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# INFOSheet

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## Free Stall Dimensions

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### Concepts

Knowledge of cow measurements and their space requirements is necessary to design stalls. Stall dimensions must be appropriate for standing, lying, rising and resting without injury, pain or fear. This document describes cow dimensions, space requirements and stall dimensions to consider for modern Canadian dairy cows.

### Choices - Stall Maintenance / Manure System

Choice of manure system and commitment to stall maintenance play an important role in determining our choices in stall design. For example, a once-per-day stall cleaning protocol may not be compatible with stall dimensions that focus on the comfort of the cow. British Columbia research has shown that stall usage is greatest with a 50-inch-wide stall compared to a 45-inch stall. The paper also stated that the increased soiling accompanied greater stall usage. Although more acceptable to cows, the wider stalls require more daily maintenance. At the outset, one must decide if the choice in stalls will be based on ease of maintenance, greatest use by the cows, or a compromise between those two ends of the spectrum. Automation of stall cleaning could sway producers to choose larger, cow-friendly stalls. The choice of stall surface, bedding material and manure handling system must be compatible.

### Cow Dimensions

Due to variation in cow size between herds, the first step in planning stall size is the measurement of Lactation 1 and mature cows in your herd. To size stalls to fit the majority of your cows, measure the larger representatives in a group. Rump heights and hook-bone widths are useful to estimate several other body dimensions. Since several body dimensions are proportional, the ratios provide reasonable estimates of dimensions for other dairy breeds.

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**Figure 1. Variation in cow size within and between herds highlights the need to measure cows before choosing stall size and to build pens of stalls accordingly.**



It is becoming common to build pens with stalls sized for Lactation-1 heifers, milking cows and dry or special-needs cows, in recognition of variation in size and needs within a herd. A barn with one group of cows and one stall size poses several challenges to both management and cows. Stall cleanliness, labour, mastitis, lameness and cow comfort are issues to consider in one-group barns.

**Figure 2. Several cow measurements taken on standing cows are useful for building free stalls. Other essential measurements are imprint length and imprint width of resting cows.**

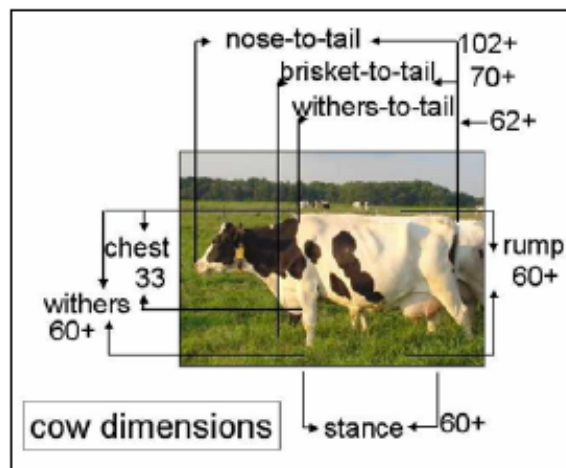


Table 1 shows measurements of mature Canadian Holsteins and some calculated proportions, taken at a local herd. For example, the cows had a rump height of 60 inches, a nose-to-tail length of 8.5 feet and a hook-bone width of 25 inches. Their weight exceeded 1550 pounds.

**Table 1. The table shows body dimension, example measurements for mature Holsteins and ratios to rump height and hook-bone width.**

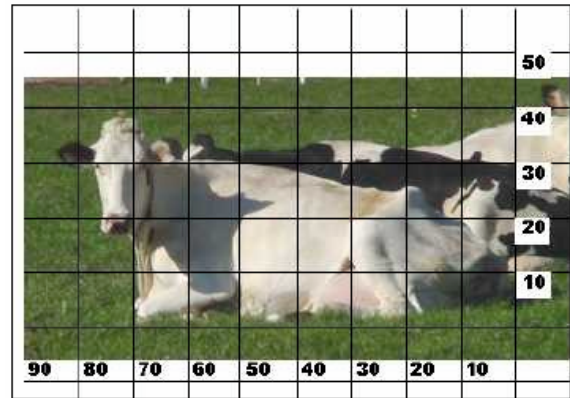
Body Dimension	Inches	Proportions
Nose-to-tail length	102 (range 96-110)	1.6 x rump height
Imprint length – resting	72 (68-76)	1.2 x rump height
Imprint width	52	2 x hook-bone width
Forward lunge space	24	0.4 x rump height
Stride length when rising	18	0.3 x rump height
Rump height – mature	Median 60 (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)	

## Space Requirements

Observations of cows freely lying and rising reveal that a mature Canadian Holstein cow uses 102 x 52 inches of living space and another 20 inches, or more, of open forward space for lunging motions. Several cow dimensions that define this living space include those shown in Figure 2 plus imprint length and width.

**Figure 3. Imprint length extends from the folded foreknee to the tail when lying in the narrow position. This length defines the bed length of a stall. For mattress barns, bed length is curb-to-brisket-locator distance but, for most sand stalls, the measurement is from the inside of the curb.**

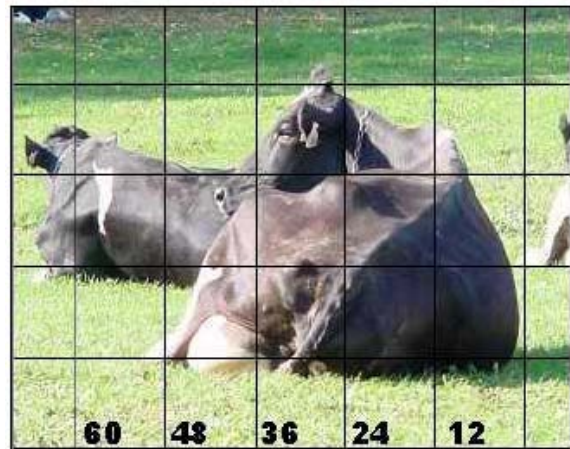
Imprint length defines the bed length needed for resting with all body parts on the stall. Imprint length is greater when the cow extends her front legs forward.



Nose-to-tail length describes the measurement from the tail to the nose of a cow standing with her head forward. When lying, the nose-to-tail length varies with the deviation of the head and neck.

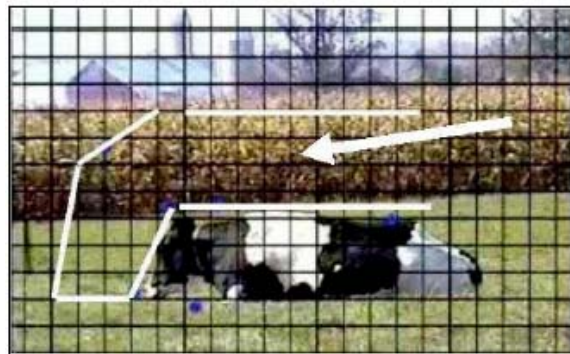
When resting in the narrow position, the point of the hock on the upper hind leg and the extension of the abdomen on the opposite side define the imprint width. This width is the minimum stall width for a resting cow.

**Figure 4. For the rear view of the cow in the photo, imprint width extends from the left hock to the right abdomen – a distance of about 52 inches for this cow. It increases when the rear legs extend outwards or the cow reclines in wide resting positions.**



The space needed for lying and rising motions (lunging) extends forward, downward and upward for head lunge and bob, vertically and forward for standing, and laterally for hindquarter movements. Knowledge of this space is essential for properly positioning neck and tie rails, deterrent straps or bars, solid stall fronts or provision for social space in open-front, head-to-head stalls.

**Figure 5. While rising freely on pasture, a cow uses the forward, downward and vertical space outlined by the white lines in the photograph. While rising, this cow lunged forward about 22% of her resting nose-to-tail length. Her nose either touches or almost touches the ground. Therefore, the space in front of free stalls should not have any obstacles higher than bed height that interfere with the normal head bob during lying and rising motions.**



## Stall Dimensions as Ratios of Body Dimensions

Although nose-to-tail length is essential, it is a difficult dimension to gather. Since hook-bone width and rump height are easy to measure and since many body dimensions are proportional, these two dimensions are useful references for sizing stalls. Table 2 shows stall dimensions, estimated relationships to body dimensions and example calculations for mature Holsteins in a study herd. Figure 31, at the end of this

document, is a drawing showing head-to-head stalls and several example dimensions for mature cows, Lactation-1 heifers and dry cows.

The standing surface for the feet is the reference for vertical placement of the neck rail or deterrent bar. The neck rail forward location is a horizontal measurement from the alley curb.

**Table 2. The table shows stall dimensions, estimated relationships to body dimensions and example calculations for mature Holsteins in a study herd.**

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

## Neck Rail

The neck rail is the restraint (often a pipe) mounted to the top or underside of the top pipe of a loop. It controls the forward location of a cow while standing in the stall. Proper location of the neck rail lets a cow stand straight with all four feet in the stall and rise without contacting the rail. The location is several inches lower and forward of the withers. It is usually directly above or an inch or two to the cow side of the brisket locator. Perching and diagonal behaviours and neck injuries are the most obvious signs of incorrect placement of the neck rail.

**Figure 6. A neck rail placed 50 inches above the mattress and 70 inches forward of the curb allows this cow to stand straight in the stall with four feet on the bed.**



## Wide Loop Opening – Forward or Diagonal Lunge

When rising or lying normally, a mature Holstein uses about 10 feet of space measured from her tail to the most forward lunge distance of her nose. This space requirement verifies that stall length should be 10 feet for stalls facing a wall. It should be about 9 feet for head-to-head stalls when a cow can use space on the opposite side of centre. The forward space must be unobstructed for frontward lunging and bobbing of the head. There must be no obstructions higher than the surface of the bed.

Shorter stalls and stalls with obstructions in the lunging space lead to diagonal (corner-to-corner) standing, lying and rising. Cows still lunge forward, relative to their body direction, but diagonal or sidewise to the stall. Since the top pipe of the loop becomes the neck rail when cows lunge through it, the loop must have a wide opening. It also must have a low mount that does not inhibit the ability to lunge over it. The measurement from the top of the mattress to the top of the bottom pipe should be less than 12 inches. Since the top pipe of the loop becomes the effective neck rail, it should be about the height recommended for the neck rail – 48 to 50 inches for mature Holsteins.

**Figure 7.** A wide loop opening and open-front stalls allow cows to lunge both diagonally and frontward. While rising, this cow did not contact the neck rail and she took the stride over the low brisket locator.



## Brisket Locator

A brisket locator restricts the forward location of a cow lying in the stall. It defines the forward limit of the bed length measured from the rear curb.

Boards of varying heights, concrete curbs, nylon straps and metal pipes have been the most common items used for brisket locators. Many barns have brisket locators that are too high and interfere with the stride taken when rising. A cow usually swings her foot high enough to clear a 4-inch obstacle. This establishes the maximum height of a brisket locator above a mattress or sand bedding.

**Figure 8.** A cow-friendly brisket locator is 4 inches or less in height, has a smoothed surface and attaches to the stall surface rather than the loops.



A brisket locator should have a rounded and smooth surface to ease movement of legs over it. The brackets used to support brisket locators on the lower pipe of a loop are an obstruction to extension of the legs. Brackets can be avoided by mounting the brisket locator on or below the stall surface. A 5-inch space between the brisket locator and the loop prevents entrapment of a leg.

## Area Forward of the Brisket Locator

Objects in the essential space forward of the brisket locator are obstructions to the head lunge and bob, the stride and resting positions for the front legs. This area should be the same height as the stall bed.

The use of one support structure for the loop in single stalls or pairs of loops in head-to-head stalls keeps the area unobstructed with support pipes.

Pre-planning the stall layout first, and then adjusting roof truss and support-post spacing, assures that posts fall immediately adjacent to loops or their supports, rather than in the forward stall space. Roof-support posts located between loops often force cows to stand and lie diagonally in the stalls.

**Figure 9.** The area forward of the brisket locator must be free of obstructions to lunging and bobbing of the head. Plan the stall layout first, then the roof and its supports, so posts are adjacent to the loops.



## Deterrent Strap or Pipe – Open-Front Stalls

Open-front stalls provide cows with a convenient route for escaping a dominant cow, a cow in heat, equipment used to bed stalls or an aversive handler. A deterrent bar or rope discourages cows from exiting through the front of stalls. The usual mounting point is the support post for the loops. The deterrent must not interfere with the upward bob of the head. If it does, expect unwanted behaviours and stall refusal.

**Figure 10. A deterrent bar or strap must not interfere with the upward bobbing of the head. A suggested placement is about 40-42 inches for Holsteins in 16-foot stalls and about 34-36 inches in 18-foot stalls. The height varies with stall length.**

Deterrents may be wood, metal, nylon strapping or rope. In one barn, a 3/8-inch polypropylene rope strung loosely between the loop mounting-posts was a very effective deterrent for Lactation 1 heifers in head-to-head stalls. Galvanized pipe is also common. In general, tie-down straps used in the trucking industry should be considered inferior choices for deterrents. When ratcheted tight, the straps can cut a cow's hide if she becomes trapped by them.



**Figure 11. A deterrent bar prevents cows from exiting the feed alley into the fronts of these free stalls. It also prevents cows from exiting forward into the feed alley. The mounting posts are about 8 feet from the rear curb. The deterrent is mounted high enough (about 40 inches above the mattress) so it does not interfere with forward lunge and head bobbing motions.**



Several management practices reduce the risk of cows trying to escape through stall fronts. Moving cows in estrus to a 'play pen' and choosing AI rather than 'running a bull' protects cows from pestering. Using motorized equipment to bed stalls or clean alleys while cows are in the holding pen and parlor is a common practice. Gentle handling must be the standard of care. On some farms, veterinarians and farmers successfully handle cows and their reproductive programs in open-front stalls without deterrent bars. A credit to gentle stockmanship.

**Figure 12. The space between an outside wall and the mounting posts for loops is a trap for cows housed in open-front stalls. This forward space is essential for front-lunging. A deterrent is absolutely essential for the cow safety. The photograph shows a pipe deterrent – probably the best choice for this application.**



## Choosing Loops

The cows in the photograph stand, go down, lie and rise diagonally in their stalls because of obstructions to their normal forward-lunging behaviour. Often, we describe this diagonal behaviour as side lunging and the stalls as side-lunging stalls. With 10 resting and 10 rising motions per day, these cows could benefit from greater ease when getting in and out of their stalls. They need the right loop for the job.

**Figure 13 shows loops that are a challenge for cows housed in side-lunging stalls. The lower pipe of the loop is 18 inches above the bed. It is too high for normal lunging motions.**

The obstructions to forward lunging in the short, 7.5-foot stalls are a gate in the closest stalls and facing cows in the head-to-head stalls beyond. The loop opening is 30 inches. The distance from the top of the mattress to the top of the lower pipe of the loop is 18 inches. When side lunging, this pipe denies cows the freedom to use their heads as a counterweight in a normal bobbing motion. Instead, their heads follow an arc reminiscent of a ski jump.



A more cow-friendly loop for side-lunging stalls would have the lower pipe mounted about 6 inches closer to the stall bed. There also would be about 5 inches of space between the pipe and the brisket locator to avoid entrapment of a leg. Finally, the loop would have a wider opening to maintain neck-rail height.

Choose the right loop for the job. When renovating older barns with short stalls, choose side-lunging loops. They make it easier and more comfortable for cows that are lunging over the lower pipe about 20 times every day.

**Figure 14 shows the Figure 13 loops installed in a new barn. They could be adequate in this installation because there is space for forward lunging.**



Several other loop dimensions are significant for cow comfort. For example, the loop shown in Figure 17 has the lower pipe extended further to the rear of the stall before the pipe bends upward. The loops are very shiny from cow contact and several cows in the herd had swellings on their bodies related to this style of loop. For a contrast, the loops shown in Figure 7 are bent differently. The lower pipe extends less to the rear of the stall before bending upward. This loop provides ample space for the hips (24-27 inches) when a cow rolls over slightly while using the stall. The downward slope of the top pipe of loops shown in Figures 7, 16 and 17 allow cows to swing their heads over easily when exiting the stalls. They can do this with their front feet still on the bed. However, the loops shown in Figure 15 do not have that feature and cows must back out of the stall before turning.

## Sand-Bedded Stalls

The effective bed length for sand-bedded stalls is the distance from the inside of the curb to the brisket locator. This is especially true with sand maintained below the level of the curb. The rear curb is the fixed reference point for vertical measurements to locate neck rails. Neck-rail height changes with the height of sand stored at the front of the stall.

**Figure 15.** The soft resting surface of sand-bedded stalls includes the space between the inside of the concrete curb and the brisket locator. This distance is the resting surface for the cow. Frequently, the neck rail in most sand stalls is placed the width of the rear curb closer to the back of the stall than it is for mattress stalls. This neck rail location forces cows to perch in the stall rather than stand with their rear feet in the sand bed or on the concrete curb. This neck rail location aims to prevent cows from urinating or defecating in the sand bed.



A brisket locator can be mounted in a sand-bedded free stall. At one farm, a 10-inch concrete curb supported the 9-inch footprint of the plastic brisket locator. However, the caregivers failed to keep sand above the concrete curb and several cows suffered injuries to their knees from the installation. Another method is to use a 10-inch wooden plank and rods driven into the sand bed and its base.

**Figure 16.** The loop for this sand-bedded stall slopes downward at the curb side so cows can swing their heads over it more easily when exiting the stall. It has a narrow opening and it is mounted higher above the bed than loops for mattress barns (see Figure 9). The loop controls cow position and generally forces forward lunging. The bottom pipe is high enough to discourage cows from lunging through it, yet low enough to discourage cows from lunging under it.



**Figure 17.** Ideally, the sand bed should be slightly sloped and filled to curb height. Piles of sand stored in stall fronts are obstructions to lying, rising and resting behaviours. The cows in the adjacent photo spent considerable time standing and perching for a few days after the once-monthly addition of sand.



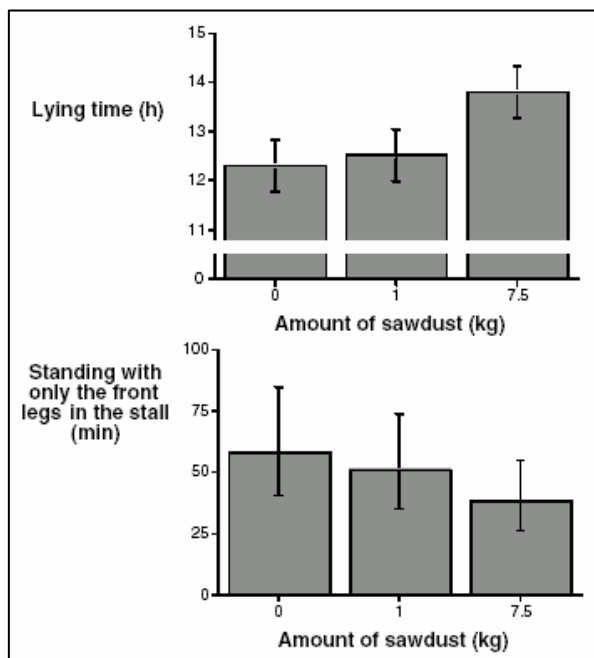
Finnish cows, when given a free choice between different bedding materials, avoided sand and preferred straw and rubber mats in both summer and winter (Emmi Manninen, 2002). Closer to home in BC, Tucker *et al* (2001) found that cows preferred stalls with deep sawdust to sand-bedded stalls.



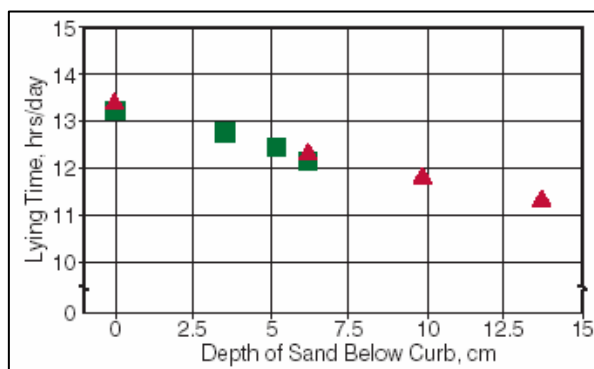
## Bedding and Stocking Density

Choice of manure system, commitment to stall maintenance and the ready availability of inexpensive bedding determine our choices in stall design. For example, a once-per-day stall cleaning protocol may not be compatible with stall dimensions that focus on the comfort of the cow. British Columbia research has shown that stall usage is greatest with a 50-inch-wide stall compared to a 42-inch stall. However, stall soiling with manure increased about two-fold with the wider stalls. In another study, they found that stalls with little use stayed clean and stalls with the greatest occupancy were dirtiest. Although more acceptable to cows, the wider stalls require more daily maintenance, just as more usage of a tractor requires more frequent oil changes. Dirtiness should not be the sole measure of stall design.

**Figure 18. Tucker and others (Univ. British Columbia) showed lying time and perching time for rubber-filled mattresses with 0, 1, and 7.5 kg of sawdust bedding. The two lowest levels of bedding represent common practice in mattress-bedded barns. Lying time increased and perching time decreased with the addition of bedding to the mattresses.**

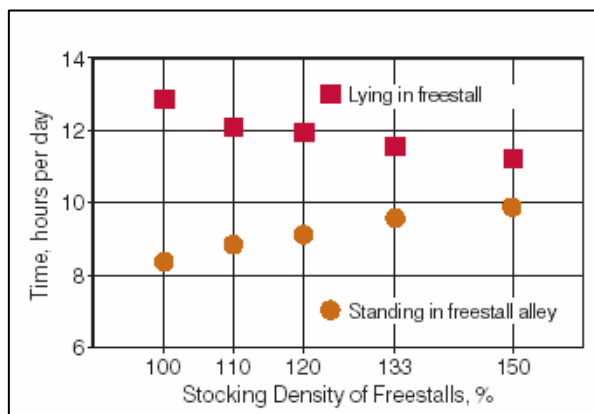


**Figure 19. Recent research from the University of British Columbia (Drissler and others) showed that sand level is important for lying time. As sand level dropped below the curb, cows spent less time lying in the stalls. Lying times decreased by 10 minutes for every 1-cm (0.4 inches) decrease in bedding level below the curb.**



The question of over-populating dairy barns is common because some believe it is economical to house more cows than there are available stalls. Nonetheless, the effects of greater than 100% stocking density are now being researched. Some producers have discovered for themselves that overstocking has definite challenges for their cows, ventilation systems, manure handling and their management.

**Figure 20. Fregonesi and others at the University of British Columbia found that lying in the stall decreased and standing in the stall increased as stocking density increased from 100 to 150%. Other researchers found lameness was more common with greater standing times.**



Researchers (Cook *et al*) at the University of Wisconsin have shown a positive relationship between standing or perching and lameness in dairy cows. They found the behaviour of lame cows differs in mattress-bedded barns and sand-bedded barns. Whereas lame cows in sand barns showed normal patterns of lying and standing, lame cows in rubber-filled-mattress-bedded barns spent more time standing and less lying. They believe that traction may be an important factor and suggest that lame cows on mattresses experience more pain and fear. They also believe that the traction afforded by loose bedding is

a great advantage to lame cows. Further, they suggest that loose bedding distributes weight bearing to the entire claw and is less painful than that experienced in mattress barns with scant loose bedding.

Foam mattresses are the most recent innovation for cow beds. Pasturemats™ are being installed with a foam layer over the rubber-filled mattress and under the top cover. Unpublished research shows cow acceptance and lying times similar to sand-bedded stalls. Animattresses™ have foam as their cushioning material.

Producers should use lots of bedding on stalls with rubber-filled mattresses or rubber mats and keep the sand level with the curb in sand-bedded stalls. The barn should not be over-populated. The challenge is to provide an optimal stall surface – one that provides thermal insulation, softness, traction, low risk of abrasion and that is easy to maintain and clean.

## Post and Rail Feed Barriers

Neck injuries occur when the skin, the nuchal ligament and its bursae and the spinous processes of the first few thoracic vertebrae at the withers experience repetitive trauma. The injuries may be gall, callus, hygroma or bursitis.

**Figure 21. The region of the supraspinous bursa of the neck can experience repetitive trauma from a neck rail or strap when a cow stands in a stall, during the motions to lie and during the motions to rise.**



Another source of trauma is the restraint used at a feed bunk. Wire cable is one type of restraint. Pipe attached either directly to a post, or on a mount to locate it forward of the post and over the manger, may be the most common restraint. A novel restraint uses pipes mounted on a pivot. With this device, the larger cows in the group raise the restraint and carry the burden while feeding at the bunk.

**Figure 22. The arrow points to an injury on the neck related to a feed-bunk restraint mounted 45 inches above the cow's feet.**



The height for placement of a feed-barrier rail is measured vertically from the cow's feet on the alley side of the bunk. It should be about 85% of the rump height of mature Holsteins – a location similar to neck-rail height in free stalls. The feed rail is often adjustable and could be raised or lowered to suit cow size in various pens. A mount offsets the rail about 6, 8 or 10 inches over the feed bunk. The drive-through feed alley must be 18 - 20 feet wide to permit passage of feed wagons without damage to the rail.

**Figure 23. A post and rail feed-bunk restraint mounted 51 inches above the cows' feet and about 8 inches forward of the centre of the manger curb. Neck injuries are rare on cows in this barn. The height of the feed rail and the frequency of pushing feed up contribute to freedom from neck injuries. However, in barns where feed is not pushed up often, cows sustain injuries to the supraspinous processes when the neck rail is mounted high.**



## Feed Bunks

Producers use sweep-in mangers because of simplicity of construction and ease of cleaning compared to feed bunks with barrier fronts. Moreover, nutritionists and veterinarians encourage the choice to assure frequent removal of stale feed and, thereby, improve feed intakes.

**Figure 24. The feed in this sweep-in manger is outside the reach of the cows. Although push up and cleaning are easy tasks, the feeding system requires labour to keep the feed close to the cows. The feed rail is low enough to prevent escapes. However, with constant reaching for feed because of infrequent feed push up, these cows are at greater risk of neck injuries.**



True to their name, sweep-in mangers require producers to push feed within reach of the cows. The frequency of push-up varies from 3 to 12 times per day. The intensity of the labour varies with the technology - brooms, snow shovels, ATVs or garden tractors with blades or brushes, skid steers or tractors. Although quicker and easier, the job still consumes time. To reduce labour even more, some producers installed automated feed pushers (an adaptation of an alley scraper) in their barns.

**Figure 25. This new tarp-type barn has a drive-through feed bunk that retains feed within easy reach of the cows. The owner does not push up feed, claims very little feed refusal and only minimal need for cleaning.**



“Keep feed within easy reach” is common advice. It benefits the cow - freedom from hunger, injury and disease - and the caretaker. Feed barriers could have a place on modern dairy farms. They just need 21<sup>st</sup> Century automation so they lift up or drop down out of the way for cleaning mangers.

**Figure 26. Slant-bar restraints and a feed-front manger are part of this barn built in 2006. The front keeps feed within cow reach. The slant bars avoid neck injuries (see Figures 21-23). The owner mixes feed and manages feeding to limit wastage. Neck injuries from post-and-rail restraints make this slant-bar restraint and feed-front manger an attractive alternative.**



Figure 27. A post and rail feed barrier must be constructed for the dimensions of the cows eating at the bunk. For most Holsteins, the manger wall should be about 20 inches higher than the walk alley (cow's feet) to avoid injury to briskets. This height also permits the addition of self-locks later. Newer designs permit vertical and horizontal adjustment of the rail as shown in some photographs above. The feed manger platform must be 4 to 6 inches higher than the walk alley (cow's feet).

(Figure courtesy of H. House, OMAFRA)

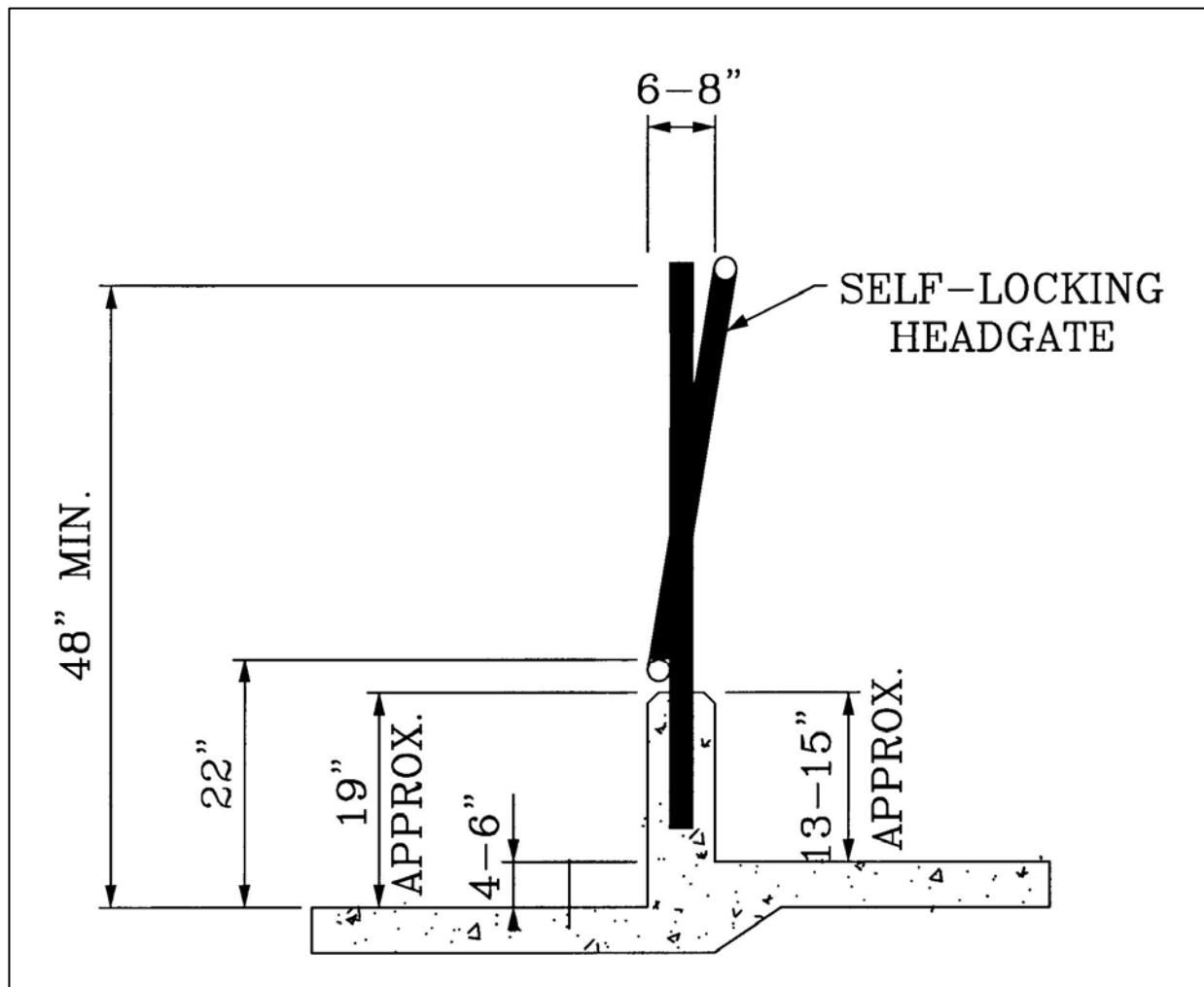
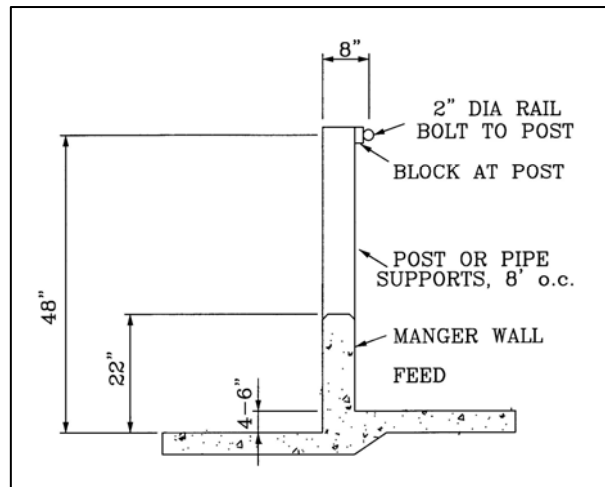
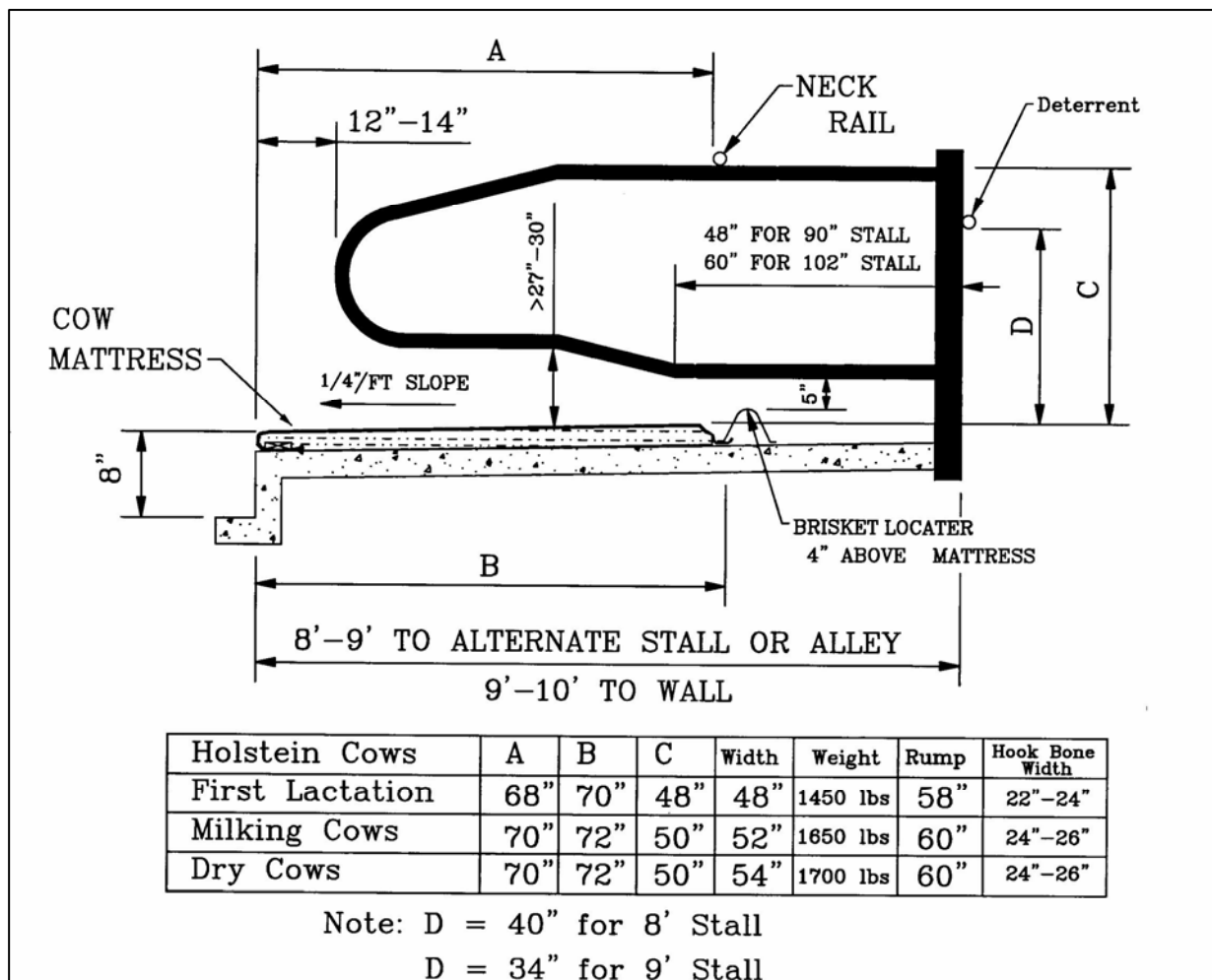
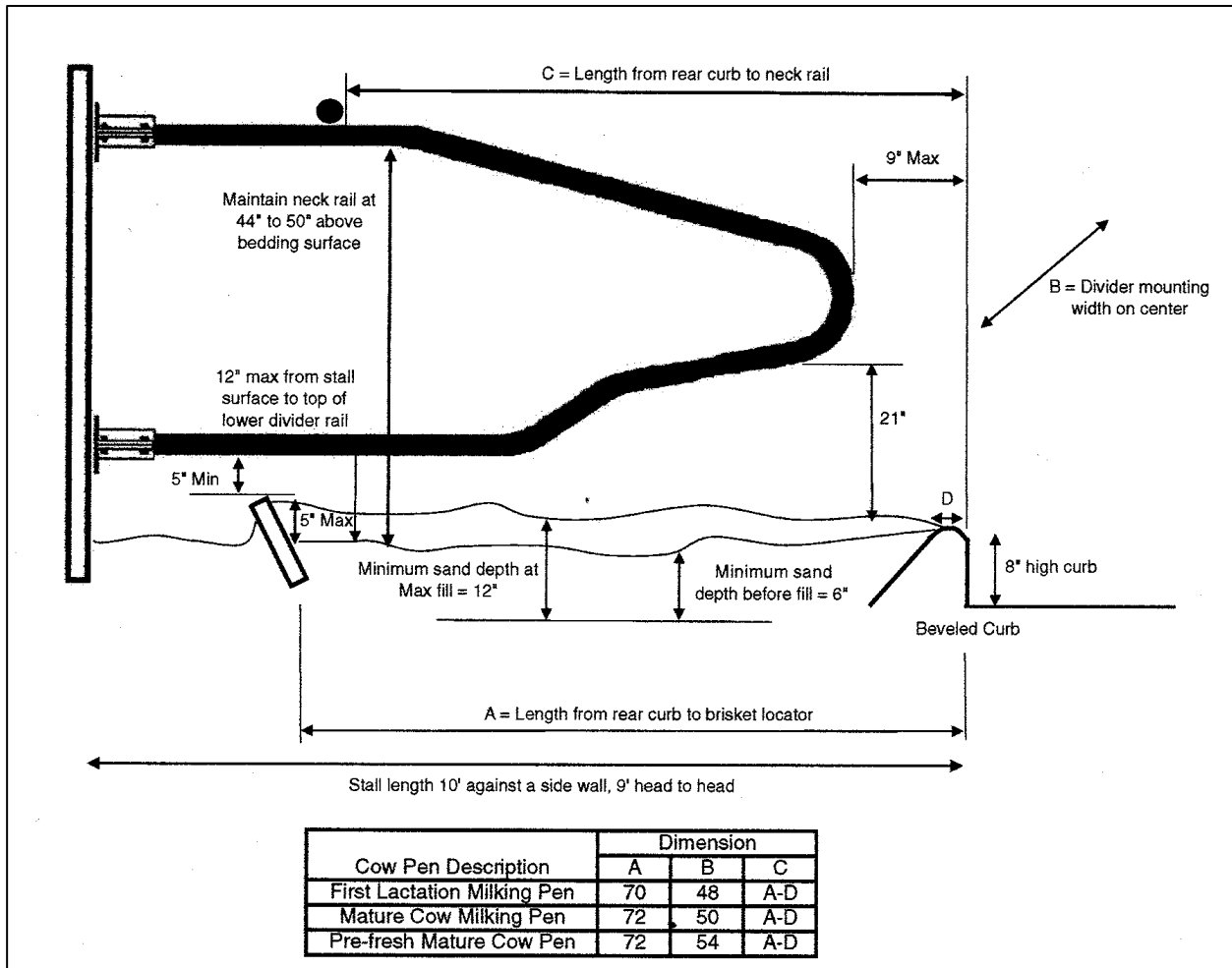


Figure 28. The diagram shows a typical installation for a self-locking front at a feed bunk. Note that the concrete manger front is lower than the one for the post and rail feed manger. The height of the concrete manger wall should be adjusted for the size of the cattle to avoid injuries to briskets.

(Figure courtesy of H. House, OMAFRA)

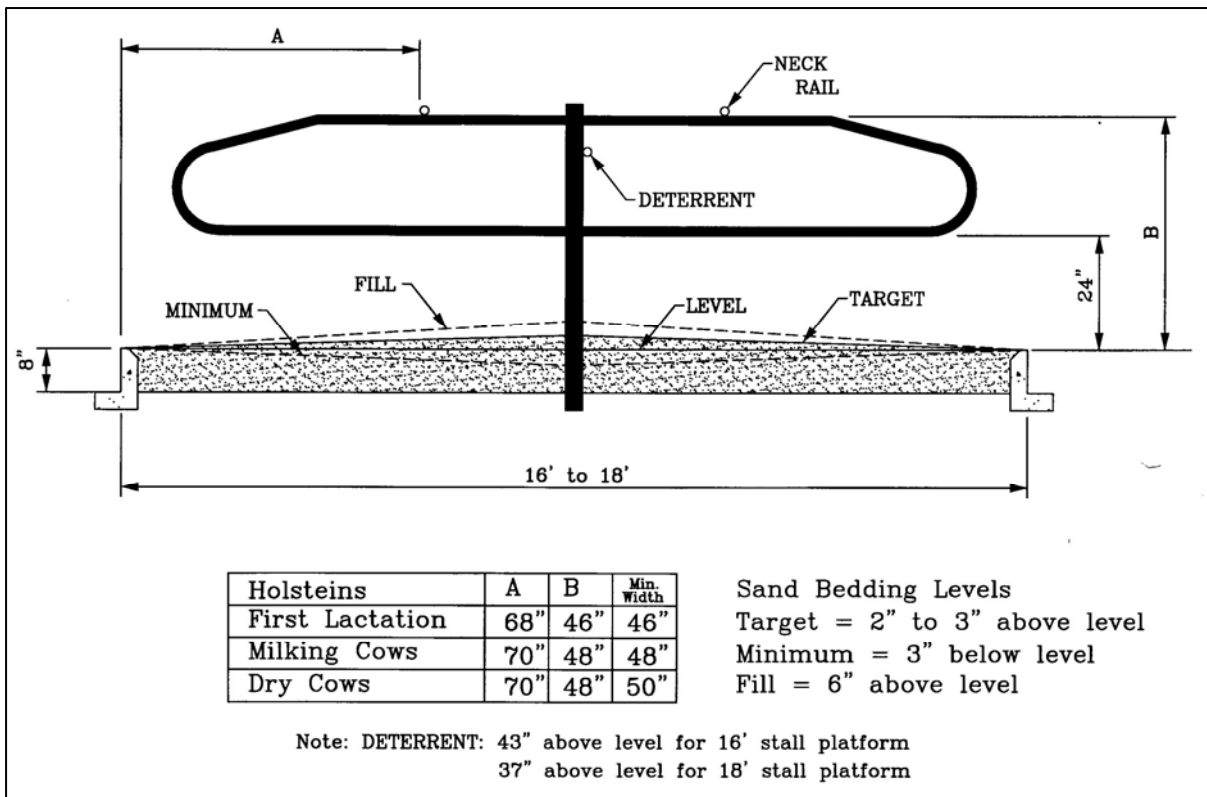


**Figure 29.** The diagram shows open-front free stalls with rubber-filled mattresses. The table shows variations in stall dimensions to meet the needs of Holsteins - first-lactation heifers, mature milking cows and dry cows. The slope on the stall is 0.25 inches per foot. For ease of side-lunging, the top of the lower pipe of the loop should be no higher than 12 inches above the bed height (mattress). The neck rail forward position should allow the majority of cows to stand squarely with all four feet in the stall. Generally, the neck rail mounts directly above or two inches behind the brisket locator. (Figure courtesy of H. House, OMAFRA)



**Figure 30.** The figure shows dimensions for a sand-bedded, free-stall design using a wide-loop divider. It shows dimensions suggested for first lactation cows, mature cows and mature pre-fresh cows. The forward location of the neck rail is the bed length minus the width of the concrete curb. Since cows will not stand on the slope of the curb, they stand diagonal ahead of the curb if stall length allows. The rearward location of the neck rail discourages cows from standing with all four feet in the bed and excessive soiling of the stall. In effect, the rearward location forces cows to perch in the stalls. However, with lower sand levels, the degree of elevation of front feet may be minimal. The height of the neck rail will vary with sand fill and should be at least 44 inches above the sand.

(Courtesy of Drs. Cook and Nordlund, Univ. of Wisconsin, Vet Clin Food Anim 20 (2004).)



**Figure 31.** The diagram shows a design for head-to-head, open-front, free stalls with sand bedding. The table shows variations in stall dimensions to meet the needs of first-lactation heifers, mature milking cows and dry cows. The figure also shows a narrow-opening style of loop and no brisket locator. The loop has a narrow opening and the bottom pipe mounts higher above the bed than wide-opening style loops for mattress barns. The loop controls cow position and generally forces forward lunging. The bottom pipe is high enough to discourage cows from lunging through it, yet low enough to discourage cows from lunging under it. (Figure courtesy of H. House, OMAFRA)

**Companion INFOSheets:**

1. Cow Behaviour to Judge Free Stall and Tie Stall Barns
2. Tie Stall Dimensions

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