages include a wide access passageway, the small group size allows for better batching and there is good access to pens.

KEY FACTS:

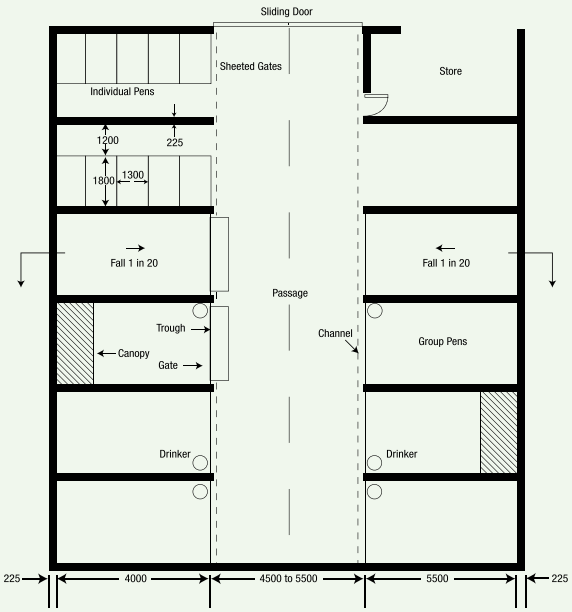
In sheds where calves are individually penned, the microclimate at the level of the calves can be very different from the general state of ventilation in the building.

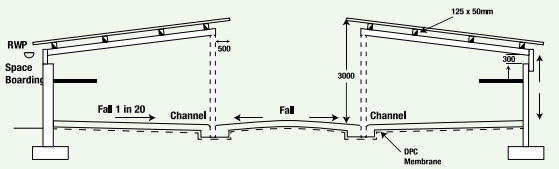
b) Automatic feeder



This house is laid out to get the most out of automated milk feeding. It is similar to the individual/group pen bucket fed house.

c) Patterson calf house





Cross Section

This house design provides accommodation for six to eight calves per pen but it can be scaled up to larger pens as long as adequate eave inlet is provided. This design usually consists of two rows of open fronted pens facing each other.

KEY POINT:

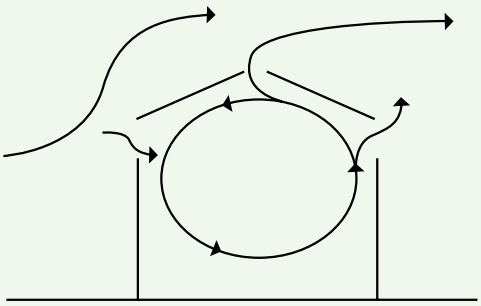
It is important that ventilation is never restricted in order to raise air temperature.

6 Design problems

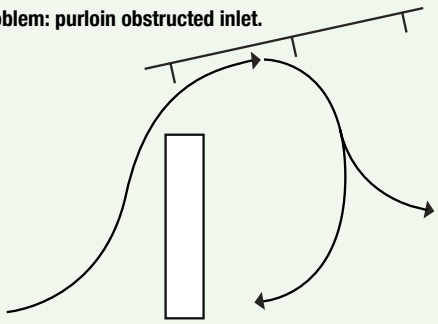
Common Design Problem	Consequences	Recommendation
Inadequate roof pitch, <15°.	Causes air to be deflected downwards leading to draughts.	Pitch of 22° recommended.
Inappropriate inlet location & poor design.	Leads to reduced effectiveness and downward deflection of air.	Eave inlets are ideal, 1.8-2.5m above floor. Gable ends are less effective.
Space boarding restriction of inlet.	Causes inadequate flow of air across the house.	Ensure space boarding is not covering or obstructing inlets.
Spaces under doorways and pen divisions.	Can cause low level draughts.	Reduce spaces, fill gaps.
Large height differences between inlets and floor.	Influence the pattern of airflow in windy conditions. Reduces the stack effect in calm conditions.	Have height difference of <3m between inlets and floor.
Obstruction of the outlet.	Reduces effectiveness of ventilation.	Simple open ridge space works best. Make sure that capped ridge outlets are properly designed and constructed.
Buildings wider than 10m.	Makes it difficult to get an even airflow across the building as the roof pitch tends to be lower, creating poorer air circulation.	Can be overcome by using spaced roof sheets or raised roof sheets.
Poor site location.	Major impact on air flow.	Ensure shed is positioned at right angles to the prevailing wind. Use mechanical ventilation.

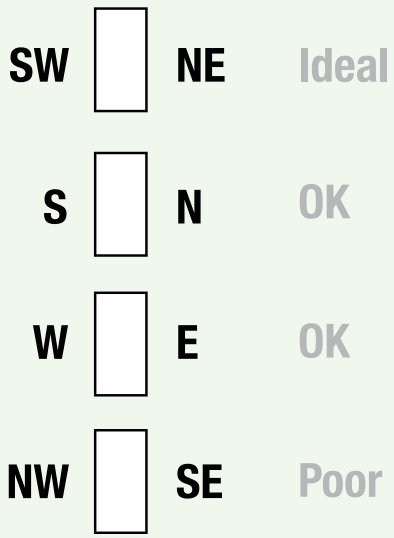
Calf house **Ventilation**

Problem: excessively high eaves.



Problem: purloin obstructed inlet.

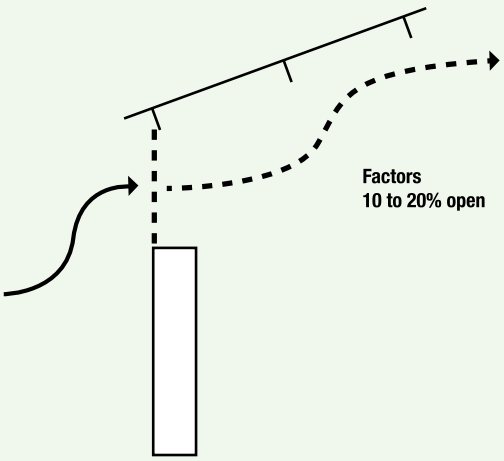




KEY TIPS:

In Ireland we have wind more than 90% of the time, even on sheltered sites, from the south west mostly. The coolest winds tend to be easterly and northerly, so naturally ventilated houses should be sited with this in mind.

7 Space boarding/perforated sheeting



Perforated inlet material slows down air and gives a more even distribution. Gaps of 20-25mm between boards 50-200mm, to give an area 0.08m²/calf, are suitable for most houses. On exposed sites reducing the gap to 12mm and the space to 0.05m²/calf gives good results, especially if the house is not more than 12m wide.

8 Mechanical ventilation

In poorly located sites, and in existing houses not designed for natural ventilation, mechanical ventilation may be the only option. Mechanical extraction fans should always be fitted to the highest point of the house roof apex.

Fans should have a minimum extraction capacity of 34m³/hour/calf. Inlet design is important to ensure good mixing of air without draughts. The inlets should be long and narrow, situated at eave height but not more than two metres above floor.

KEY TIPS:

In calf sheds you can use smoke pellets to test the airflow. Preferably choose a still day for the test. The smoke should rise and clear through the outlet areas in about two minutes. If that is not the case try to modify outlet and inlet areas. Mechanical ventilation should only be considered if there is no other way to improve airflow.