Housing & Equipment

Calves, Heifers, Dry Cows & Milk Cows … They All Need The Same Basic Things!

Animals have the same basic needs that humans do – food, water, shelter from the cold and heat, and a dry place to live. Think about your own house. Do you have air conditioning in the summer? Heating in the winter? Do you have your own space or do you share a room? All of these factors and more affect how happy you are in the space you live in.

Just like people, cattle will be happier and healthier if they have a good place to live. Animals may not be able to tell you if they do not like where they are but they show you in other ways by getting sick or staying healthy, growing slowly or quickly, and being energetic or sluggish.

Cattle have the same basic needs throughout all stages of their lives: adequate food and water, comfortable and dry surroundings, a well ventilated area and frequent manure removal. The most comfortable cows, heifers and calves will grow, thrive and be more productive than ones who are less comfortable. Cow comfort is affected by many different factors:

1. Feeding Systems
2. Water
3. Manure Removal
4. Ventilation
5. Stall Base
6. Bedding

Water and Feeding Systems

- Water must be clean and readily available for all animals.
- Feeding areas must provide enough manger space for the size of the animal. The amount of space required increases as an animal grows, until they are mature cows. Milking cows need approximately 60 cm of manger space each.
- Cattle do not like sticking their heads into patterns with light and dark because they cannot perceive depth, so the lighting in the feeding area should be consistent.
- There should also be sufficient manger space for all animals in a grouping to be able to eat.

Did You Know…

A mature dairy cow exhales about 12 litres of water into the air each day!

Manure Removal

Manure removal is important to reduce odours, reduce the number of flies and other pests, and to keep animals clean. The manure system should be designed to be friendly to the cows and the environment.

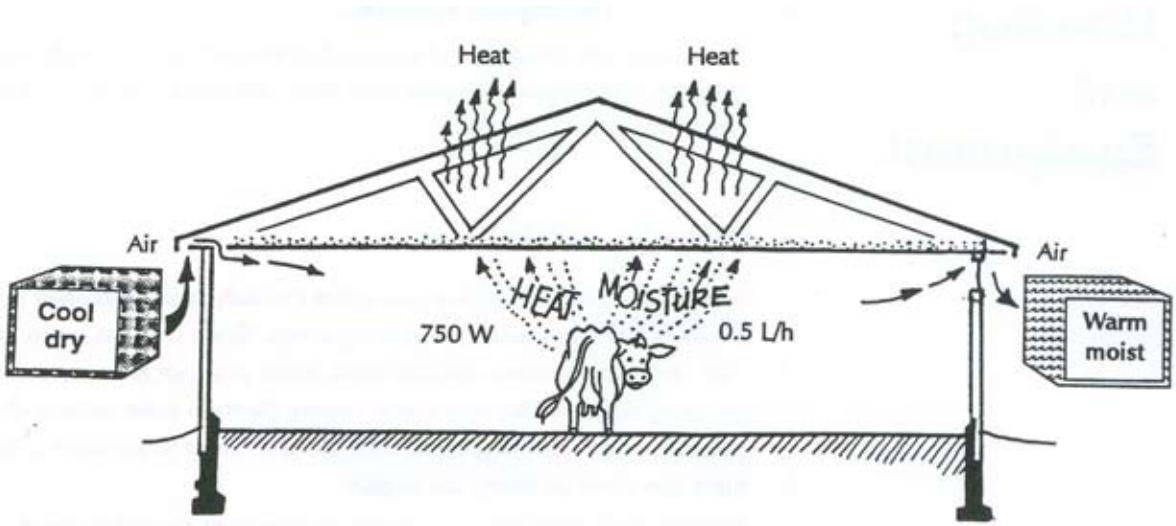
Ventilation

Ventilation systems serve two purposes:

1. Keep cattle cool in the summer
2. Remove moisture from the air in the winter

Cows need fresh, dry air and would prefer to be cold and dry than warm and damp. Ventilation must ensure that humidity in the barn never exceeds 75% to 80%. There are three different types of ventilation:

- **Cold Environment** – ventilation is the result of natural air flow. In the winter, these barns stay close to the temperature outside. In the summer, air inlets are opened as much as possible for maximum air flow and cooling. Many new barns are being constructed with curtains over openings that can be raised or lowered depending on the temperature outside.
- **Warm Environment** – the barn is kept ventilated and at a more constant temperature by mechanical ventilation and insulation. Mechanical ventilation is more expensive than natural ventilation because it results in monthly electricity bills.
- **Modified Environment** – a combination of mechanical and natural ventilation is used to regulate the barn. An example would be a barn that has fans for mechanical ventilation as well as windows for natural air flow.



Tunnel Ventilation

Tunnel ventilation is becoming an increasingly popular method of creating air flow in dairy barns. Tunnel ventilation is a system where fans are installed in an opening at one end of the barn, on the main level or in an upper level with a boxed in opening that allows air to flow up from the lower level. The fans pull air through the barn, creating continuous air flow. Really long barns would also need fans in the centre of the barn to pull enough air through. The air in a barn should flow at a rate of 250 feet per minute.

How do you figure out what fans you need for your barn?

The number and size of fans depends on the size of your barn and the speed of air flow. The required fan capacity is the useable cross-sectional area (height x width) of the barn multiplied by the desired air speed. Note that the space taken up by cattle stalls reduces the net area available for air flow. The most common fans are 48 inches (1200 mm) and will move about 20,000cfm (cubic feet per minute) each.

Stall Base

The stall base is the material located under the bedding in an animal's stall or pack. If compared to your bed at home, your sheets would be the "bedding" and your mattress would be your "stall base". Stall base is of particular concern in milking cow housing. However, it is also important to ensure that calf, heifer and dry cow housing environments keep animals comfortable to help them thrive.

Different Stall or pen base options include:

- Earth
- Rubber mats over concrete
- Rubber tires embedded in earth
- Cow mattresses
- Wooden planks

Bedding

Regardless of how comfortable the stall or pack base is, bedding is always required to keep animals clean and dry. More comfortable base types do not require as much bedding as less comfortable ones. If you were sleeping on cement, you would want a lot more pillows and blankets underneath you than if you were sleeping on a rubber mattress.

There are several factors to consider when selecting a base and bedding type for your farm, including the cost, comfort level, cleanliness, potential bacteria growth, potential for injury, and maintenance. The table below compares different types of bedding. For specific information on the cost of various bedding mediums, contact your local supplier.

Base/Bedding	Annual Cost per Cow ($ - low expense; $$$$ very high expense**)	Cow Preference	Cow Appearance	Potential Bacterial Growth	Potential for Injury	Maintenance
Clay/CS*	$$	High	Clean	Medium	Low	High
Concrete	$	Low	Dirty	High	High	Low
Wood/Plank/CS*	$$$	Low	Moderate	High	High	Medium-High
Concrete/Rubber Mat/ CS*	$$$	Low	Moderate	High	Medium-High	Low-Medium
Concrete/Layered Mat/CS*	$$	High	Clean	?	Low	Low
Rubber Tires in Concrete/CS*	$$	High	Clean	Medium-High	Low	Medium-High
Concrete/Mattress/ CS*	$$	High	Clean	?	Low	Low
Concrete/Long Straw	$$$$	High	Clean	Medium	Low	Medium-High
Concrete/Sawdust	$$$	Medium	Moderate	High	Medium-High	Medium-High
Concrete/Straw/ Paper	$$$	Medium	Clean	Medium	Low-Medium	High
Concrete/Sand	$$	High	Clean	low	Low	Low

CS* - chopped straw; ** - in the price scale above, $ = less than $10/year, $$ = less than $40/year, $$$ = less than $100/year, $$$ = greater than $100/year

Adapted from: OMAFRA Factsheet 'Alternative Bedding Systems' by Harold House, 1993

Another Cow Comfort Concern: Tingle Voltage

Tingle or stray voltage on farms is another problem that affects cow comfort and should not be present in housing areas of calves, heifers or cows. Stray voltage is an electrical current in the cow stalls or milking parlour. The greatest impact is seen on milking animals where the voltage leads to uneven milkout, nervous milkers, or cows that do not want to enter the parlour. When cows are nervous, they do not stand still as well and it is harder to keep milkers on them. This results in more cases of clinical mastitis and higher somatic cell counts. Normal housing always has some voltage present but it can be reduced by filtering. An electrician can help you find the problem and reduce its impact.

The Calf 'House'

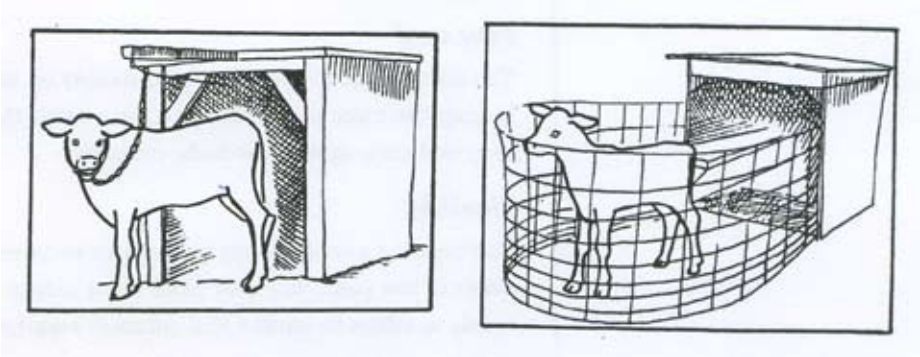
There are several features of ideal calf housing, including:

1. **Easy to clean** – keeping calves clean is a big priority because dirty calves often get sick. Many diseases spread through manure. When older calves move out and younger calves move in, the facility should be cleaned out, disinfected, and rebedded.
2. **Low cost** – keeping the budget for housing facilities low will ensure that more money is available to feed and take care of the calves properly.
3. **Flexible** – at certain times during the year you will probably have more calves than at other times during the year. Calf housing should be able to adapt to changes in the number of animals it needs to accommodate as well as changes in the seasons.
4. **Well-ventilated** – fresh air that is not damp or draughty is very important in raising healthy calves.
5. **Individual** – calves being fed a liquid diet from birth to two months of age should usually be kept separately, with no physical contact, to prevent the spread of diseases. Each calf needs approximately 1.2 m x 2.4 m of her own space to thrive.
6. **Dry** – wet calves get sick so it is very important to keep them dry and well bedded.
7. **Convenient to Work In** – the design of the housing should allow the farmer to feed and clean the calves easily. Young calves require a lot of care so they should not be located too far away from where their feed is prepared.
8. **Easy to observe** – the housing should be in an area that you can watch easily so that you are more likely to notice problems during early stages.

Cold Environment vs. Warm Environment

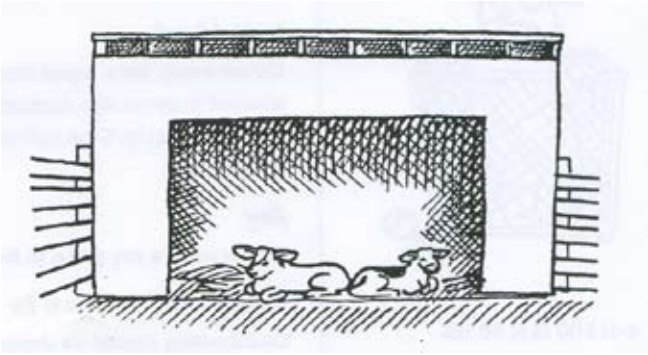
There are two main types of calf housing, cold and warm, that farmers can choose from.

Cold Calf Environment – Calves do not need to be kept as warm as people do so they can live in cold temperatures. Cold housing is naturally ventilated, which saves money because there are no heating costs; however, colder calves tend to be hungrier and eat more.



Examples of cold environments are hutches, monoslope barns and gable roofed barns. Hutches are made of plywood, plastic or fiberglass and placed outside. Calves can even be placed in hutches when it is very cold outside, as long as their bodies have not adapted to the warm climate inside the barn where they were born. They are usually 1.2 m x 2.4 m in size. Underneath a calf hutch, you must put a layer of sand, gravel or stone that can be used for drainage. Straw and/or shavings can then be used as a top layer to make a dry and comfortable bed.

A calf hutch is like a little house that a young calf gets all to itself! Hutches often have places for water, grain and milk containers. Some hutches allow the calf to run in and out for exercise; other hutches allow the calf to run around inside the hutch only, but it can stick its head out of the opening. In the hot summer hutches should be placed in shady areas because they can act like greenhouses and get very hot. In the winter, the hutch must be oriented in a way that the wind and snow do not blow on a calf.

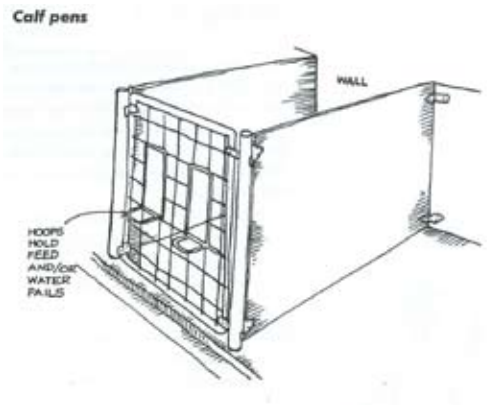


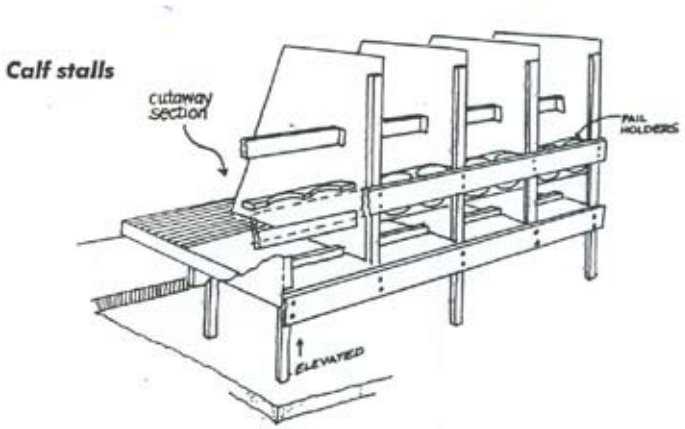
Monoslope (roofs that slope in only one direction) barns have an open side to let calves run inside and out.

Gable roofed barns have side openings for natural ventilation.

Warm Calf Environment – These are heated barns with mechanical ventilation systems. The temperature inside should be 10°C with less than 80% humidity. Since people like warm temperatures, warm calf houses are more comfortable for the dairy farmer to work in.

Warm calf environments often have calf stalls because stalls take up less space so there are more calves heated for the same amount of money. They should be made of solid sides about 1.3m high. The floor space should be 0.9m x 1.80m. Calves could be loose or tied in a stall.





Alternative Pen Types for Cold or Warm Housing

Calf pens can be set up inside a building. The building should be well ventilated and separate from adult cows. Individual pens should be at least 1.2 m x 2.4 m. They should have three solid sides and an open front. The open front will make the calf easier to observe and to feed, and will improve ventilation. These pens can be constructed out of wood and made in a way that they can be taken apart and stored when they are not needed. They are also easy to clean.

Group Housing is an option that some farmers choose to cut down on the amount of space and time needed to care for calves. When in group housing, calves should still have at least 1.2 m x 2.4 m of space each. This method of housing makes it easier for diseases to spread from one calf to another. Calves are also able to suck on each other, which could lead to infections of the navel or future udder problems. The advent of feeding unlimited acidified milk is making group housing preferable for some people. Since unlimited feeding allows calves to drink milk instead of sucking on each other, the sucking problem is minimized; however, sick calves should be removed from the group to prevent the spread of disease.

Comparing Common Types of Calf Housing

Factors	Hutch	Cold calf barn	Warm calf barn
Easy to clean	• yes	• if designed properly	• if designed properly
Low cost	• cheap to build and maintain • spend more on winter feeding	• more expensive than hutches, but still economical • spend more on winter feeding	• most expensive due to heating and building costs • feeding costs the same all year
Flexible	• can be moved anywhere on farm and stored when not in use	• if designed properly	• if designed properly
Well-ventilated	• yes, uses natural ventilation	• yes, if designed properly	• harder to keep well-ventilated due to mechanical ventilation
Individual	• eliminates calf-to-calf contact	• eliminates calf-to-calf contact, depending on design	• eliminates calf-to-calf contact, depending on design
Dry	• yes, if well built	• yes, if well built	• sometimes humidity gets too high
Convenient to work in	• farmer exposed to weather during feeding (snow, rain, etc.) • water freezes in winter	• protected from weather, but the temperature is the same as outside • water freezes in winter	• warm for farmer • less labour thawing water and feeding cold calves
Easy to observe	• yes, in the right location	• yes, in the right location	• yes, in the right location

Mooving On…It's time for Heifer Housing

When a heifer is two to three months old, she needs to be weaned and moved from her 'calf house' to heifer housing. This transition involves a change in physical surroundings, feed and social environment. There are a few things you can do to make the adjustment easier:

- Move calves in small groups of three or four 'friends': animals that are about the same age and size
- Minimize the change in surroundings such as moving from a hutch to a super hutch with more animals
- Make sure they are able to eat grain and hay when they change locations

A Heifer's New Home

Heifer housing should have the following features:

1. **Separation** – group by age and size and keep dry cows and heifers separate.
2. **Easy movement** from one group to another – as heifers get older or bigger they need to be able to move into the next age or size grouping area.
3. **Easy observation** – you must be able to watch heifers for health disorders, eating problems and signs of estrous (heat).
4. **Feed bunks** that are suitable for the height and size of the heifers.
5. **Areas for treatment and breeding** – heifers need to be vaccinated, treated when they are sick and bred when they are ready. Self-locking headgates or other means of confinement may be necessary to be able to hold the heifers in these instances.
6. **Easy removal of manure and bedding** – heifers need to be kept clean and dry to remain healthy.
7. **Water available.**
8. **Natural ventilation**.
9. **Space for exercise**.

Grouping Heifers

Why not with the dry cows? Heifers and dry cows are often housed in the same building, which is okay. They do need to be located in separate pens or pastures though. There are a few reasons why they should be kept separate:

- Heifers and dry cows need to eat different rations
- Heifers should not be exposed to older cows because they have not had time build up resistances to all of the same diseases
- Older cows are bigger and stronger. They can take over watering and feeding areas and prevent the heifers from eating and drinking enough

Heifers should be grouped according to size and age, for the same reasons that they need to be grouped differently from the dry cows. An ideal method of grouping would involve assembling animals that are no more than 3 months apart in age:

Group 1: 0-3 months
Group 2: 3-6 months
Group 3: 6-9 months
Group 4: 9-12 months
Group 5: 12-15 months
Group 6: 15-18 months
Group 7: 18-21 months
Group 8: 21 months to calving

These groups could be grouped differently and some may be combined if you have a small herd

Heifers Need Their Space…Just Like You!

Imagine if you had to share a room with your entire family. It would feel quite crowded and would not be very fun at all. Heifers require adequate space just like you do.

The chart on the next page shows the amount of space heifers need when they are different sizes. The age indicated is for Holsteins or Brown Swiss, but for other breeds, the weight can be used to figure out the amount of space needed.

Space Heifers Require

					4		
		1	2	3		Free Stall Neck Location	
Weight (kg)	Age in Months	Manger Space (cm)	Depth of Feeding Area (m)	Bedded Pack Area (sq.m)	Dimensions (cm x cm)	cm from rear curb	cm above stall base
75	2	30.5	1.8	0.9	61 x 117	86	71
150	5	35.6	2.1	1.4	69 x 130	94	84
200	7	38.1	2.3	1.8	76 x 142	104	89
300	11	44.5	2.5	2.3	89 x 165	122	99
400	16	48.4	2.9	2.8	97 x 183	135	107
500	20	54.6	3.3	3.3	109 x 203	150	112
600	24	61.0	3.7	3.7	122 x 229	168	117

To figure out how much space per animal you need for each type of heifer housing use the following formulae and the numbers from the top of the columns on the above table:

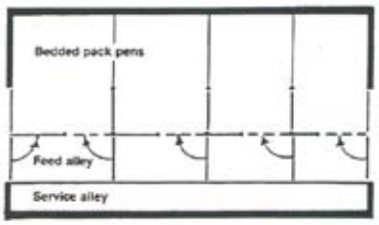
Area needed for loose housing = 1 x 2 + 3

Area needed for free stalls = 1 x 2 + 4

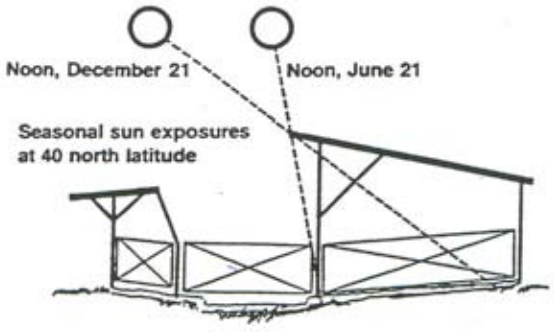
Sample Heifer Housing

A gated bedded pack barn is like a free stall barn but instead of stalls, there are bedded pens. They are flexible about the size of the animals that can be put in each pen. Animals need about 2.8-4.5 square metres of bedding, depending on their size, so they do require more straw, sand or shavings than in a free stall housing. If the barn is designed well it could be remodeled into a free stall barn later.

Gated bedded pack barn



Open front housing



Open front housing is a good transition type of housing for animals that have been kept in calf hutches. The open front faces south to maximize sunlight and minimize cold winds. The single sloping roof minimizes the amount of sunlight that can get in the summer. A scrape alley and open building can easily be cleaned out with a tractor. Heifers and dry cows of different ages can be separated by dividers.

Milking Cow Housing

The dairy industry is continually focusing more and more on cow comfort to increase profitability on dairy farms. The cow housing and milking systems on dairy farms are a primary focus on many dairy farms. More focus is usually placed on the comfort of the milking herd than the rest of the herd because it has a more obvious and direct impact on milk production and productivity.

It is very important that the feed and water systems, ventilation, manure removal, stall base and bedding of animals are comfortable to maximize productivity and animal health.

The Ultimate Way to Judge Cow Comfort

Go into the barn during a quiet time of the day (not feeding or milking time). How many cows are lying down? How many cows are chewing their cud? These behaviours will indicate that cows are comfortable. Remember, comfortable cows make more milk!

Housing cows in inadequate facilities can lead to lost milk production, dirtier cows with increased risk of mastitis and other disorders and cows defecating in areas that are difficult to keep clean. While cows cannot tell you when they are comfortable or uncomfortable, there are many signs to watch for that will tell you if your cows are happy in their physical environment:

Lying Down on the Job!

50% more blood flows to the cow's udder when she is lying down. Since it takes 454kg of blood flowing through her udder to make 1kg of milk – a cow that is comfortable lying down can make more milk!

- **Idle standing** - such behaviour, when a cow is not eating, resting or going somewhere, may indicate that a cow is lame or has a hard stall surface that she does not want to lay down on.
- **Perching** – when a cow stands with her front legs in the stall and her rear legs in the alley or lying down partially in the stall and partially in the alley. This behaviour is usually a sign of a cow that does not like how she is tied up, a lack of headspace, poor location of a neck rail, a stall that is too short, an uncomfortable stall or lameness.
- **Diagonal standing or lying** – when a cow is diagonal in her stall it usually means that there is not enough space for her to stand, lie or lunge in a straight direction. In tie stalls, it could also mean that the opening at the front of the stall is narrow, the manger curb is too high or that she does not like the location of the tie rail or electric cow trainer.
- **Lying backwards** – when free stall cows lie backwards in stalls it usually means they are turning away from something they dislike and turning towards the open space for easier movement. For example, if there is a wall very close to the front of the stall (with not enough lunge space), cows may turn backwards.
- **Restlessness or long periods of lying** – these behaviours describe cows that change position while lying down or fidgeting. The result is often chafed hocks from the movement of their legs against the stall. The cause may be high curbs that prevent front legs from moving forward, injuries or lameness.
- **Alternate occupancy** – occurs when cows in free stall barns situate themselves in nose to nose stalls so that the stall facing them is empty. This occupancy allows animals to avoid facing dominant cows and to have sufficient lunge and social space. It may mean the stalls are too short for the cows.
- **Bunching** – occurs when free stall cows stand in one area and avoid another location. This could mean that there are variations in air movement and temperature in the barn, or that some stalls are more comfortable than others.

- **Rising and lying motions** – these movements should be continuous and smooth. When a cow rises, her body lunges forward and her head bobs down and up to counterbalance the rising of her hindquarters. During the rising process, her shoulders move forward about 16 inches and her head moves forward about 24 inches. Any obstruction that limits her movement will cause her to move differently when rising.

- **Caudal licking (grooming)** – occurs when cows groom the fold between their udder and their leg. It is important for hygiene between the leg and the udder and can prevent scalding in that area. When cows are unable to perform this behaviour, it is a sign that the floor is too slippery.

- **Kneeling cow syndrome** – KCS describes cows that stand upright on their hind legs and down on their front knees. It could happen when cows are eating below or at the same level as their feet (the manger should be slightly raised); cows could be trying to avoid poorly positioned electric trainers or neck rails; there may be obstructions to rising; cows with laminitis may also exhibit this behaviour.

- **Dog sitting** – when a cow sits like a dog, with her hindquarters down on the ground and her front legs extended it may mean that she has an injured front leg or that she does not have adequate lunge space to rise normally.

- **Nose-pressing** – this behaviour, when a cow pushes her nose into a pole or steel rail, is also called stereotypy. It is a response to a stressful condition. The cause could be hard to identify and is often related to stall dimensions and the amount of space available for the cow.

Housing Design

The three main types of housing for dairy cattle in Canada are tie stalls, free stalls and pack barns. Generally, farms with less than 50 cows use tie stalls and those with more than 100 cows use free stalls. Farmers milking between 50 and 100 cows have especially careful decisions to make about what system to use. Pack barns are newer and as such there are fewer in existence. In the end, the type of housing usually depends on the farmer's preference, cost and the amount of labour involved.

In both free stall and tie stall housing, the stalls must be designed with animal comfort and health in mind. There are a couple of features that must be considered regardless of which housing method is used:

- **Partitions** – the dividers between stalls should be wide enough apart for the animals to get up and down freely. Lunge space should also be provided. Dividers encourage cows to lie straight, keeping the area cleaner. Dividers with posts that extend back into the platform the cow stands on can allow the cows' legs to get caught. Suspended or flexible dividers are more suitable.

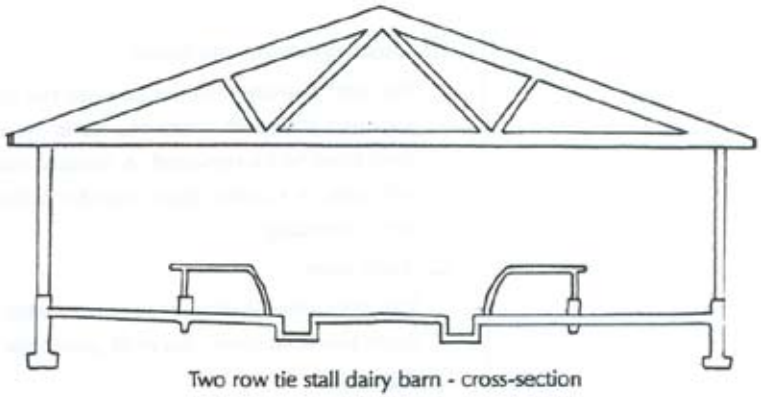
- **Stall size** – must be adequate for comfortable resting positions and adequate lunge space for rising.

- **Slope** – a downward slope to the back of the stall allows the stall to drain towards the gutter or scrape alley and keeps the stalls cleaner.

- **Freedom from obstructions** that prevent lunging and other normal behaviour.

Tie Stall Housing

'Tie stall' means that each cow is tied inside a stall and is not constantly roaming around. Instead of having to walk around to seek feed, water, milking, and resting areas, everything that the cow needs is brought to her. Cows are often let outside for exercise. This is the traditional type of housing that was used on dairy farms in the past and is still very popular for herds that milk less than 60 cows.



Two row tie stall dairy barn - cross-section

There are some important stall features to consider when constructing tie stalls:

- Traditional comfort or stanchion stalls do not allow cows to lunge forward in their natural manner when they are getting up. Single head rails with a chain (that reaches the height of the manger curb) and a neck strap allow each cow to get up and down the most naturally.
- Tie rail (head rail) height should be adjusted as in the chart below.
- The stall opening should be large to allow sufficient lunge space and to allow the animal to back up and turn out of her stall when she is leaving.
- Manger curbs should be added to keep bedding out of the feed and vice versa.
- Manger height should be four inches above the cows' feet to reduce pressure on her feet.
- The bed should have adequate dimensions (as in chart below) and cushion.
- Water bowls should be placed in a manner that provides easy access to them without obstruction.
- Cow trainers are helpful in keeping animals clean but should be located 2-5 inches above the cow's backs approximately 6 inches behind the point of shoulder. If they are not properly installed they can cause nervousness, teat injuries, accidents and reduce reproductive performance. They must be located at least two inches above the cow's back and do not need to be left on all the time.
- The dimensions should be large enough to enhance cow comfort:

Stall Dimension	Ratio and Reference Body Dimension	An Example a median cow
Bed length = imprint length	1.2 x rump height	1.2 x 60 = 72 in.
Tie rail height above cow's feet	0.80 x rump height	0.80 x 60 = 48 in.
*Stall width = imprint width +	2.0 x hook-bone width	2 x 26 = 52 in.

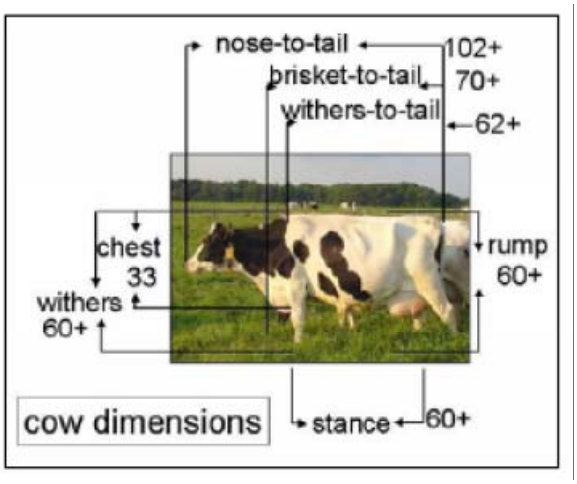
* Producers are building most new tie stalls wider than this minimum width. The most common minimum width is 54 inches.

Source: "Tie Stall Dimensions", OMAFRA INFOSheet, Neil Anderson, 2007.

The measurements for both tie stall and free stall barns are based on the cow body dimensions below:

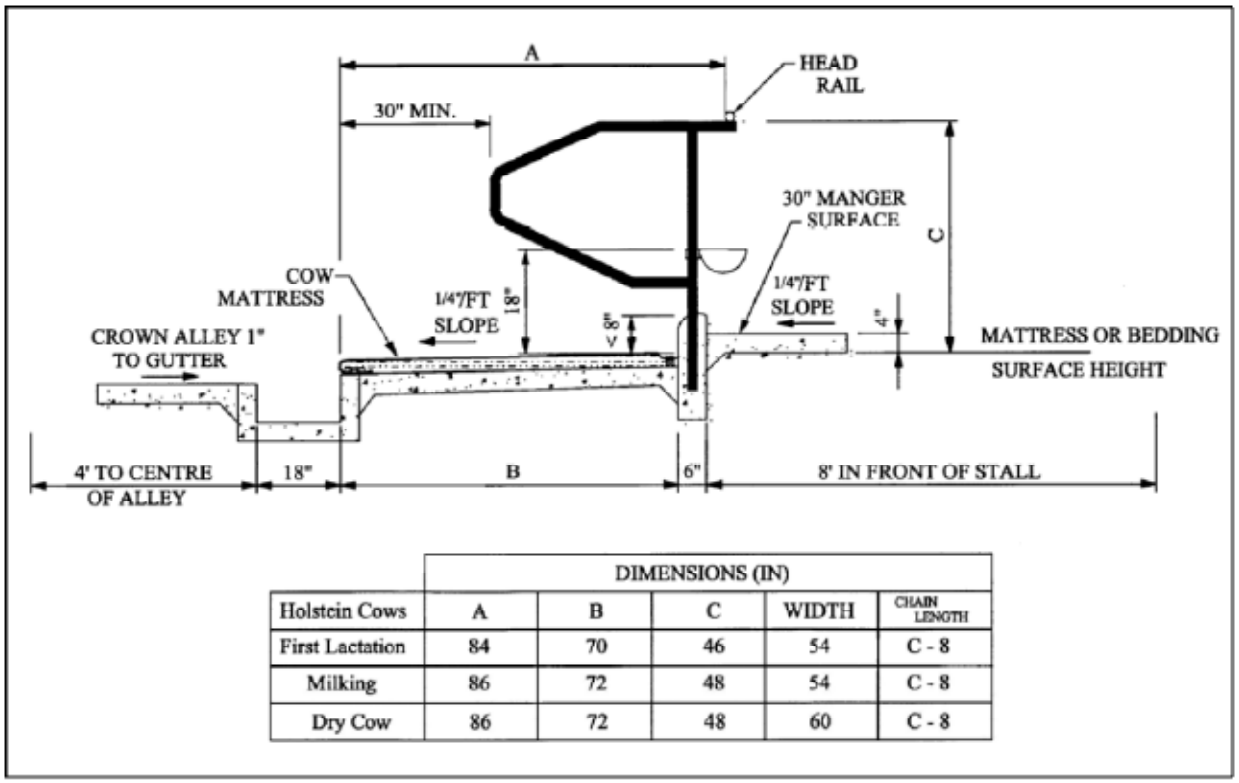
Body Dimension	Inches	Proportions
Nose-to-tail length	102 (range 96-110)	1.6 x rump height
Imprint length – resting	72 (68-76)	1.2 x rump height
Imprint width	52	2 x hook-bone width
Forward lunge space	24	0.4 x rump height
Stride length when rising	18	0.3 x rump height
Rump height – mature	Median 60 (range 58-64)	
Rump height – Lactation 1	Median 58, top 25% - 59	
Stance – front-to-rear feet	60 (range 58-64)	1.0 x rump height
Withers (shoulder) height	60 (range 58-64)	1.0 x rump height
Hook-bone width	26 (range 24-27)	

Source: ' Free Stall Dimensions', OMAFRA INFOSheet, Neil Anderson, 2007



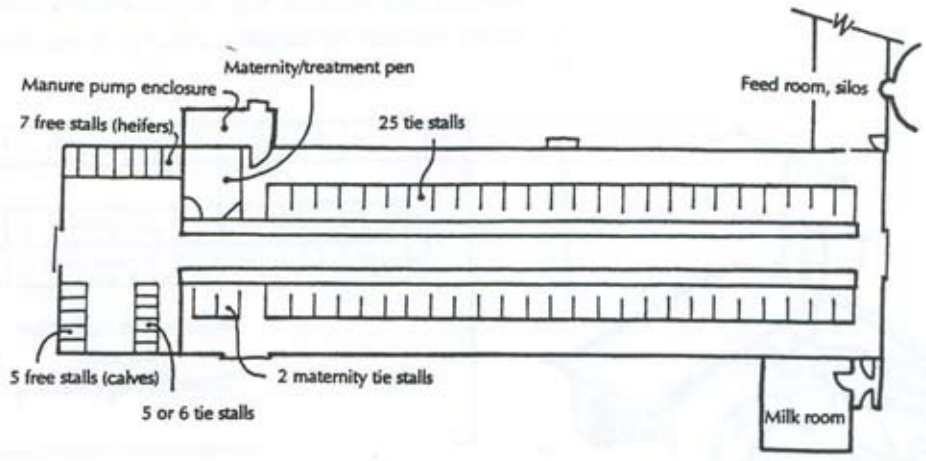
Source: "Free Stall Dimensions", OMAFRA INFOSheet, Neil Anderson, 2007.

A sample tie stall with proper slope and dimensions will help maximize milk production and improve reproductive performance and overall cow health



	DIMENSIONS (IN)				
Holstein Cows	A	B	C	WIDTH	CHAIN LENGTH
First Lactation	84	70	46	54	C - 8
Milking	86	72	48	54	C - 8
Dry Cow	86	72	48	60	C - 8

Source: "Tie Stall Dimensions", OMAFRA INFOSheet, Neil Anderson, 2007 (Diagram courtesy of Harold House, OMAFRA)

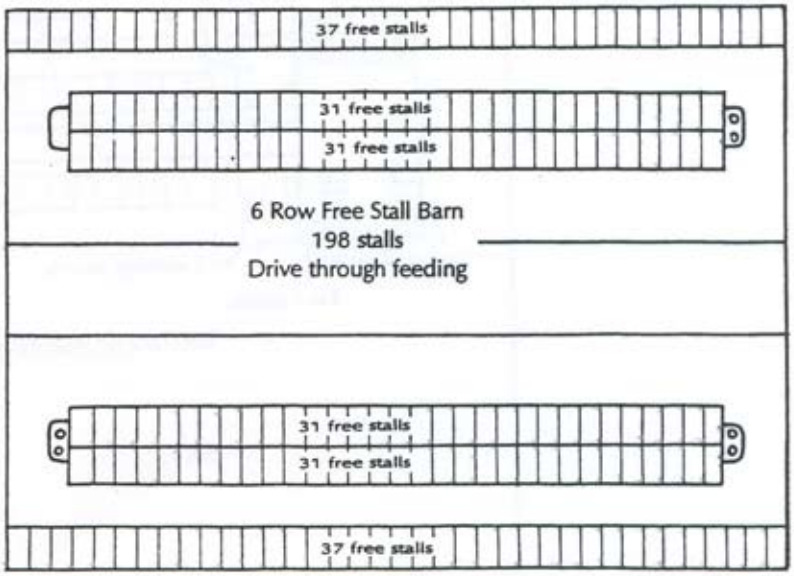


Sample Tie Stall Layout

Free Stall Housing

'Free stall' means that cows roam freely through the barn. It is one form of **loose housing**. There are separate areas for eating, drinking, resting, and milking. Milking is done in a parlour or by a Voluntary Milking System (Robot). The free stalls are the place where the animals rest. There are several features to pay attention to when building free stall barns to make sure that the stalls are adequate for the cows:

- The neck rail needs to be properly located to allow cows to stand up straight and to lunge forward when rising.
- The partitions between the stalls must have wide loop openings at a proper height so that cows are able to lunge diagonally through them when rising if they so choose.
- Brisket locators are important to keep the cows from moving forward too far in the stalls, but they should not be so high that they limit the ability to swing front legs forward when resting.



Sample Free Stall Layout

- The front area of the stall should not have any objects that obstruct the cows' abilities to rest or lunge forward when rising.
- Deterrent straps or pipes may be necessary to prevent cows from exiting from the front of the stall.
- Some measurements may change with the type of base and bedding used in the stalls.
- Just like in tie stall barns, cow dimensions should be considered to maximize cow comfort in stalls:

Stall Dimension	Ratio and Reference Body Dimension	An Example a median cow
Stall length from curb to solid front	2.0 x rump height	2.0 x 60 = 120 in.
Stall length for open front head-to-head	1.8 x rump height	1.8 x 60 = 108 in.
Bed length = imprint length	1.2 x rump height	1.2 x 60 = 72 in.
Neck-rail height above cow's feet	0.83 x rump height	0.83 x 60 = 50 in.
Neck-rail forward location = bed length-2	(1.2 x rump height)-2	(1.2 x 60)-2 = 70 in.
Deterrent strap in open-front stalls – 18-ft.	0.6 x rump height	0.6 x 60 = 36 in.
Deterrent strap in open-front stalls – 16-ft.	0.7 x rump height	0.7 x 60 = 42 in.
Stall width – loops on centres	2.0 x hook-bone width	2.0 x 25 = 50 in.
Space between brisket locator and loop	foot width	5 inches

Source: "Free Stall Dimensions" OMAFRA INFOSheet, Neil Anderson, 2007.

Pack Barn Housing

'Pack barns' do not contain any individual cow stalls at all. They are similar to free stall barns because cows roam around freely, in another form of **loose housing**, with separate areas for eating, drinking, resting, and milking. Instead of resting in a stall, animals rest on a large bedding pack that is big enough to hold a large group of cows. These packs are often made of sand. Compost packs are becoming increasingly popular. Such beds involve an accumulation of manure that bedding is continually added to so the cows remain clean and dry.

There are advantages and disadvantages to the different types of barns used for dairy cattle housing:

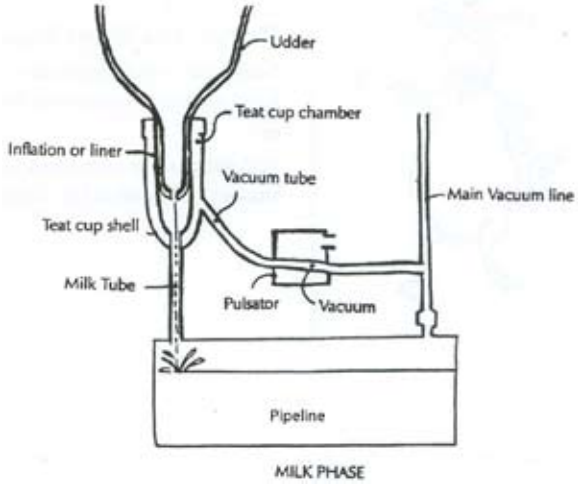
Type of Housing	Advantages	Disadvantages
Tie Stall Housing (with pipeline)	• More time spent with each cow • Animals get individual attention • Small installation cost of milking system • Easier to treat sick animals since they are already tied up	• Cows do not get as much exercise • One person can milk fewer cows per hour than in a parlour • Heat detection more difficult • More labour taking feed and equipment to cows
Free Stall Housing (with parlour)	• Lower amount of labour per cow • Parlour can milk 60-120 cows per hour depending on design • Cows get adequate exercise	• Less time spent with each animal • Less individual attention • More expensive to install milking system • If a parlour is used to milk, cleanup takes about 30minutes longer than tie stall
Pack Barn Housing	• Lower amount of labour per cow than tie stall • Parlour can milk 60-120 cows per hour depending on design • While the milking system is expensive, it is less costly than free stall because stall work is unnecessary – housing is simple and relatively inexpensive • Cows get adequate exercise • Very comfortable	• Manure must regularly be picked from the pack to keep it clean and pack must be aerated if composted • Less individual attention • More expensive to install milking system • If a parlour is use to milk, cleanup takes longer than in a tie stall • A composting pack needs bacteria, but cow udders don't! • More space per animal is needed

Milking Systems

Choosing a milking system goes hand-in-hand with choosing a type of housing and the two decisions are usually made together.

There are three types of milking systems in Ontario:

1. In-barn pipeline – used in tie stall barns only.
2. Parlour – used primarily in free stall and pack barns; could be used in a tie stall barn if cows leave their stalls to be milked in the parlour.
3. Automatic Milking System (AMS) / Voluntary Milking System (VMS) / Robotic Milker – used in free stall or pack barns.

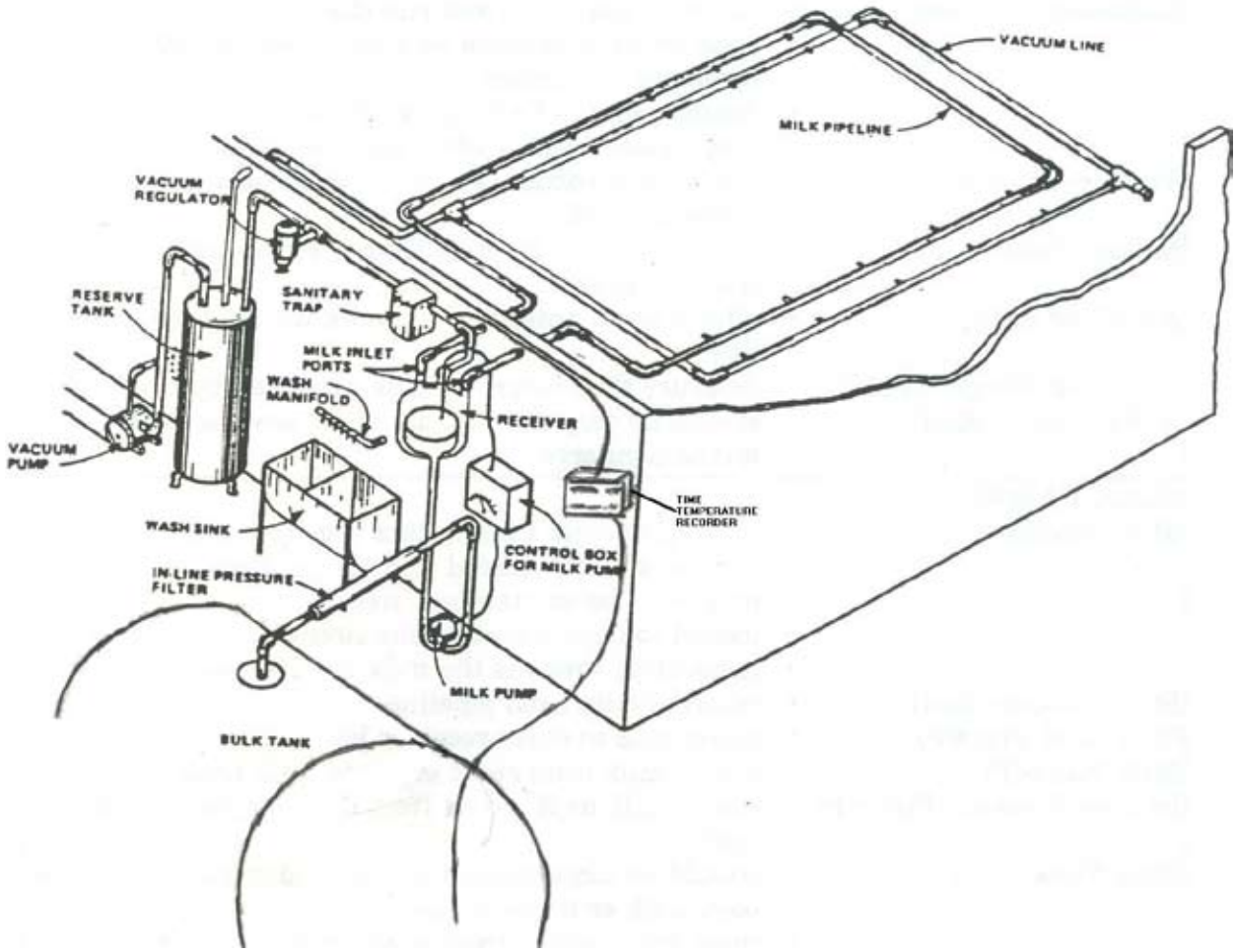


MILK PHASE

The **purpose of all milking systems** is the same:

1. Get milk to flow out of the teat.
2. Massage the teat so that it does not get sore during the milking process.

Parts of a Milking System



Name of Part	What job does it do?
Note: There are many parts of a milking system and some equipment varies from farm to farm. This chart outlines the major components of typical systems.	
Vacuum parts (pump, hoses, regulator)	Control the amount of air and vacuum in the milking system
Pulsator Automatic takeoff (option)	Creates and controls the milking cow cycle electrically. The cycle is air-vacuum-air-vacuum. It is like sucking on a straw. When you suck on it, you create a vacuum; when you stop, air is let in. If equipped with an automatic takeoff option, when the milk flow stops, the takeoff unit will turn off the unit and remove it automatically from the cow.
Teat cup shells and liners	The shells are stainless steel and inside them are the rubber or silicone liners. The liners go onto the cow's teats. They inflate with air and then collapse during the vacuum part of the milk cycle. Rubber liners must be replaced every 500-700 milkings and silicone ones every 5,000 to 10,000 milkings.
Milk Claw	Catches the milk after it is sucked from the udder. Milk goes from here into a hose that reaches the pipeline.
Pipeline	Carries the milk from the claw into the receiver jar and from the receiver jar into the bulk tank. It is very short in parlours but if cows are milked in a tie stall barn, the pipeline is long enough to run over top of all the cow stalls and back into the milk house. It is like a long plastic or stainless steel hose that carries milk and is easy to clean. They are sloped towards the milk house so that milk can flow by gravity.
Receiver Jar	Milk comes into the receiver jar from the pipeline and is held here until there is enough milk to be mechanically pumped through a short pipeline into the bulk tank
Bulk Tank	The large 'refrigerator' that holds and agitates the milk after milking. It cools and keeps the milk between 1°C and 4°C until the milk truck comes to pick it up.
Time Temperature Recorder (TTR)	A monitor that keeps track of pipeline and bulk tank temperatures, milking and wash times. It alarms producers, bulk tank milk graders and milk inspectors about problems in milking, cooling and washing cycles.

Keeping the System Clean

All milking systems must be kept very clean to avoid contamination of the milk. All parts of the milking system that milk comes into contact with must be washed every day. Washing milking equipment is like running the system through a dishwasher with several cycles:

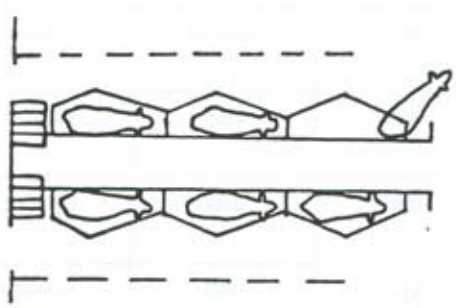
Steps to Washing:

1. Warm water rinse to remove any debris and excess leftover milk from the system
2. Alkaline chlorine based detergent wash to remove dirt and residues
3. Acid rinse to remove residues left after washing
4. Sanitizer rinse just before the next milking to kill any leftover germs

Milk houses and parlours must also be rinsed to ensure that they are kept clean as well.

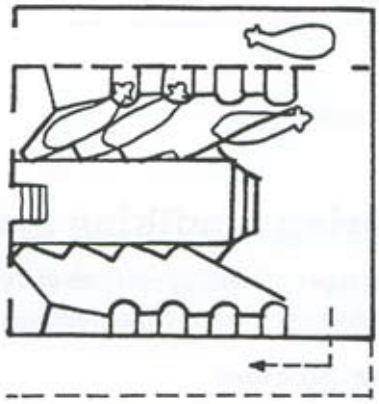
Types of Parlours

While in-barn pipeline systems are very straightforward, with a pipe to carry milk running around the barn alongside a pipe to hold the vacuum, there are several parlour designs that farmers can choose from. These include side opening (double and single), herringbone (polygon, double and single), rotary platform and parallel. The most common types in Canada are the double side opening, double herringbone, and parallel designs.



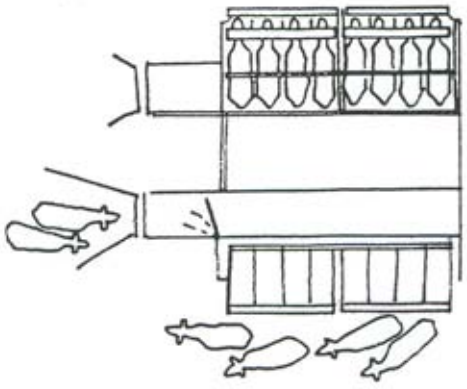
Double Side Opening

Animals stand nose to tail in this type of parlour. The operator must walk the length of an animal to get to each udder, so more time is spent walking than in other systems. Each cow has her own door to exit through so as soon as she is finished, her door opens and she leaves so that another cow can enter to be milked. Thus, an advantage is that a slow milking cow does not hold up the entire parlour.



Double Herringbone

The operator needs to walk less distance from one animal to the next because the cows are standing on an angle to the parlour pit. More cows can be milked per hour because walking time is reduced and more cows can fit into the parlour at once. There are disadvantages though. The cows are milked in groups, so all cows in the group must be finished milking before any of them can exit the parlour. The cows enter at one end and exit at the other, so there is some time delay as the cows must leave in single file and the next group of cows must enter in single file. In r*apid exit herringbone parlours,* the side of the stalls furthest from the parlour pit lifts up like a garage door so that it is out of the way and the cows can turn around and leave at the same time. This reduces the time required for milking from that of a regular herringbone parlour.



Parallel Parlour

The cows stand perpendicular to the parlour pit, so the shortest amount of time is needed to move from cow to cow. Milkers are attached to cows from behind, between their rear legs, unlike in-barn pipeline, herringbone and side opening parlours where the milkers are attached from the side of the cow. There is less chance of the operator being kicked or of the cow kicking the milker off. However, the operator needs to guard against defecation. The cows are milked in groups, so slow milking cows hold up the entire group. Most of these parlours have a rapid exit design so that the transition time is minimized between groups of cows.

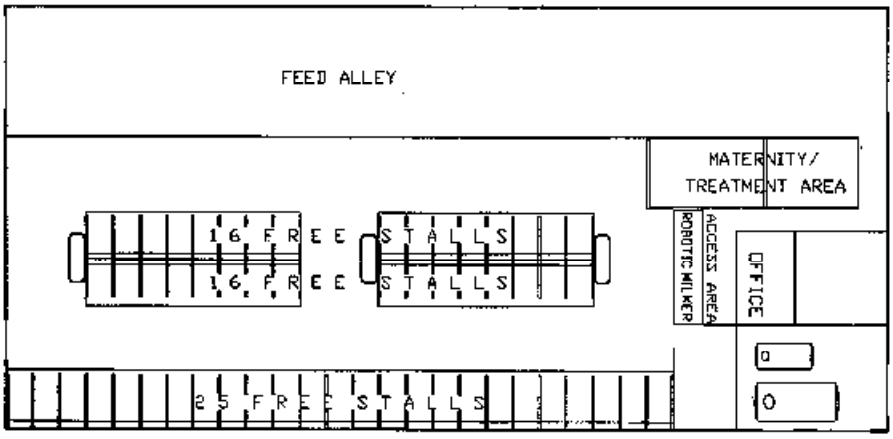
Rotary Parlour

Cows stand on a rotating circular platform, past a stationary central pit. Typically, animals walk from a holding area into a stall – the stall is part of a circular steel platform with stalls arranged all around the circumference. When a cow stands in a stall, her head faces towards the inside of the circle. Once a cow stands in a stall, the circular wheel rotates a few feet until the cow is situated in front of the operator. The milking claw can be placed on the cow and the platform can then be rotated another few feet, so that the milking claw can be placed on the next cow. When a cow is finished milking, an automatic takeoff removes her milking claw and she can exit when her part of the circle comes around to the exit gate. Old rotary parlours suffered from high maintenance costs. While the 'bugs' have been worked out in new models, rotary parlours are still the most expensive parlour option. They are designed for producers milking 300 or more cows and are appealing because a lot of cows can be milked in a short period of time.

A comparison of some common milking parlours:

System	Number of Milking Stalls	Milking Units	Cows Milked per Hour
Automated 2 x 4 side opening	8	8	60
2 x 8 standard exit double herringbone	16	16	70
2 x 8 rapid exit parallel	16	16	80
2 x 12 rapid exit parallel*	24	24	120

* This is the only parlour (excluding rotary) that keeps the operator busy, making the best use of labour. However, in Ontario, these parlours cost much more and would milk 700 cows three times a day. In Ontario, most herds are not that large. In a 100 cow herd, a parlour of this size would only be used 10% of the time.



A basic three row freestall barn set up with one robotic milking unit. The robotic milker is set up near the office for easy heating and transfer of electronic information on individual cow milkings from the milking unit to the office computer.

Source: OMAFRA Factsheet 'Housing Considerations for Automated Milking Systems' by Harold House, 2001

Automatic Milking Systems

Automatic Milking Systems (AMS) or Voluntary Milking Systems (VMS) are more commonly known as *Robotic Milkers*. They have been used since 1992, with most of the units installed in Europe, particularly the Netherlands. These systems are primarily used in herds between 100 and 150 cows. They are becoming more popular for one-man operations because one person can care for 65 cows with minimal additional labour. When cattle numbers get larger (>120) the animals need to be arranged into smaller groupings or more robotic milkers need to be installed.

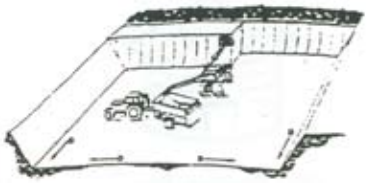
There are a few reasons why some people have decided to adopt this technology. From the cow's perspective, this system allows her to move freely not just when eating, drinking and resting but also when milking. This allows the animals to act naturally. From the perspective of the farmer, AMS milking enables more flexibility in scheduling, reduces the financial and mental stress of hiring labour, and allows other aspects of management to receive more attention.

There have been several drawbacks related to AMS as well. Some farmers have experienced increases in somatic cell and bacteria counts. Reasons for this may be poor bulk tank washing, uncleaned hoses attached to a second robot that is not used, frequent washing of the system that results in some water being left inside equipment. Arranging cow traffic must also be arranged to enable all animals access to the robot and eliminate confusion. Robotic systems do not tolerate freezing temperatures and as such at least some of the equipment must be in a heated, confined area. Animals must also be trained to adapt to this system, which could take two or three weeks.

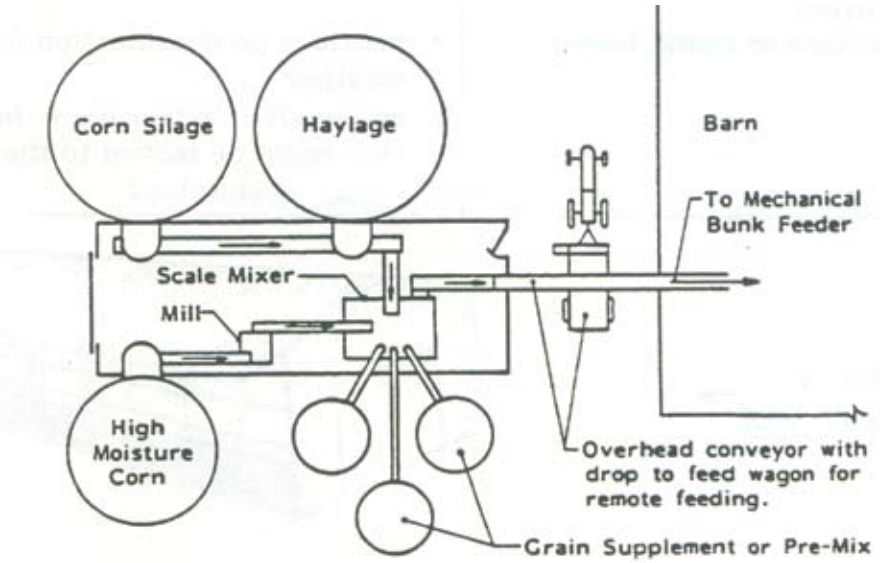
Feed Storage

Buildings to house cows and heifers are not the only structures needed on the farm. Feed storage silos, bins and buildings play an important role in maintaining high quality feeds that are readily available on the farm throughout the year.

The type of feed storage on your farm will depend on the facilities you have and the feed you need to store. The chart below gives you several options.

Structure & Feeds Stored in it	Characteristics
Conventional Tower Silo • Corn silage • Haylage • Ground high moisture grains • Corn cob meal 	• Top unloading so that the feed put in last gets used first • Need to remove 5-10cm daily in winter and 7.5-10cm in warm weather to avoid spoilage • Silo height determined by amount fed annually (or what the silo holds) • Fill with blower from self unloading truck or wagon • Well suited to mechanical unloading • Need to be well maintained
Oxygen Limiting Silo / Sealed Silo • High moisture grains • Corn silage • Haylage 	• Bottom unloading so that the oldest feed gets used first • Expensive but convenient
Horizontal Silo / Bunker Silo / Trench Silo • Corn silage • Haylage 	• Adaptable to self feeding • Difficult to mechanize • Pack and cover to reduce losses • Packing usually occurs with a tractor • Polyethylene plastic with old tires on top is a common cover. Reduces losses but is expensive • Labour intensive for packing, snow removal, covering • Unload with tractor, unloader or by self feeding
Loft of Two Storey Barn • Dry hay (square or chopped) • Dry grains • Mixed rations and supplements	• Hard to change or improve facilities • Bales put pressure on outside walls • Storage is convenient (animals located below it) • Putting feed inside labour intensive • Expensive in new construction • Can help insulate lower barn
Pole Building or Tarp/Fabric Buildings • Dry hay (square or round bales)	• Good weather protection • Relatively inexpensive to build • Feed must be moved to the barn • Easily mechanized
Grain Bins • Cereal grains • Dry corn • Supplements  Wooden Granary Flat Bottom Bin Hopper Bottom Bin	• Using augers to connect bins to each other and to feeding system makes grain transfer fairly easy • Two types of bins: gravity flow unloading with hopper bottom and auger unloading with flat bottom bins • Grain dryers are often used to speed drying of grain before storage
Outside Storage • Baled dry hay • Extra crop if other storage is full	• Short term • Covering with plastic is expensive but reduces losses • Feed is subject to weather conditions

Several of the storage methods outlined on the last page may be used on a single farm. The system below shows one example of how feed storage can be integrated into the feeding system on the dairy farm:



Bringing Supper Home!

Feed must be moved from the storage areas to the barns where animals need to be fed.

Tie Stall Barns – Feeds are brought to a feed room for mixing to create a total mixed ration (TMR) or to be fed separately. The feed is delivered to the cows by:

- Push carts with hand unloading that are economical
- Power carts that are more expensive but require less manual labour. They can also deliver feed to adjacent barns. They can feed TMR in different locations if they are equipped with weighing devices.
- Computerized grain feeders that are expensive but convenient. They allow animals to be fed individually and can be programmed to deliver small amounts of feed to animals several times per day.

Free Stall Barns or Pack Barns – Feeding is usually done in a bunk filled by a mechanical conveyer or a mobile mixer that has a scale to weigh feeds. These systems are easily adapted to mixing complete, balanced rations to feed cattle in groups according to production. Computer feeding can be used to more accurately feed concentrates to individual cows within production groups in the free stall barn.

Farm Safety in Feed Handling

It is important to protect yourself and farm employees from injury when dealing with all aspects of farming. Feed handling involves many potential dangers:

Flowing Grain – It only takes a couple of seconds to become trapped in flowing grain in a feed bin. In less than 10 seconds, you could become completely buried. To prevent being buried in flowing grain, never enter a bin while it is unloading, never walk across stored grain, and always have another person with you if you need to examine a bin.

Silo Gas – Nitrogen dioxide (NO_2) is produced during rapid fermentation of silage. This gas is heavier than air and settles to the ground. It can be colourless or a yellow-brown or reddish colour. It can be odourless or smell like bleach. It can kill someone within seconds, so it is important to follow several safety rules:

1. Post warning signs near the silo.
2. Do not enter the silo for three weeks after filling.
3. Ask your local fire department if they have pressure demand remote breathing available in case of an emergency.
4. Do not enter the silo to level it by hand.
5. Ventilation is important. Sealing the feed room while filling the silo and during fermentation will keep the deadly gas from entering the milking barn.
6. Make sure everyone on the farm knows it is dangerous.

Silo Equipment Dangers – Make sure the silo ladder can be reached from the ground. If you need to climb it, make sure another person is around and attach yourself to a harness. Electrical controls should have lock switches to prevent someone from turning it on while it is being repaired.

Equipment Safety – All equipment with moving parts should be regarded as a danger. Ensure that augers, power takeoff shafts and other motors are equipped with their protective shielding and keep limbs away from moving parts. Do not wear loose clothing when working around machinery because your body could be drawn into a moving part if your clothing gets caught.

Farming for a Healthy Environment

Maintaining a healthy environment is an important consideration for dairy farmers as they try to minimize the waste produced on their farms and design their operations in a manner that controls wastes as easily and efficiently as possible.

The main environmental concerns for dairy farmers are water quality, air quality, and soil quality.

Water Quality – Water is one of the most important resources on a farm. Its purposes include drinking, cleaning, and cropping. Since dairy cattle drink 50-130 litres of water daily and 87% of the milk they produce is made up of water, it is an absolute necessity.

Dairy farms must be designed in a manner that does not pollute drinking water. This is important not only for the farmer and his or her cows, but for the rural homes around the farm that need their water to be safe and taste good.

Water on the farm can become contaminated from three sources:

1. Manure
2. Wash water from the milk house
3. Pesticides used to kill bugs and weeds

Air Quality – There is no doubt about it, farms really can smell bad! People and cows do not like the smell of manure. Bad odours can cause mood changes and upset stomachs.

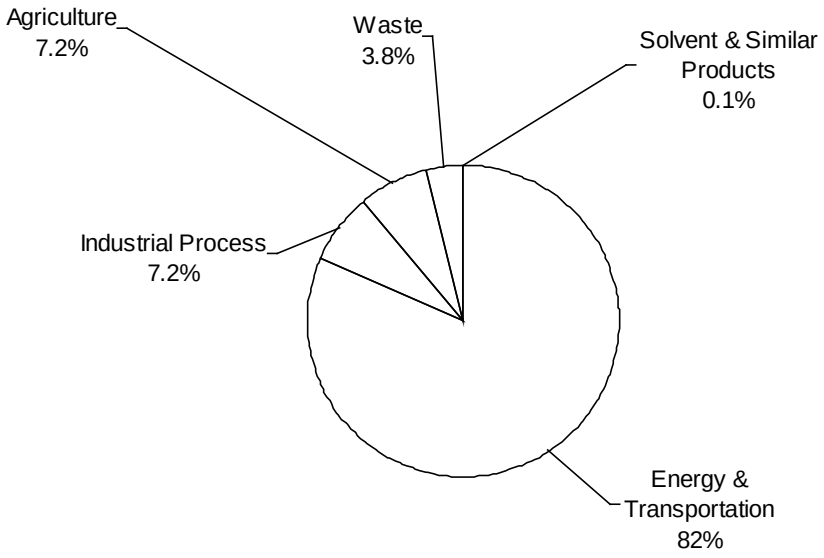
Air quality can also be affected by dust and other gases in the barn. Grain, hay and dried manure affect the air inside barns. Cows and farm workers breathe in those particles, potentially resulting in breeding problems and aggravating existing allergies. Even more dangerous than dust particles are gases from manure and silage fermentation, which can kill people and animals.

Soil Quality – Maintaining and improving soil quality means that crops grown will be better with fewer inputs of fertilizers. Growing crops in a more productive and less expensive manner means that animal feed costs are lowered. Implementing a crop rotation plan on your farm, where different crops are rotated from field to field each year helps to keep the soil healthy.

Soil erosion is another problem that can be minimized by ensuring that land is not left bare. Leaving corn stubble on the land over the winter and planting cover crops helps to reduce erosion by wind and water. Creating windbreaks by planting trees is another way to reduce soil erosion. Trees provide added benefits as they provide shelter for grazing animals and help to clean the air. Trees use up carbon dioxide and release oxygen.

Greenhouse Gases and the Dairy Industry

There are many misconceptions about livestock farming and its contribution to greenhouse gas (GHG) emissions. In fact, agriculture as a whole is only responsible for only 7.2% of GHG emissions in Canada. That's 25 times less than the transportation sector!



Reducing Greenhouse Gas Emissions

In 2002, Canada committed to reduce GHG emissions to 6% below 1990 levels by the year 2012 as part of the country's participation in the Kyoto Protocol. Between 1990 and 2003, GHG emissions from dairy cows had dropped 12% and since then have continued to lower by approximately 1% per year.

The Dairy Farmers of Canada, Soil Conservation Council of Canada, Canadian Cattlemen's Association and The Canadian Pork Council delivered programs promoting efforts of the Greenhouse Gas Mitigation Program for Canadian Agriculture (GHGMP). GHGMP was a program funded through the Government of

Canada that ended in 2006. The dairy component entitled "Our Cows, Our Air" was very successful and resulted in many seminars and training sessions for Canadian Dairy Farmers.

There are several ways that dairy farmers can manage their animals to reduce the amount of methane and other emissions from each cow:

- Good breeding
- Improve milk production and feed efficiency
- High quality forages
- Well managed pastures
- Well formulated rations
    - Feed additives
    - Balance the energy and protein in the ration
    - Lower forage to grain ratio in the ration
    - Process grain into smaller pieces to increase digestibility

These strategies are good for the farmer because not only do they reduce GHGs but also increase profitability! Cows that produce more milk usually produce less methane per litre of milk.

Cows are Natural Recyclers with Environmental Benefits

Despite some GHG emissions, there are many ways that cows act as recyclers with positive impacts on the environment. Some of these examples include:

- Cattle are often raised on pasture land that is unsuitable to grow crops for food production. This means that well managed pasture systems are able to effectively use land area that would otherwise be wasted.
- Crops grown to feed dairy cattle enrich the soil for crops grown for human consumption. For example, alfalfa and clover help the soil stay fertile for the growth of cereal crops such as wheat and oats. These crops also prevent soil erosion from wind and rain.
- Cattle eat leftovers of human food processing and agriculture. Some farmers feed their animals cereal wastes. More common are feeding brewers grains or distillers grains as protein sources. These grains are byproducts of beer and alcohol distillation processes.
- The manure that cows produce can be used to fertilize the soil, which in turn helps crops to grow better.
- When dairy cows are alive, they are used for milk production. When they are slaughtered, they are used for food production. They also give leather, bristles, medicine, gelatins and a variety of other products. That means that not very much of an animal is wasted.

Dairy Farms can Reduce GHG Emissions by Managing their Landbase

There are several things that dairy farmers (and other types of farmers) can do to manage their land in a way that is cleaner for the environment:

- Reduce tillage intensity
- Timing of nutrient application to the needs of crops
- Reduce soil compaction
- Include more forage in crop rotations
- Increase production on land used for grazing
- Replace permanent grass, wooded areas and shelters

Creating Environmental Farm Plans (EFP)

An EFP is a tool farmers use to identify the positive and negative effects of farming practices on the environment. Once a farmer finds problems, he or she can find solutions to fix them.

When examining your own farm , examine air and water quality, use of chemicals, soil erosion, manure and wash water handling, fly populations and odour problems. Supportive grant funding may be available to assist with projects that benefit the environment.

> **Check This Out…**
>
> Manure contains 75 different odour causing chemicals. Since a 625kg cow will produce 60kg of manure and urine each day, that's a lot of smells!

Manure Matters

Manure is a valuable resource because it can be spread on the land as fertilizer. But it can also pollute the air and water, so it must be handled carefully. All Farms should have some plan to manage manure. Storage facilities should be planned according to the amount of manure your cattle produce. The farm should have storage facilities for up to 240 days of the year. When there is less manure sitting around there are fewer odours and gases.

Nutrient Management Plans (NMPs)

NMPs can be developed to protect water, soil and air quality, maximize crop production and reduce odours. In Ontario, the Nutrient Management Act outlines regulations for farmers to comply with.

For farms to have effective nutrient management strategies they must have:

1. At least 240 days of manure storage on the farm
2. Minimum Distance Separation – A specified distance between new barns and existing homes or businesses that is determined by the number of animals the barn could hold, the type of manure produced, the size of the expansion and other factors.
3. A formal Nutrient Management Plan, which includes:

a. Soil test results

b. Nutrient storage areas (i.e. for fertilizers and manure)

c. When and how to apply nutrients to crops

d. Manure test results

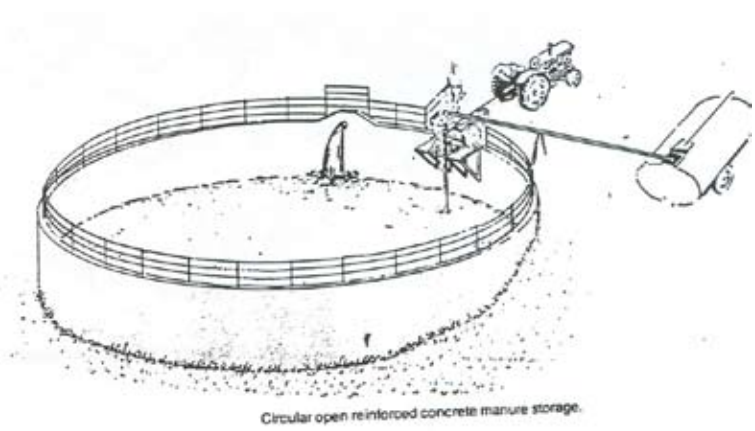
e. Contingency plans in case a problem arises

f. Manure spreaders that calibrate for accurate nutrient application

g. Good neighbour policy

Manure Storage

Manure is approximately 85% wet matter and 15% solids. This means that manure can be handled as a solid, semi-solid or liquid. When more bedding is used for the animals, the manure becomes more solid.


Circular open reinforced concrete manure storage.

Liquid Manure Storage – This can be handled on the farm in several ways:

- Rectangular storage below a slatted floor barn
- Circular concrete storage in the ground
- Silo-type concrete or steel storage above the ground
- Earthen storage in clay soil

Concrete structures may be covered or uncovered.

Semi-solid Manure Storage – A concrete slab is suitable for storage and can either be surrounded by a concrete slab or an earthen embankment. Like liquid storage methods, they can be covered or uncovered. Farms in areas where there is a lot of rainfall should cover their semi-solid storage structures to make the manure easier to remove later.

Solid Manure Storage – A concrete slab surrounded by a curb to hold in the liquid is sufficient to store solid manure. The curb prevents seepage of liquid into the soil and groundwater. Solid manure must be controlled to reduce flies and smells.

How much manure storage do you need? As a rule of thumb, a 625 kg cow produces 0.07 m^3 of manure each day (0.075 m^3 if a lot of bedding is used). This formula will help figure out how big your manure storage area must be:

V(s) = N x T x V(m) + V(w)*

V(s) = total storage volume N = number of cows
T = storage time in days (should be at least 240 days)
V(m) = manure production per day per cow including bedding
V(w) = volume of water added (precipitation, milk house wash water). Each m^2 of opening collects 0.55 m^2 of rainwater each year
**Source: "Tie Stall Dairy Housing," Agriculture Canada*

Remembering that volume is equal to the length x heigh x width will help with the calculations on your farm.

Spreading Manure – Farms do not have enough space to store manure forever, so it must be removed eventually. There are a few things to remember when spreading manure on your farm:

- Know the best time and amount to spread on your land.
- Apply it evenly.
- Recalculate the amount of commercial fertilizers that will be needed to grow your crops.
- Apply manure when crops are growing and need the most nutrients.
- Do not spread manure if it is going to rain because this causes runoff which can pollute water and prevent crops from getting the nutrients they need.

Milk House Wash Water

Manure and wash water are the main sources of waste on the dairy farm. Milk house waste contains detergents and acids that are necessary to clean milking equipment. Farms produce about 15 kg of wash water per cow per day. For example, a 100 cow herd uses 1500 kg of wash water each day or 547,500 kg each year. If it is not disposed of properly, it can pollute streams and groundwater. In streams, it causes algae to grow, which uses up some of the oxygen that fish need to survive.

There are different ways to handle milk house wash water:

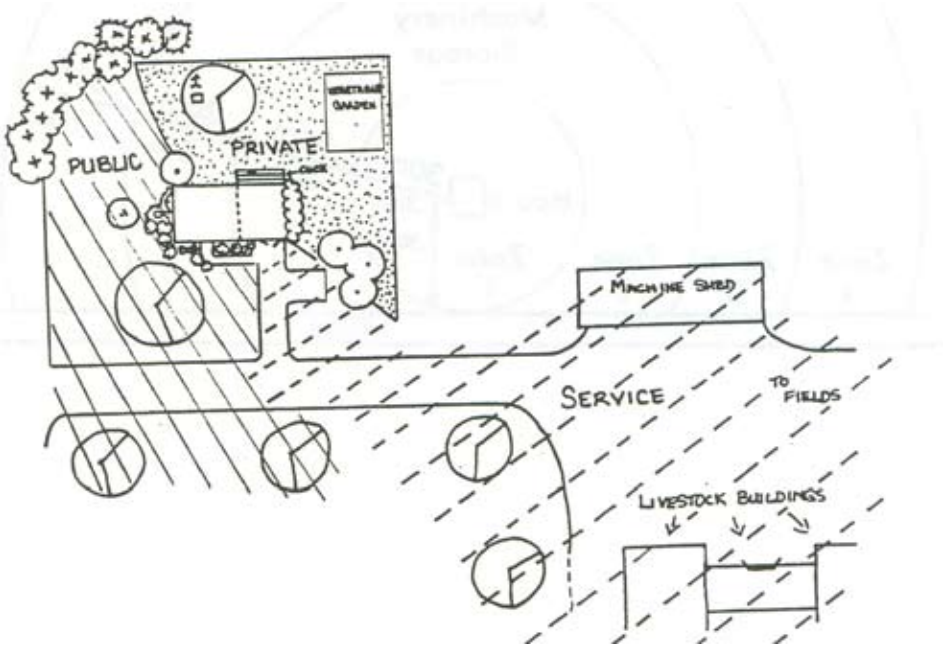
- Adding it to the liquid manure storage system
- Storing it separately
- Treating it with a septic system and treatment trench

The Farmstead: Putting the Pieces Together!

Most farmsteads include both the family home and the workplace. They include the house and barns and surrounding area. Since a farm family spends most of its time near the farmstead, it should be designed in a safe, healthy, well designed and convenient manner.

There are usually different zones on the farmstead. They could be viewed as public, private, and service:

PUBLIC	PRIVATE	SERVICE
What people first see (needs to give a good impression) • Area along laneway • Road entrance • Trees, lawns, shrubs, • Area visible from road	Informal and visible from the house • Garden • Children's play area • Deck, patio, pool • Recreation areas	The farm business areas • Driveway, garage • Workyard • Farm buildings and farm work areas



Another way to look at the farmstead is in zones of activity that should be located further and further away from the living area of the farmstead.

Zone 1 – Where you live and play

Zone 2 – Parking and farm workshop areas (no odours here)

Zone 3 – Smaller livestock, crop storage and feed storage facilities

Zone 4 – Major livestock facilities, forage and silage storage, pastures, manure storage and disposal, milking equipment centre

It is important to ensure that these areas are set up well in relation to one another (i.e. no manure smells in the house) but also that they obey laws and meet requirements of nutrient management, your local municipality, and your dairy regulatory agency.

Planning a New Facility?

If you are thinking about building a new farm structure, there are many things to consider and research so that you make sure you build exactly what you want:

1. **Establish goals** – What will the building be used for? What does it need to hold?
2. **Collect information** from tours, magazines, contractors, etc.
3. **Evaluate alternatives** – Is there something new or unheard of that would work?
4. **Plan it out** on paper.
5. **Layout to scale** – This will help you see how it fits in on your farm and if it will be the right size.

How will the new building fit into the farm?

There are certain locations where it would be suitable to build and other places that would not be very good at all! There are a few things to consider when figuring out where to put it:

1. **Topography** – is the ground level or sloped?
2. **Soil** – make sure it is deep enough to dig, but remember that you probably do not want to use up your best farmland for a building.
3. **Climate** – will the building be naturally ventilated? What direction does the wind blow? Will there be enough sunlight to warm it in the winter?
4. **Existing buildings** – will the new facility blend with the rest of the buildings and be convenient for access to feeding or cleaning? Does it prevent future expansion? Remember that existing buildings can change where sunlight will fall and can also change the wind pattern.

The Building Itself – there are many things that new animal housing might need, such as:

- Feed storage and a way to feed animals
- Manure removal and storage area
- Drinking water
- Utilities (i.e. hydro)
- Access to other buildings
- Ventilation
- Environment – cold or warm

Need to expand? Don't want to rebuild? Remodel!

Remodeling is often an inexpensive way to accomplish your goals. Just like redoing a room in your house, it can be satisfying to turn a useless space into something functional. As with rebuilding, there are several things to consider when renovating a farm structure:

- **Location, location, location**… If you do not like where the old building is, you are probably better off to tear it down and start over than to remodel it. Make sure the building is far enough away from the farmhouse, other neighbours, other buildings, drainage and has easy access for feeding and manure removal. Take note of the prevailing winds. You do not want snow and rain blowing into the barn but you also do not want the smell of manure blowing towards your house.
- **Current Use** – will you ever need the building for its current purpose again?
- **Building Structure** – do not remodel if the building is cracking or falling down and needs a lot of major repairs to the roof or walls.
- **Ventilation** – natural ventilation is best! Buildings should be at least 15m from trees and silos and 23 m from other buildings.
- **Size** – make sure the animals have enough space and are not crowded.
- **Cost** – make sure that it really is cheaper to remodel than it is to rebuild. Remember that it usually costs 10-20% more to remodel than your initial estimate will tell you!

VO-COW-BULARY

A glossary of housing & equipment terms

Bedding — Material such as straw, wood chips or sand used as cushion for animal comfort. This bedding often covers a mattress made of recycled rubber tires.

Bulk Tank — A refrigerated stainless steel storage unit in which milk is cooled quickly to 1°C to 4°C (35° F to 39° F) and stored.

Free stall barn — The cows are housed in large group pens or individual stalls without being tied. The cows are loose in the barn to access water and feed in specific places. They get milked by walking to a milking parlour or a milking robot.

HACCP — This acronym stands for Hazard Analysis Critical Control Point (HACCP). This is a quality assurance program that identifies risk factors (critical points) to reduce them to an absolute minimum. Dairy Farmers of Canada has developed an on-farm food safety program, called Canadian Quality Milk, which is recognized by the Canadian Food Inspection Agency.

Milk house — A section of the barn that houses the milking and sanitizing equipment as well as the bulk tank, in which the milk is stored and cooled.

Milking Machine — A machine used to obtain milk.

Milking parlour — A cow walks onto a raised platform with gates, which keep the animal from moving while she is being milked. The milk goes directly from the milking machine through a pipeline to the bulk tank in the milk house. When milking is over, the cow walks out.

Pack Barn Housing — A type of loose housing with separate areas for eating, drinking, resting and milking. Animals rest on large bedding packs instead of in stalls.

Pipeline — Glass or stainless steel pipe that collects the milk from the milking machines and brings it to the bulk tank.

Robotic milking system — Also called a Voluntary Milking System or Automatic Milking System, this setup is similar to a parlour system, except that the entire milking system is automated. Cows can enter the robot at anytime during the day to be milked. This technology is still new to North America. This technology is still new to North America.

Silage — Made of grasses (e.g. hay), legumes (e.g. alfalfa) or corn, which are chopped and stored while still moist in a silo.

Silo — Silos are extremely useful to store a wide variety of livestock feeds, including silage. A silo can be vertical (like a tower) or horizontal (called a bunker).

Slatted floor	A floor with open spaces to allow evacuation of manure.
Stall Base	The material located under the bedding in an animal's stall or pack.
Tie stall milking system	In this type of barn, the cows are tied in stalls next to each other. They have constant access to water and are fed in a manger in front of them. The cows are milked in their stall.
Tingle Voltage	Also called Stray Voltage, this electrical current adversely affects animals in their housing environment.
Time Temperature Recorder	An electronic device that records milking and washing times and temperatures in the pipeline and bulk tank. An alarm sounds when temperatures or timing of washing cycles is inadequate.
Ventilation	Ventilation is extremely important in dairy barns as cows need to have access to fresh air year-round. There are several types of ventilation systems that are adaptable to the change in seasons. Natural ventilation is the result of natural air flow and mechanical ventilation is the result of air movement by fans.

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- OMAFRA Factsheets: Land Application of Liquid Manure in an Environmentally Responsible Manner, Livestock Manure Storages, Air Quality Inside Livestock Barns, How to Handle Seepage from Farm Silos, Milking Centre Washwater Disposal, Disposal of Farm Wastes that Cannot be Composted, Reducing Odour and Noise Conflicts Between Rural Neighbours.
- Ontario Farm Animal Council
- Ministry of the Environment

Related Activities (See Activity Book)

The Ideal Calf House	Housing	All ages
Building a Calf House	Housing	All ages
Calf House Inspection	Housing	All ages
Farmstead Planning - Constructing a Calf House	Housing	Senior members
Keeping them Separate - Heifer Housing	Housing	All ages
Qualities of Heifer Housing	Housing	All ages
Heifer Housing Match UP	Housing	All ages
Having a Heifer Building Plan	Housing	Senior members
Exploring Heifer Housing	Housing	All ages
Stall Sketch	Housing	All ages
Mechanics of a Milking Machine	Housing	All ages
Proper Milking Procedures	Housing	All ages
Looking at Feed Storage	Housing	All ages
Safety Lessons	Housing	All ages
Looking at Farmsteads	Housing	All ages
You Be the Judge - Farmstead Planning Selection	Housing	All ages
Evaluating Farmsteads	Housing	All ages
My Space - Your Space	Housing	All ages
Ventilation Demonstrations	Housing	All ages
Ventilation Case Studies	Housing	Senior members
Manure as a Resource Demonstration	Housing	All ages
The Manure Cycle	Housing	All ages
Manure Handling	Housing	All ages
Liquid Manure System Safety	Housing	All ages
Elements of an Efficient Dairy Facility	Housing	All ages
Testing the Water	Housing	Junior members
Getting Along with the Neighbors	Housing	All ages
Creating an Environmental Farm Plan	Housing	Senior members
Keep your Water Clean, Clear and Cool!	Housing	Junior members